Gila Exhibit 001

Volumes I thru IV

1

96 - 003 - 001

GILA RIVER

ORIGINAL

RECEIVED 8-29-96

BEFORE THE

ARIZONA NAVIGABLE STREAM ADJUDICATION COMMISSION

IN THE MATTER OF THE NAVIGABILITY OF THE GILA RIVER	))))	ADMIN. DOCKET NO. _________ SUBMITTAL OF OWNERSHIP EVIDENCE RE: PUBLIC TRUST

A. NAME, ADDRESS AND TELEPHONE NUMBER OF RESPONDENT:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
Telephone: (602) 506-1501

Represented by: Julie M. Lemmon, General Counsel
1805 N. Scottsdale Road, Suite 5
Tempe, Arizona 85281
Telephone: (602) 941-1126

B. STATEMENT REGARDING THE PUBLIC TRUST VALUES OF THE GILA RIVER IF FOUND NAVIGABLE:

The public trust values of the Gila River include the use of, and the protection of, the river for the conveyance of flood waters and drainage originating or passing through the watershed.

C. POSSIBLE WITNESSES AND BRIEF SUMMARY OF TESTIMONY:

David R. Johnson, Manager, Regulatory Division
Richard G. Perreault, Manager, Planning Branch
James L. Schwartzmann, Manager, Land Management Division
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
Telephone: (602) 506-1501

If the Gila River is found navigable, Mr. Johnson and Mr. Perreault will testify on the public trust value of flood control and storm drainage in the Gila River and how flood control projects and floodplain zoning protect the public trust and safety, provide regional planning for drainage and flood control, enhance transportation, and preserve and enhance environmental resources and open space. Mr. Schwartzmann will testify as to the nature of the lands owned and controlled by the District in the Gila River.

D. EVIDENCE SUBMITTED:

Index map of District's 1000-foot corridor, Gillespie Dam to 91st Avenue, and individual parcel maps with easements and fee ownerships shaded.

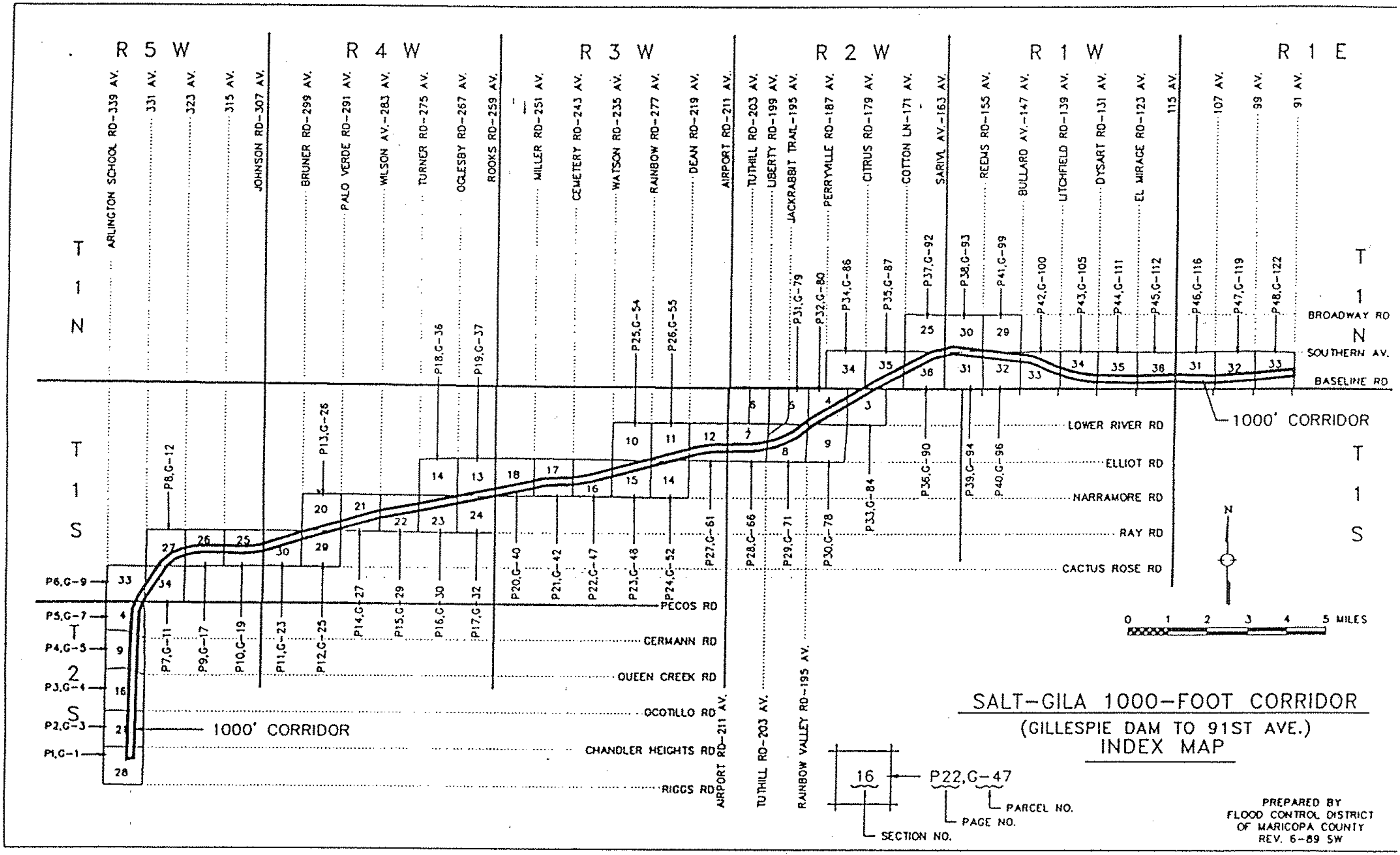
Permit (M-5) from Department of Interior for Gila River Wildlife Management Area.

Land Use Permit from Arizona State Land Department.

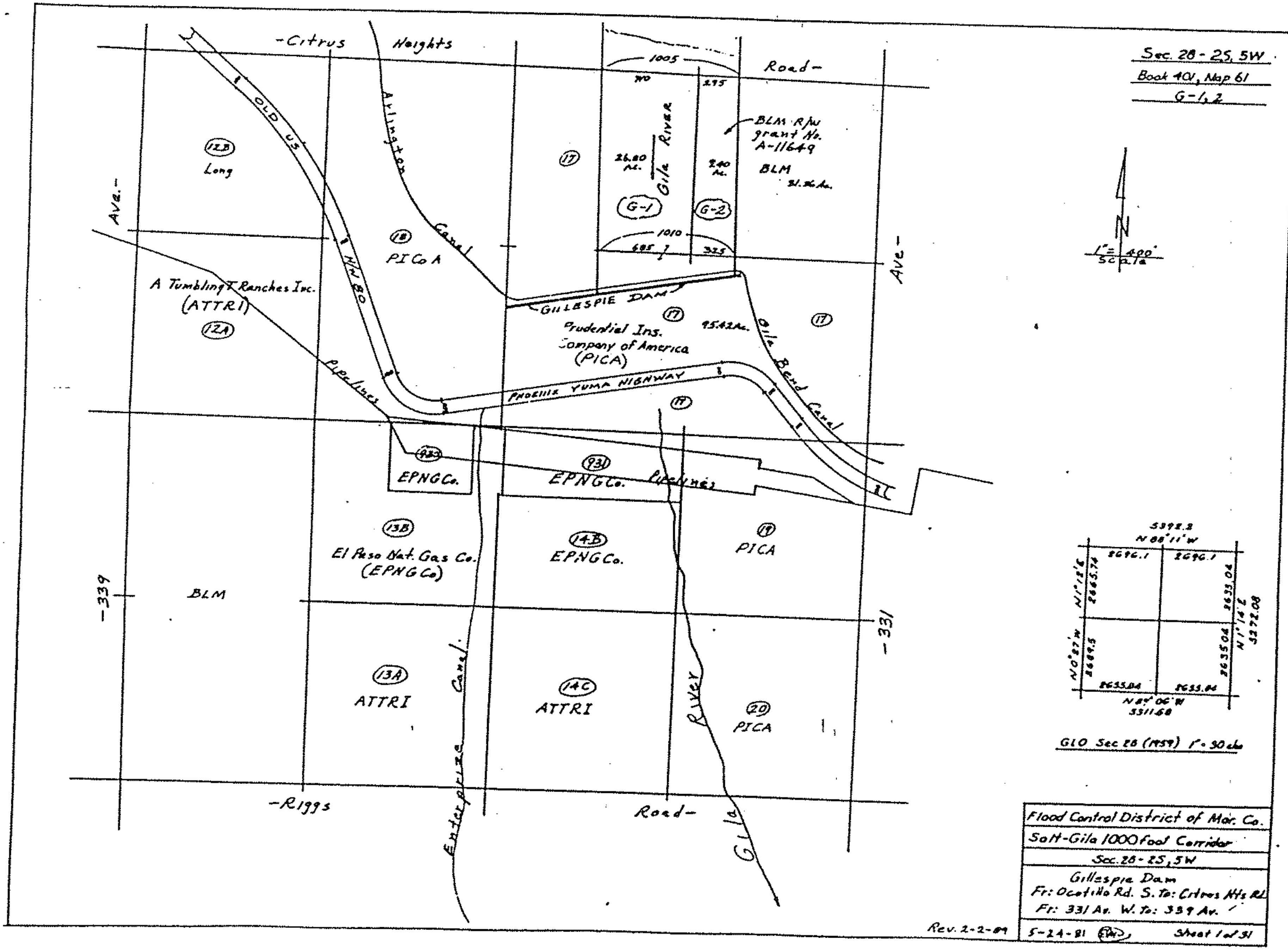
DATED this 28th day of August, 1996.

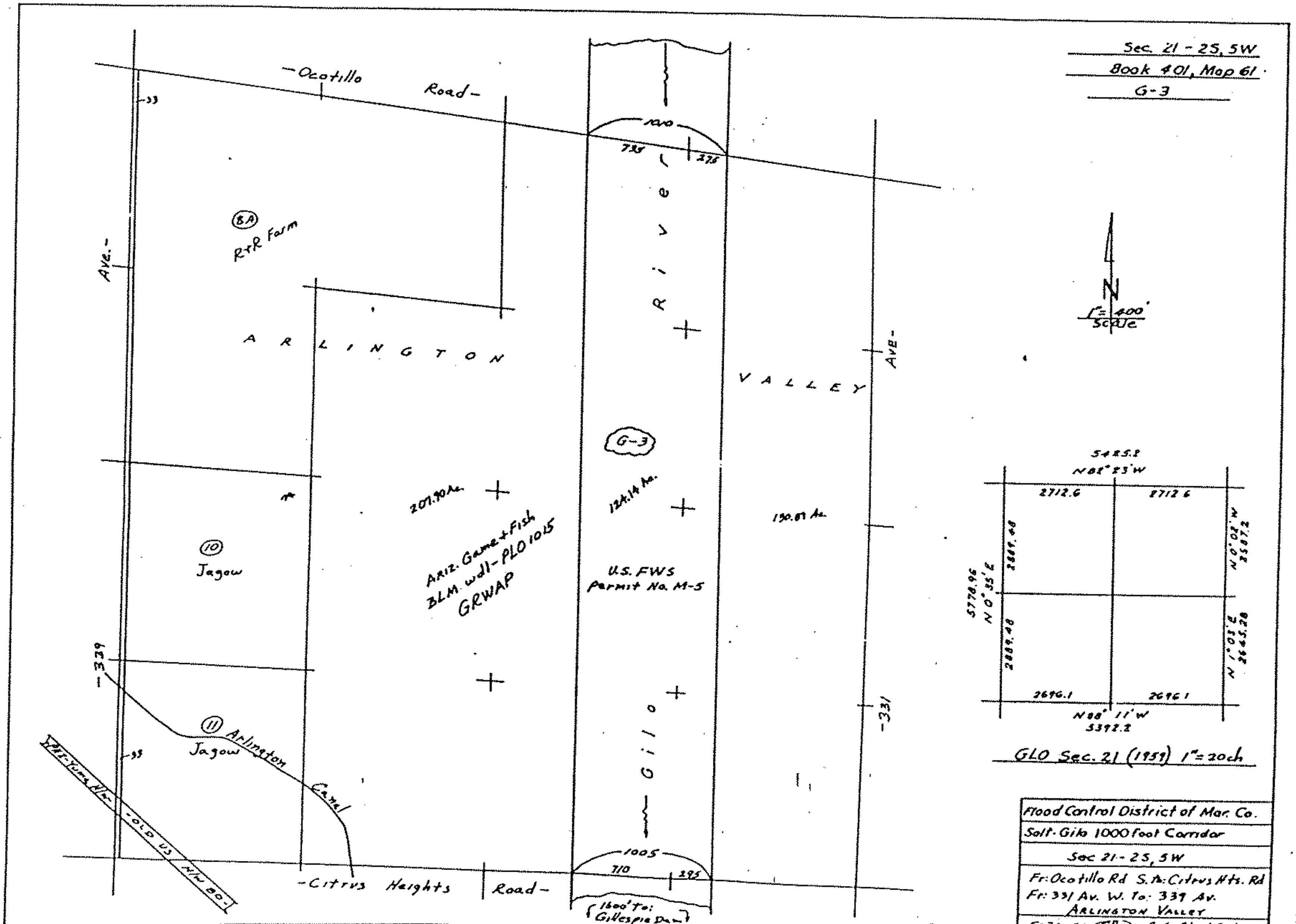
Julie M. Lemmon

Julie M. Lemmon, General Counsel
Flood Control District Of Maricopa County

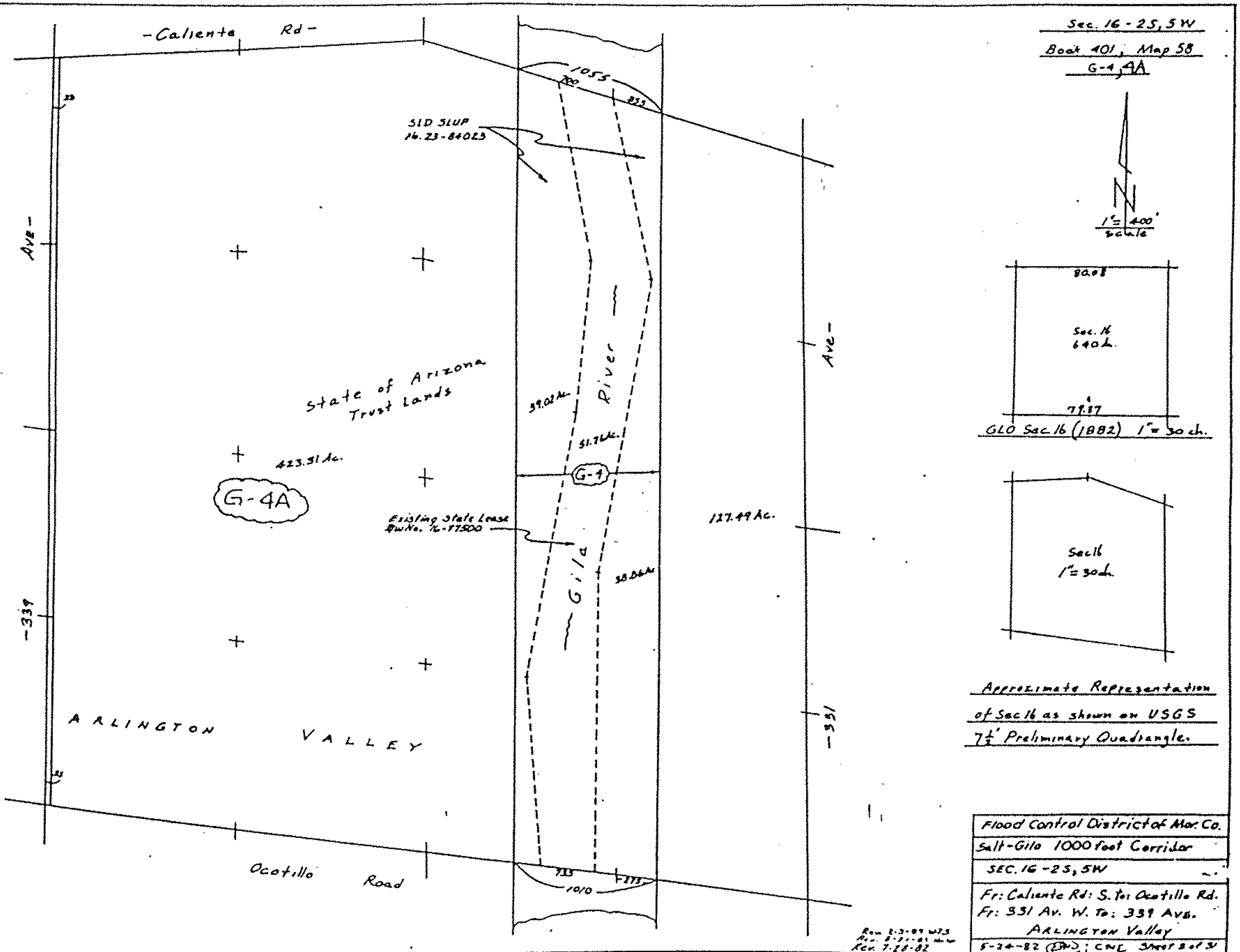


SALT-GILA 1000-FOOT CORRIDOR
(GILLESPIE DAM TO 91ST AVE.)
INDEX MAP
PREPARED BY
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
REV. 6-89 SW
R 5 W
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
T 1 N
T 1 S
T 2 S
ARLINGTON SCHOOL RD-339 AV.
331 AV.
323 AV.
315 AV.
JOHNSON RD-307 AV.
BRUNER RD-299 AV.
PALO VERDE RD-291 AV.
WILSON AV.-283 AV.
TURNER RD-275 AV.
OGLESBY RD-267 AV.
ROOKS RD-259 AV.
MILLER RD-251 AV.
CEMETERY RD-243 AV.
WATSON RD-235 AV.
RAINBOW RD-277 AV.
DEAN RD-219 AV.
AIRPORT RD-211 AV.
TUTHILL RD-203 AV.
LIBERTY RD-199 AV.
JACKRABBIT TRAIL-195 AV.
PERRYVILLE RD-187 AV.
CITRUS RD-179 AV.
COTTON LN-171 AV.
SARIVL AV.-163 AV.
REEMS RD-155 AV.
BULLARD AV.-147 AV.
LITCHFIELD RD-139 AV.
DYSART RD-131 AV.
EL MIRAGE RD-123 AV.
115 AV.
107 AV.
99 AV.
91 AV.
BROADWAY RD
SOUTHERN AV.
BASELINE RD
LOWER RIVER RD
ELLIOT RD
NARRAMORE RD
RAY RD
CACTUS ROSE RD
PECOS RD
GERMANN RD
QUEEN CREEK RD
OCOTILLO RD
CHANDLER HEIGHTS RD
RIGGS RD
RAINBOW VALLEY RD-195 AV.
1000' CORRIDOR
N
0 1 2 3 4 5 MILES
SECTION NO.
PAGE NO.
PARCEL NO.
P22,G-47
P1,G-1
P2,G-3
P3,G-4
P4,G-5
P5,G-7
P6,G-9
P7,G-11
P8,G-12
P9,G-17
P10,G-19
P11,G-23
P12,G-25
P13,G-26
P14,G-27
P15,G-29
P16,G-30
P17,G-32
P18,G-36
P19,G-37
P20,G-40
P21,G-42
P22,G-47
P23,G-48
P24,G-52
P25,G-54
P26,G-55
P27,G-61
P28,G-66
P29,G-71
P30,G-78
P31,G-79
P32,G-80
P33,G-84
P34,G-86
P35,G-87
P36,G-90
P37,G-92
P38,G-93
P39,G-94
P40,G-96
P41,G-99
P42,G-100
P43,G-105
P44,G-111
P45,G-112
P46,G-116
P47,G-119
P48,G-122

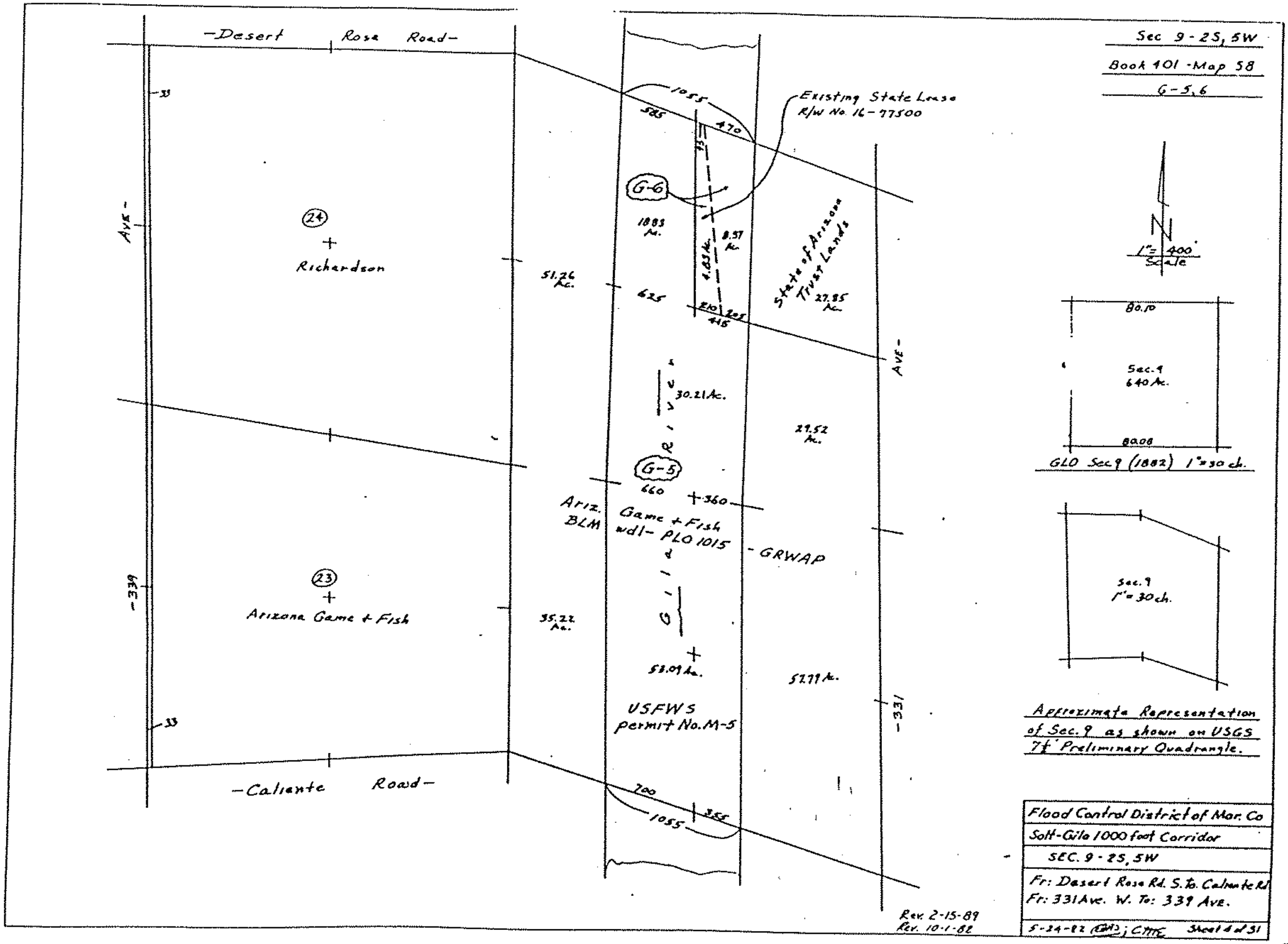

Sec. 28 - 2S, 5W
Book 401, Map 61
G-1, 2
-Citrus Heights Road-
Ave.-
-Ave-
-339
-331
-Riggs Road-
1005
1010
910
295
685
325
BLM R/W grant No. A-11649
BLM
31.36 Ac.
26.80 Ac.
2.40 Ac.
Gila River
G-1
G-2
12B
Long
OLD US
H/W 80
Arlington Canal
18
PICo A
17
GILLESPIE DAM
Prudential Ins. Company of America (PICA)
95.42 Ac.
Gila Bend Canal
PHOENIX YUMA HIGHWAY
A Tumbling T Ranches Inc. (ATTRI)
12A
Pipelines
933
EPNG Co.
931
EPNG Co.
Pipelines
13B
El Paso Nat. Gas Co. (EPNG Co)
14B
EPNG Co.
19
PICA
BLM
13A
ATTRI
14C
ATTRI
20
PICA
Enterprize Canal
Gila River
N
1" = 400'
Scale
5398.8
N 88°11' W
2696.1
2696.1
N 1°12' E
2665.74
2633.04
N 1°14' E
5272.08
N 0°27' W
2669.5
2635.04
2655.04
2655.04
N 89° 06' W
5311.68
GLO Sec 28 (1959) 1" = 30 chs
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 28 - 2S, 5W
Gillespie Dam
Fr: Ocotillo Rd. S. To: Citrus Hts Rd
Fr: 331 Av. W. To: 339 Av.
Rev. 2-2-89
5-24-81
Sheet 1 of 31
1.

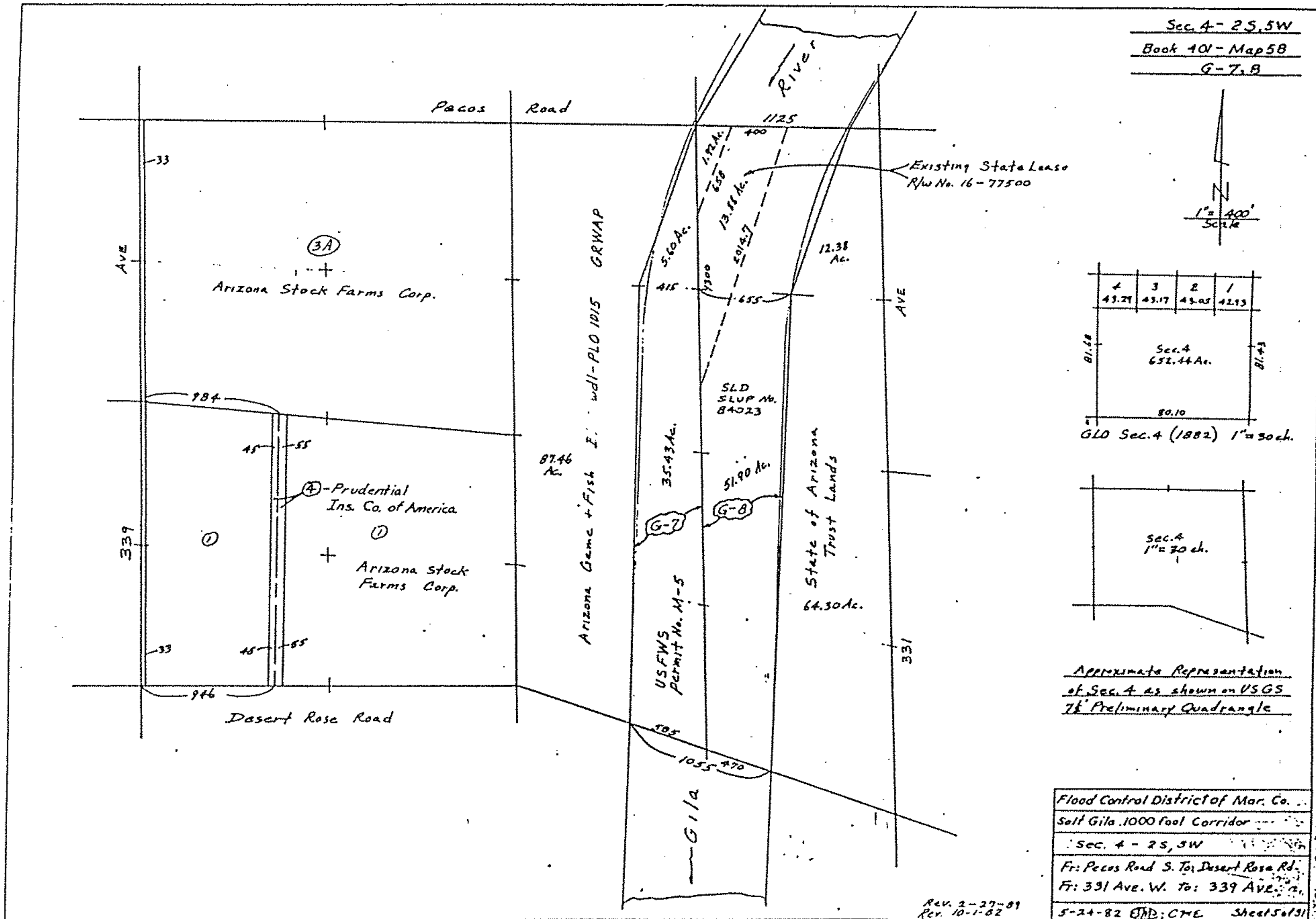

Sec. 21 - 25, 5W
Book 401, Map 61
G-3
-Ocotillo Road-
1010
735
275
River
Gila
1005
710
295
(1600' To: Gillespie Dam)
8A
R+R Farm
ARLINGTON
VALLEY
Ave.-
Ave-
10
Jagow
11
Jagow
Arlington Canal
-339
-331
33
G-3
207.90 Ac.
124.14 Ac.
130.81 Ac.
Ariz. Game+Fish
BLM wdl-PLO 1015
GRWAP
U.S. FWS
Permit No. M-5
-Citrus Heights Road-
PHX-Yuma H/w -OLD US H/W 80-
N
1" = 400'
Scale
5485.2
N 88° 25' W
2712.6
2712.6
5778.96
N 0° 35' E
2889.48
2889.48
N 0° 02' W
3507.2
N 1° 03' E
2645.28
2696.1
2696.1
N 88° 11' W
5392.2
GLO Sec. 21 (1959) 1" = 20ch
Flood Control District of Mar. Co.
Salt-Gila 1000 Foot Corridor
Sec 21 - 25, 5W
Fr: Ocotillo Rd S. To: Citrus Hts. Rd
Fr: 331 Av. W. To: 339 Av.
ARLINGTON VALLEY
5-20-82 (E.W.) ; Cont. Sheet 2 of 31
Rev 2-3-91

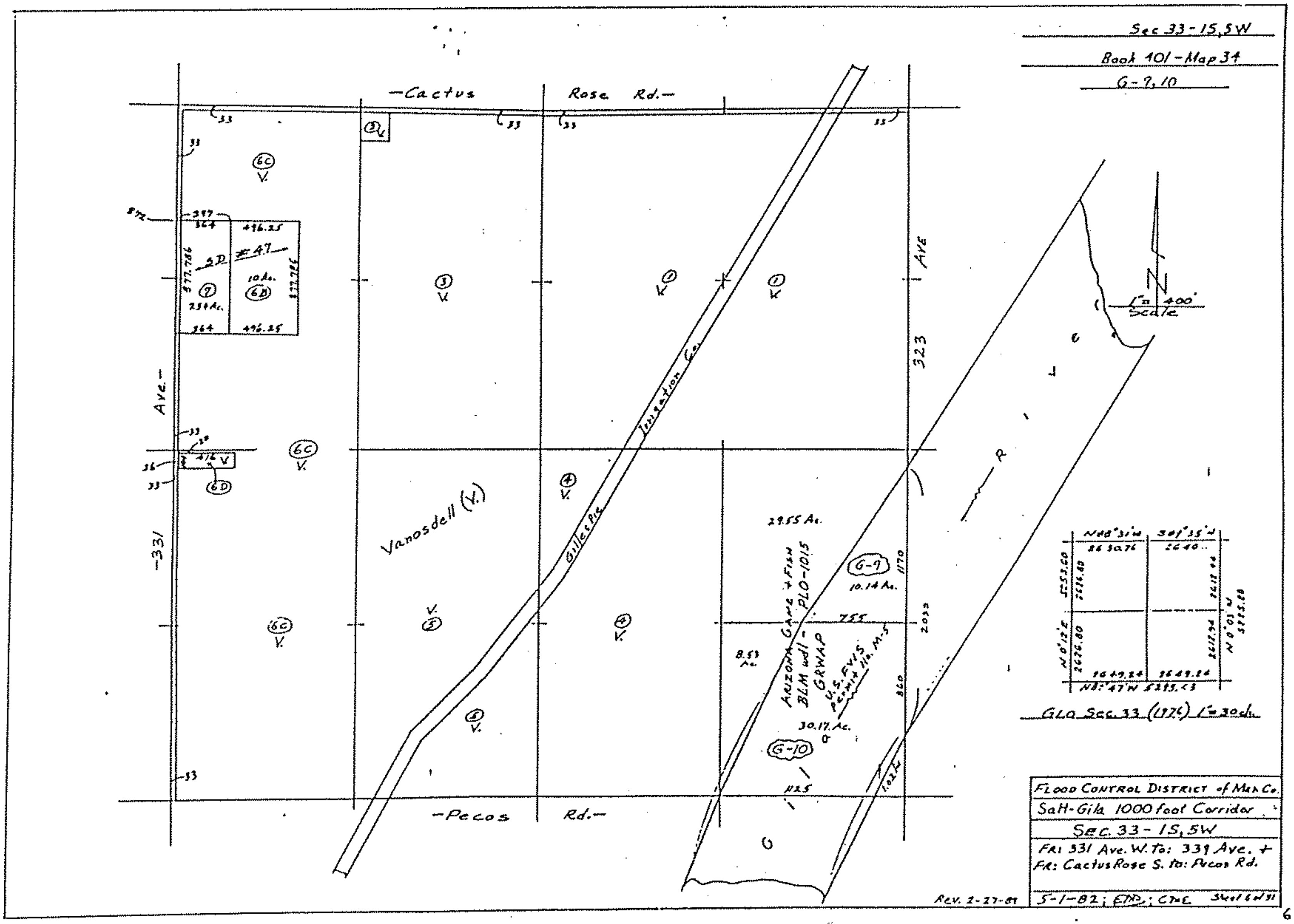
2 1

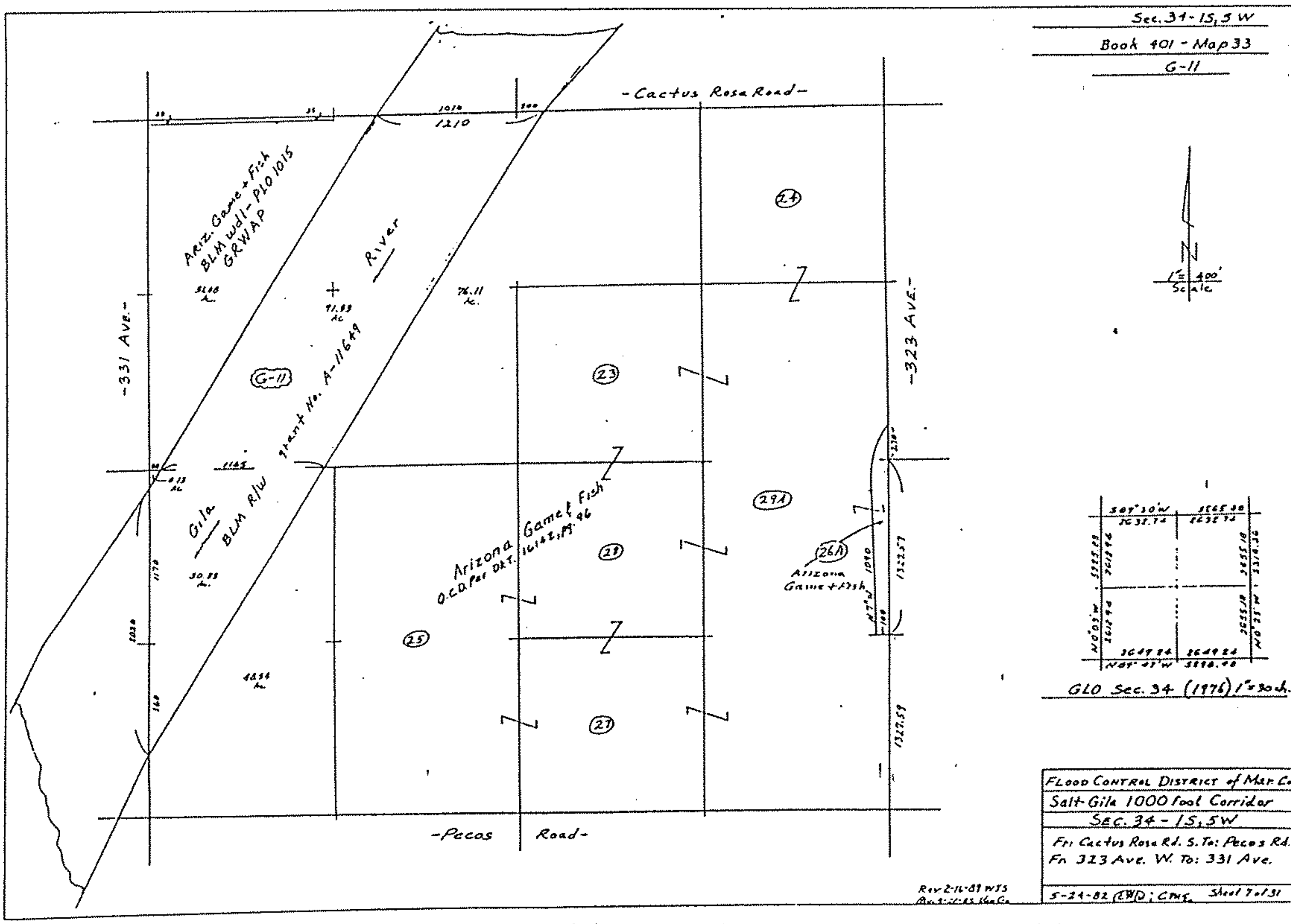


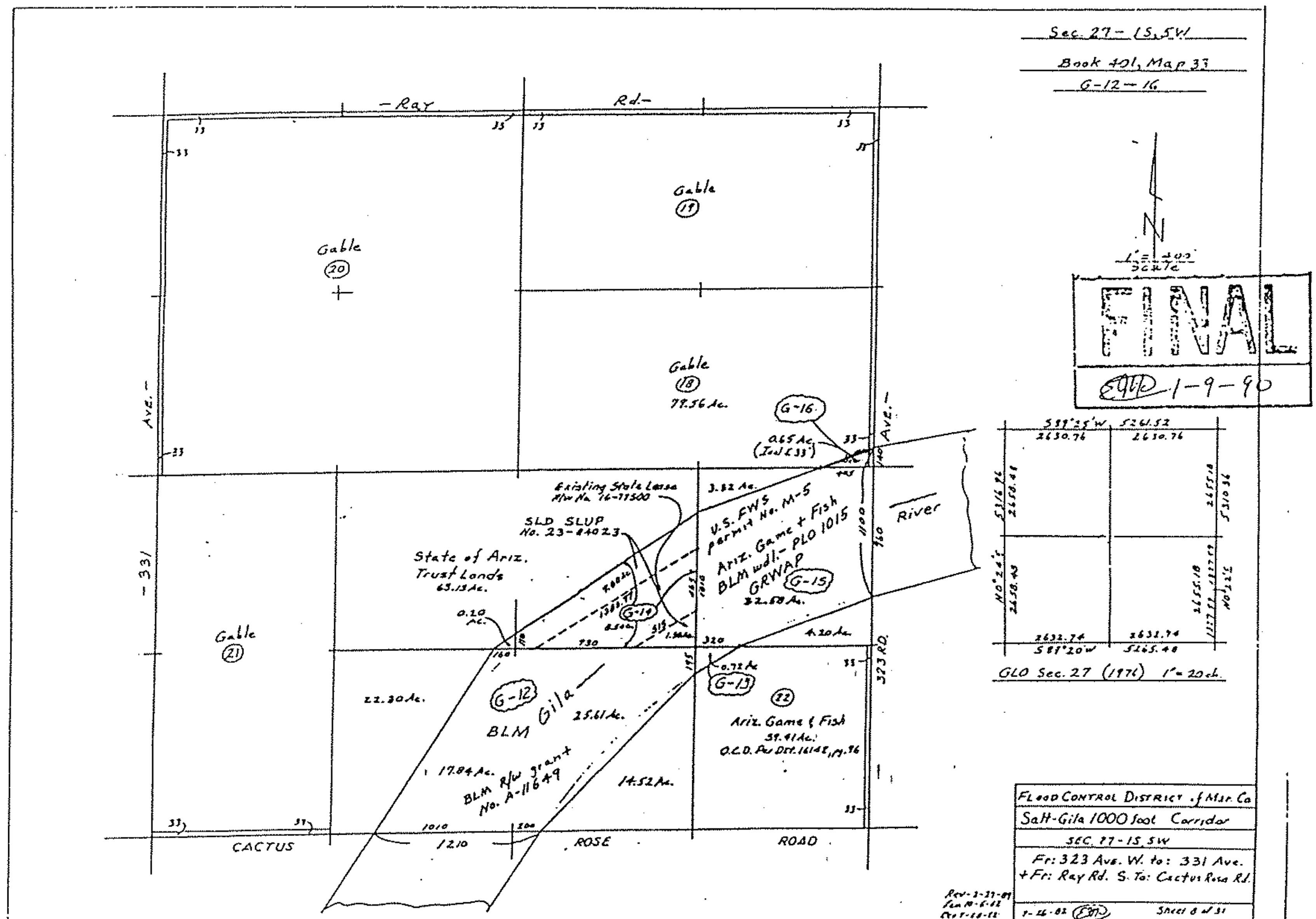
Sec. 16 - 2S, 5W
Book 401, Map 58
G-4, 4A
1" = 400' scale
80.08
Sec. 16 640 Ac.
79.87
GLO Sec 16 (1882) 1" = 30 ch.
Sec 16 1" = 30 ch.
Approximate Representation of Sec 16 as shown on USGS 7½' Preliminary Quadrangle.
- Caliente Rd -
Ave -
- 339
Ave -
- 331
1055
1010
SID SLUP 16.23-84023
State of Arizona Trust Lands
423.51 Ac.
G-4A
Gila River
39.02 Ac.
51.76 Ac.
G-4
38.86 Ac.
Existing State Lease R/W No. 16-77500
127.49 Ac.
ARLINGTON VALLEY
Ocotillo Road
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC. 16 - 2S, 5W
Fr: Caliente Rd: S. To: Ocotillo Rd.
Fr: 331 Av. W. To: 339 Avs.
ARLINGTON Valley
5-24-82 ; CNC Sheet 8 of 31


Sec 9 - 2S, 5W
Book 401 - Map 58
G-5, 6
-Desert Rose Road-
-Caliente Road-
Ave-
-339
-33
33
Ave-
-331
24
Richardson
23
Arizona Game + Fish
51.26 Ac.
35.22 Ac.
1055
585
470
Existing State Lease R/W No. 16-77500
G-6
1883 Ac.
8.57 Ac.
4.83 Ac.
State of Arizona Trust Lands
27.85 Ac.
625
210
205
415
30.21 Ac.
29.52 Ac.
Gila River
G-5
660
360
Ariz. BLM
Game + Fish wdl- PLO 1015
-GRWAP
53.09 Ac.
52.79 Ac.
USFWS permit No. M-5
700
355
1055
1" = 400' Scale
80.10
Sec. 9 640 Ac.
80.08
GLO Sec 9 (1882) 1" = 30 ch.
Sec. 9 1" = 30 ch.
Approximate Representation of Sec. 9 as shown on USGS 7½' Preliminary Quadrangle.
Flood Control District of Mar. Co
Salt-Gila 1000 foot Corridor
SEC. 9 - 2S, 5W
Fr: Desert Rose Rd. S. To. Caliente Rd
Fr: 331 Ave. W. To: 339 Ave.
5-24-82; CMTE
Sheet 4 of 31
Rev. 2-15-89
Rev. 10-1-82
4


Sec. 4 - 2S, 5W
Book 401 - Map 58
G-7, 8
N
1" = 400'
Scale
Pecos Road
River
1125
400
1.92 Ac.
658
13.88 Ac.
2014.7
5.60 Ac.
1300
415
655
12.38 Ac.
Existing State Lease
R/w No. 16-77500
3A
Arizona Stock Farms Corp.
AVE
33
984
45
55
4 - Prudential
Ins. Co. of America
1
Arizona Stock
Farms Corp.
339
45
65
946
Desert Rose Road
87.46 Ac.
Arizona Game + Fish E. wdl-PLO 1015 GRWAP
SLD
SLUP No.
84023
35.43 Ac.
51.90 Ac.
G-7
G-8
USFWS
Permit No. M-5
State of Arizona
Trust Lands
64.30 Ac.
AVE
331
585
1055
470
Gila
4
43.29
3
43.17
2
43.05
1
42.93
Sec. 4
652.44 Ac.
81.68
81.43
80.10
GLO Sec. 4 (1882) 1" = 30 ch.
Sec. 4
1" = 30 ch.
Approximate Representation
of Sec. 4 as shown on USGS
7½' Preliminary Quadrangle
Rev. 2-27-89
Rev. 10-1-82
Flood Control District of Mar. Co.
Salt Gila 1000 foot Corridor
Sec. 4 - 2S, 5W
Fr: Pecos Road S. To: Desert Rose Rd.
Fr: 331 Ave. W. To: 339 Ave.
5-24-82 EMD; CME
Sheet 5 of 31

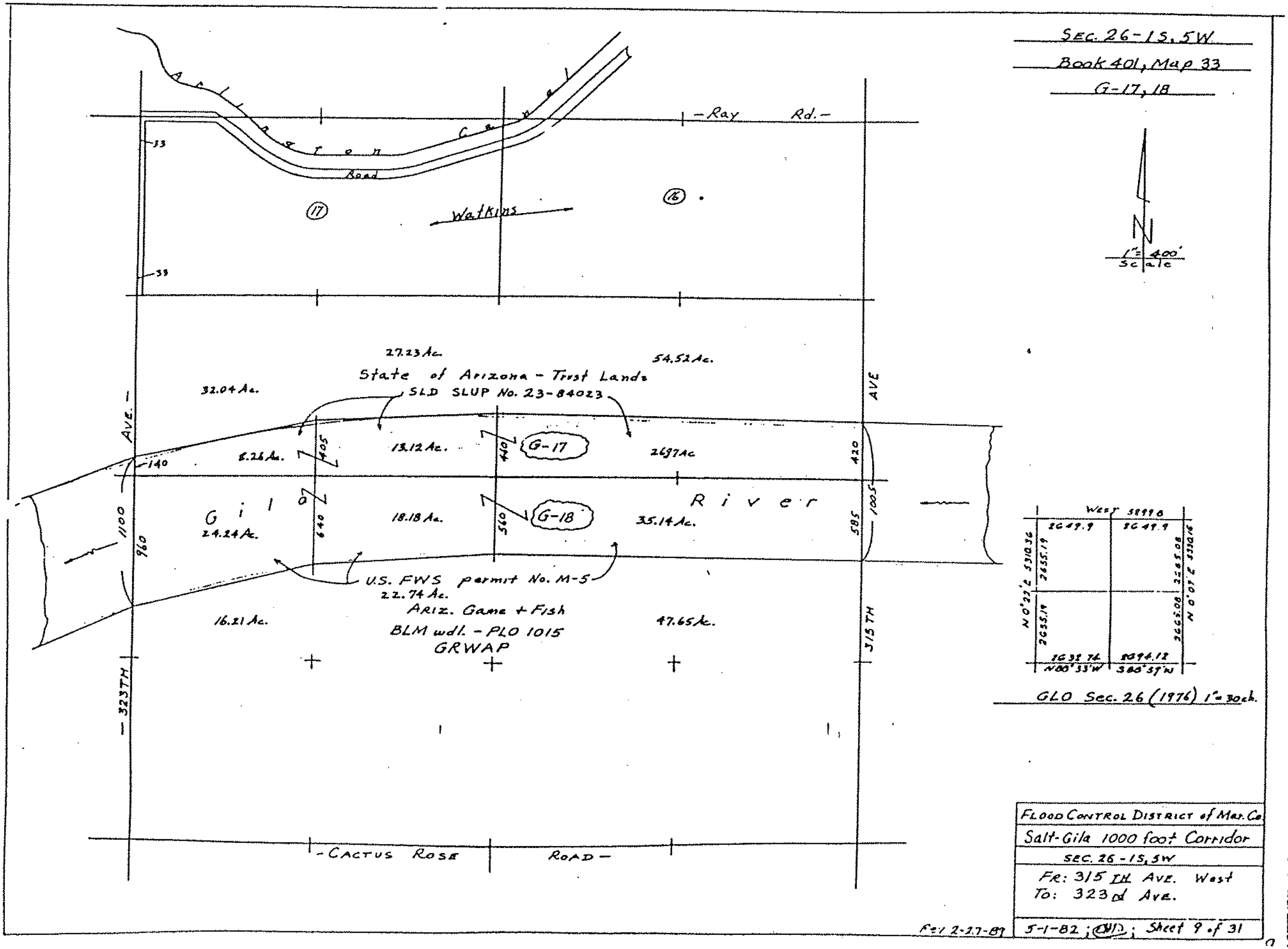

Sec 33-1S,5W
Book 401-Map 34
G-9,10
-Cactus Rose Rd.-
-Pecos Rd.-
Ave.-
-331
323
Ave
Vanosdell (V.)
Gillespie Irrigation Co.
Arizona Game + Fish
BLM wdl - PLO-1015
GRWAP
U.S. F.W.S. Permit No. M-5
29.55 Ac.
10.14 Ac.
30.17 Ac.
8.53 Ac.
G-9
G-10
#47
10 Ac.
23+Ac.
496.25
364
377.786
1" = 400' Scale
GLO Sec. 33 (1926) 1" = 30 ch.
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 33 - 1S, 5W
Fr: 331 Ave. W. To: 339 Ave. +
Fr: Cactus Rose S. to: Pecos Rd.
5-1-82; EMD; CME
Rev. 2-27-89

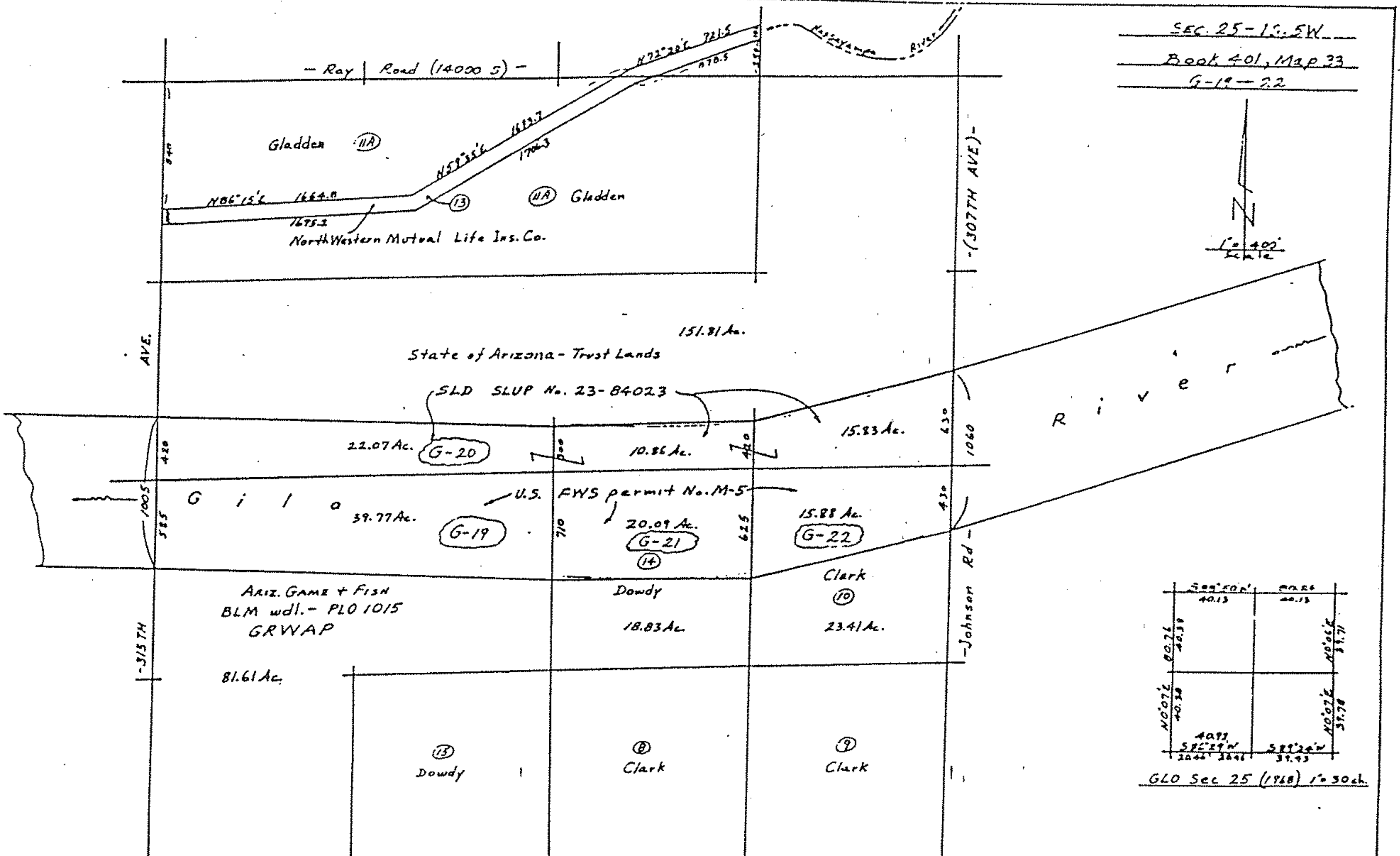

Sec. 34-1S,5W
Book 401 - Map 33
G-11
-Cactus Rosa Road-
-331 Ave.-
-323 Ave.-
-Pecos Road-
1010
1210
Ariz. Game + Fish
BLM wdl- PLO 1015
GRWAP
River
grant No. A-11649
G-11
Gila
BLM R/W
Arizona Game + Fish
O.C.D. Per DKT. 16142, Pg. 96
24
23
29A
26A
Arizona
Game + Fish
28
25
27
1" = 400'
Scale
GLO Sec. 34 (1976) 1" = 30 ch.
FLOOD CONTROL DISTRICT of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC. 34 - 1S, 5W
Fr: Cactus Rosa Rd. S. To: Pecos Rd.
Fr: 323 Ave. W. To: 331 Ave.
5-24-82
Sheet 7 of 31
Rev 2-16-89 WTS
7



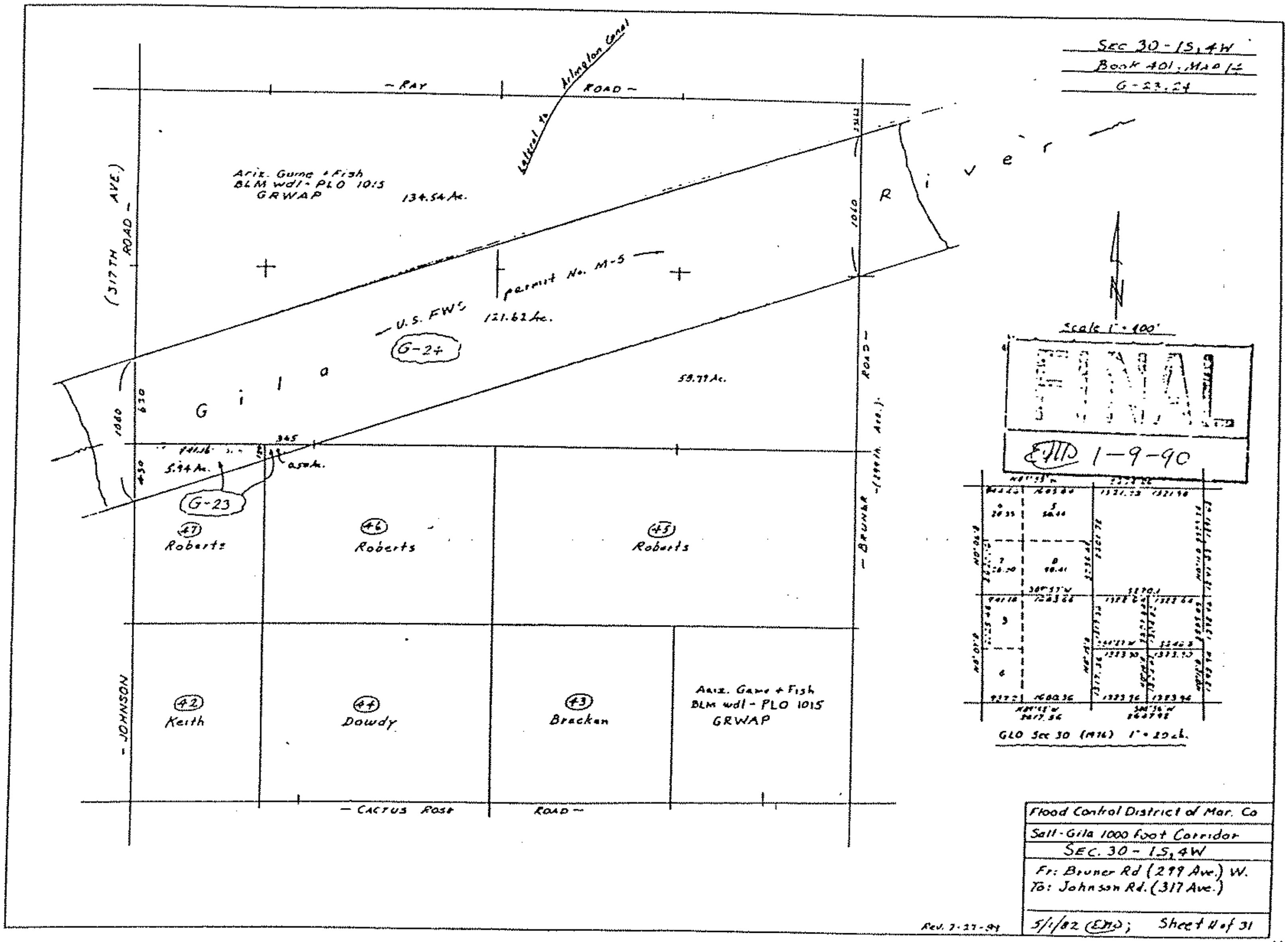
Sec. 27 - 1S, 5W
Book 401, Map 33
G-12 - 16
N
1" = 400' Scale
FINAL
1-9-90
- Ray Rd. -
Ave. -
- 331
Gable 20
Gable 19
Gable 18
79.56 Ac.
Gable 21
G-16
0.65 Ac. (Incl. 33')
Existing State Lease R/w No. 16-77500
SLD SLUP No. 23-84023
State of Ariz. Trust Lands 65.13 Ac.
0.20 Ac.
3.82 Ac.
U.S. FWS permit No. M-5
Ariz. Game + Fish BLM wdl. - PLO 1015 GRWAP
G-15
32.58 Ac.
G-14
4.20 Ac.
River
Gila
G-12
BLM
22.30 Ac.
25.61 Ac.
17.84 Ac.
BLM R/w grant No. A-11649
14.52 Ac.
G-13
0.72 Ac.
22
Ariz. Game & Fish 39.41 Ac.
323 RD.
CACTUS
ROSE
ROAD
1210
1010
1100
760
320
930
S 89°25' W 5261.52
2630.76
2630.76
N 0°24' E
5316.96
2658.48
2658.48
2655.18
5310.36
N 0°22' E
2632.74
2632.74
S 89°20' W 5265.48
GLO Sec. 27 (1976) 1" = 20 ch.
FLOOD CONTROL DISTRICT of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC. 27-1S.5W
Fr: 323 Ave. W. to: 331 Ave.
+ Fr: Ray Rd. S. To: Cactus Rose Rd.
Sheet 8 of 31

8


Sec. 26-1S, 5W
Book 401, Map 33
G-17, 18
1" = 400'
Scale
Arlington Canal
Road
Ray Rd.
Watkins
(17)
(16)
27.23 Ac.
54.52 Ac.
32.04 Ac.
State of Arizona - Trust Lands
SLD SLUP No. 23-84023
13.12 Ac.
8.26 Ac.
2697 Ac
G-17
G-18
Gila River
18.18 Ac.
24.24 Ac.
35.14 Ac.
U.S. FWS permit No. M-5
22.74 Ac.
Ariz. Game + Fish
BLM wdl. - PLO 1015
GRWAP
16.21 Ac.
47.65 Ac.
140
405
640
410
560
420
585
1005
1100
960
33
33
AVE.
323TH
AVE
315TH
Cactus Rose
Road
West 5299.8
2649.9
2649.9
2655.19
2655.19
2665.08
2665.08
N 0°22'E 5310.36
N 0°07'E 5330.16
2632.74
2694.12
N00°33'W
S80°59'W
GLO Sec. 26 (1976) 1" = 30 ch.
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 26-1S, 5W
Fr: 315 th Ave. West
To: 323 rd Ave.
5-1-82 ; (JHD) ; Sheet 9 of 31
Rev. 2-27-89



Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 25 - 1S, 5W
Fr: Johnson Rd. (307 Ave.) West
To: 315 Ave.
5-1-82; (EW); Sheet 10 of 31


Sec 30 - 1S, 4W
Book 401, Map 14
G-23, 24
~ RAY ROAD ~
Lateral to Arlington Canal
(317TH AVE.)
ROAD -
Ariz. Game + Fish
BLM wdl - PLO 1015
GRWAP
134.54 Ac.
Gila River
permit No. M-5
U.S. FWS
121.62 Ac.
G-24
59.79 Ac.
1060
630
450
345
5.94 Ac.
G-23
47 Roberts
46 Roberts
45 Roberts
42 Keith
44 Dowdy
43 Bracken
Ariz. Game + Fish
BLM wdl - PLO 1015
GRWAP
- JOHNSON
- CACTUS ROSE ROAD -
- BRUNER ROAD -
(299th Ave.)
N
Scale 1" = 400'
FINAL
EMD 1-9-90
GLO Sec 30 (1916) 1" = 20 ch.
Flood Control District of Mar. Co
Salt-Gila 1000 foot Corridor
SEC. 30 - 1S, 4W
Fr: Bruner Rd (299 Ave.) W.
To: Johnson Rd. (317 Ave.)
5/1/82 (EMD); Sheet 11 of 31
Rev. 7-27-94

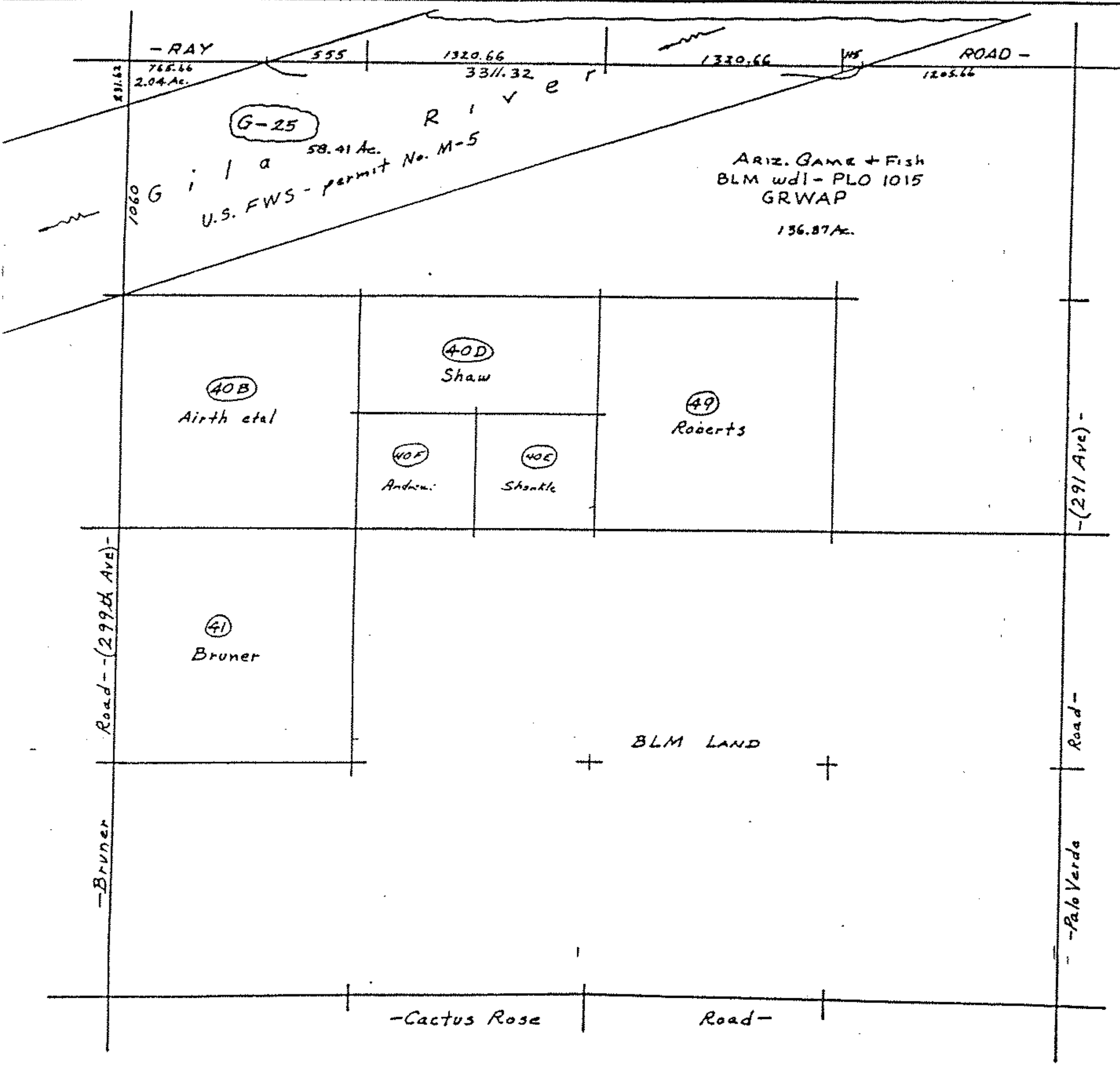
11

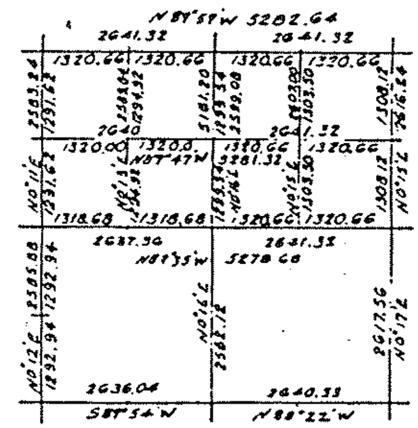
Sec. 29-1S,4W

Book 401, Map 14

G-25

1" = 400
Scale

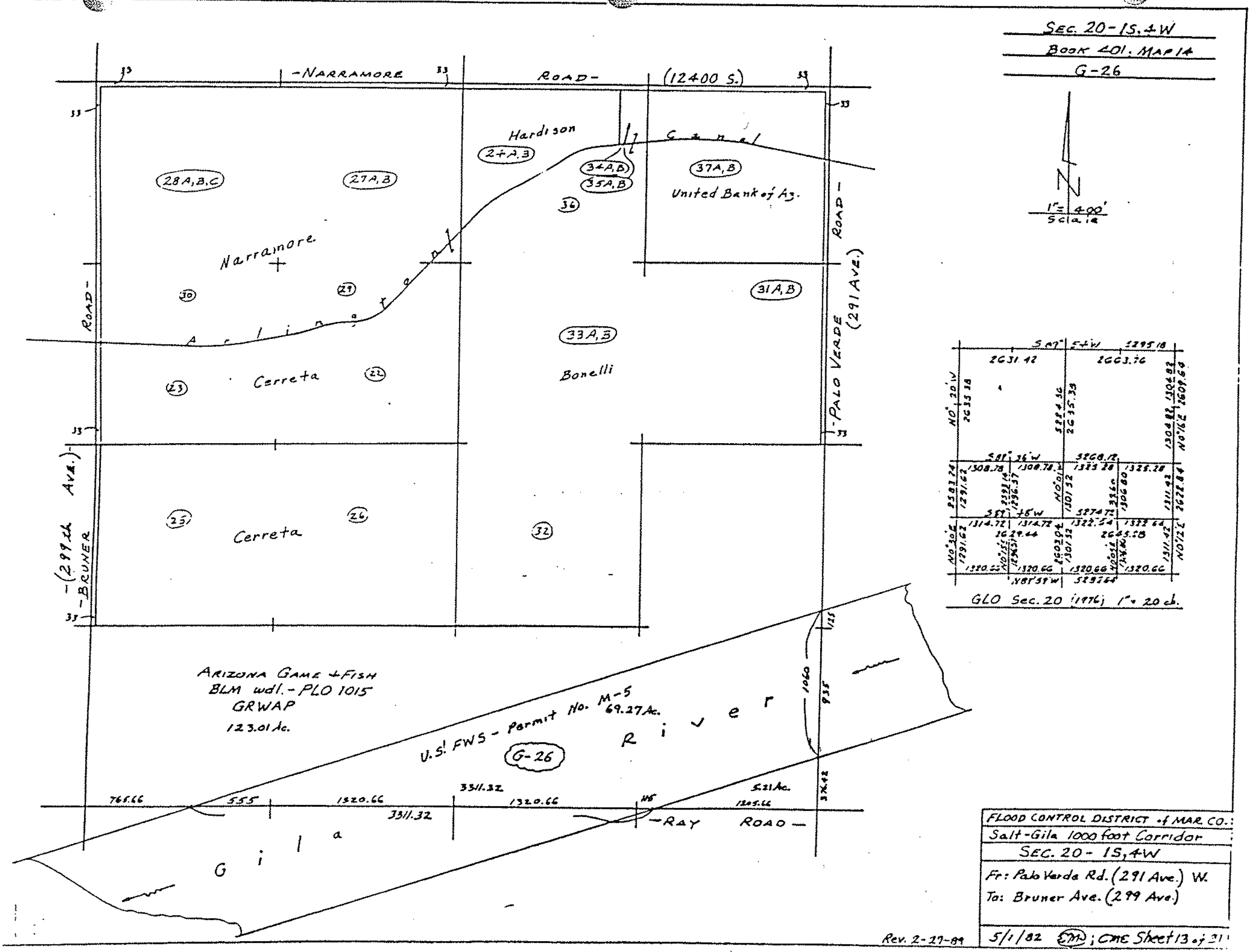




GLO Sec. 29 (1976) 1" = 20 ch.

FLOOD CONTROL DISTRICT of MAR. Co.
Salt-Gila 1000 foot Corridor
SEC 29 - 1S, 4W.
Fr: Palo Verde Rd. (291 Ave.) W. To: Bruner Rd. (299 Ave.)
5/1/82 (EM); cmc Sheet 12 of 31

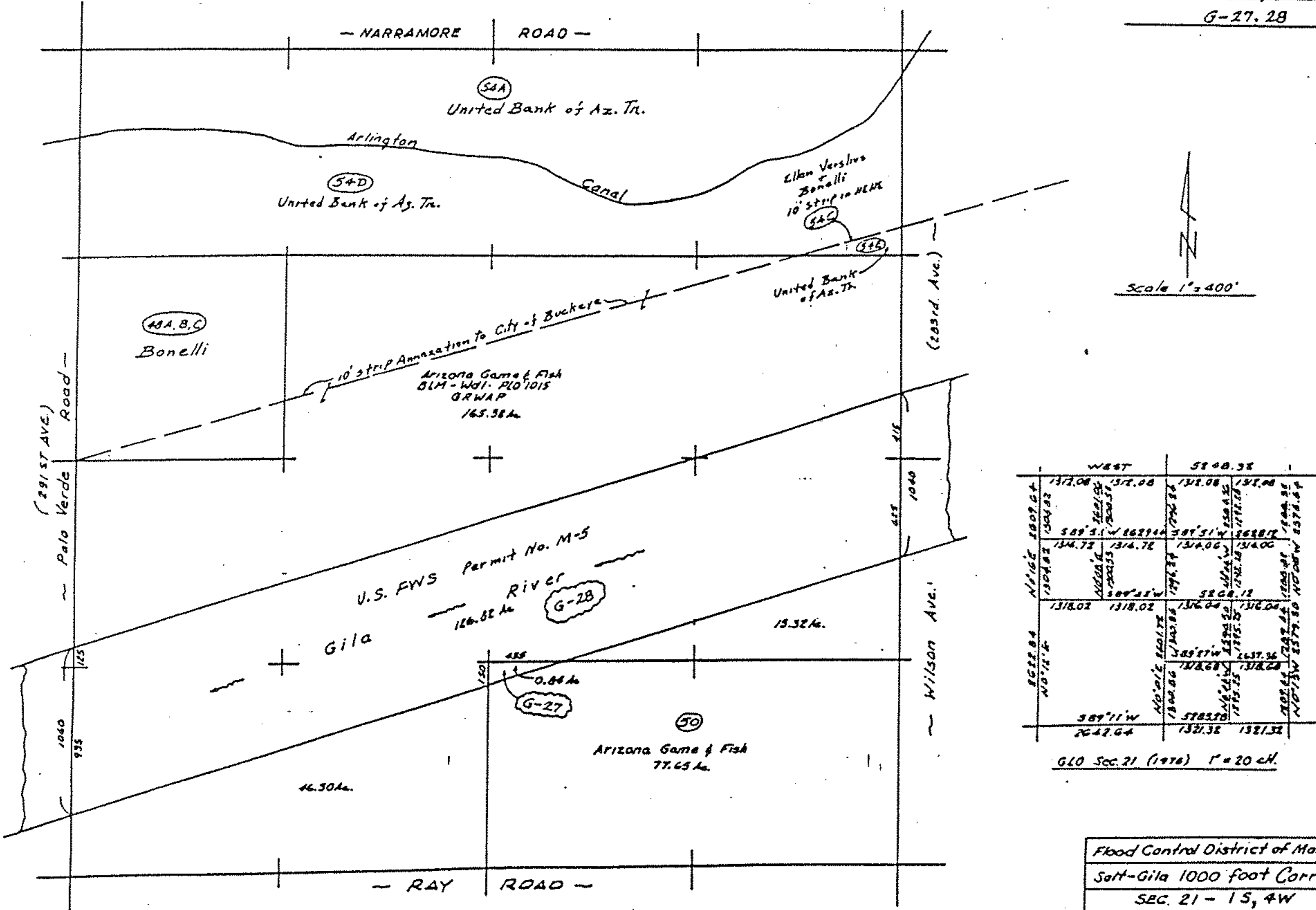
Rev. 2-27-84
Rev. 6-11-85


Sec. 20-1S,4W
Book 401, Map 14
G-26
1" = 400'
Scale
-Narramore Road- (12400 S.)
Road- Palo Verde (291 Ave.)
-Bruner (299th Ave.) Road-
Arlington Canal
Hardison
24A,B
28A,B,C
27A,B
34A,B
35A,B
36
37A,B
United Bank of Az.
Narramore
30
29
31A,B
33A,B
Cerreta
23
22
Bonelli
25
26
Cerreta
32
Arizona Game & Fish
BLM wdl. - PLO 1015
GRWAP
123.01 Ac.
U.S. FWS - Permit No. M-5
69.27 Ac.
G-26
Gila River
765.66
555
1320.66
3311.32
3311.32
1320.66
5.21 Ac.
1205.66
-Ray Road-
1060
935
GLO Sec. 20 (1976) 1" = 20 ch.
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 20 - 1S,4W
Fr: Palo Verde Rd. (291 Ave.) W.
To: Bruner Ave. (299 Ave.)
5/1/82 ; Sheet 13 of 31
Rev. 2-27-89

Sec. 21-1S, 4W

Book 401, Map 14

G-27, 28



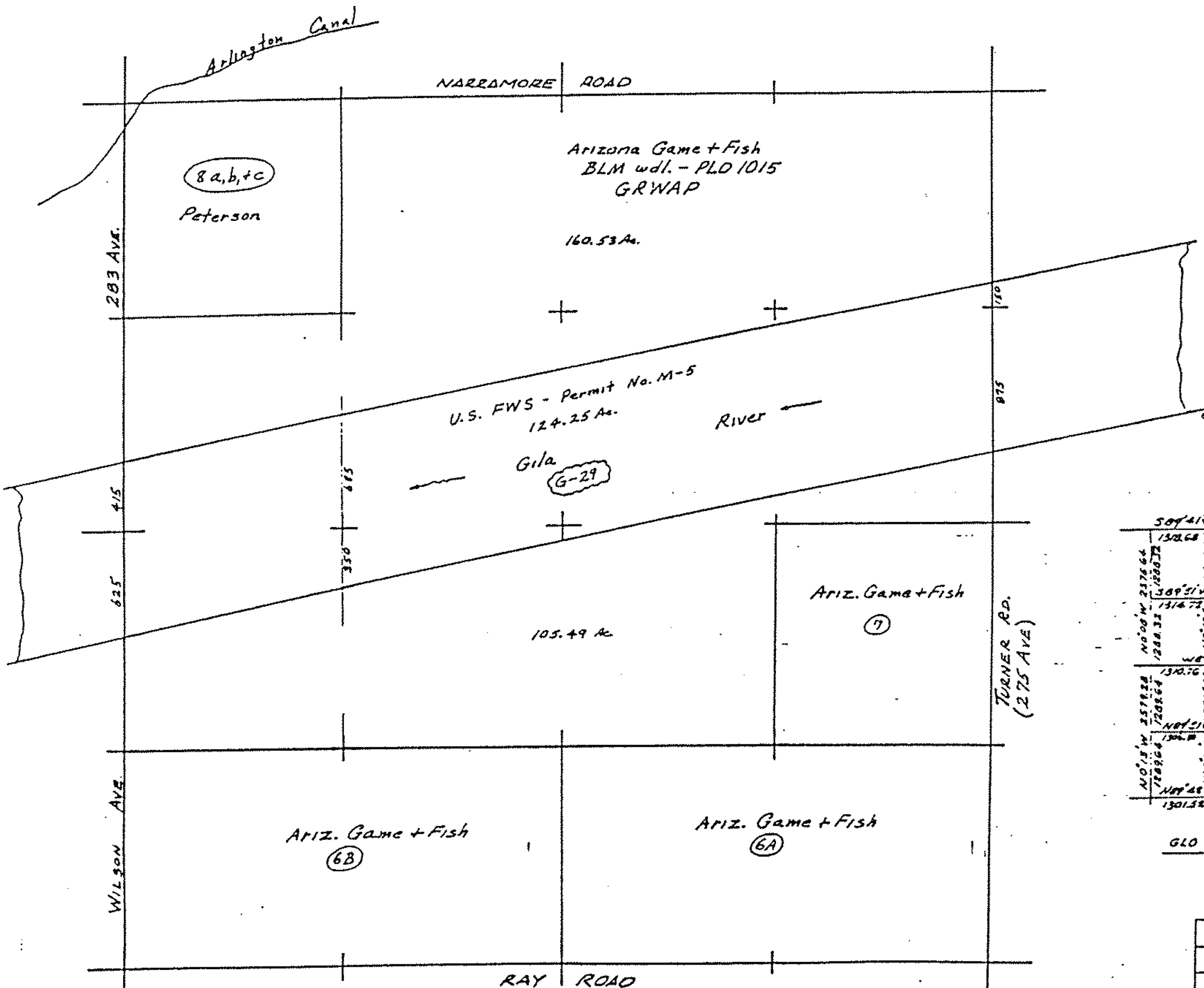
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC. 21 - 1S, 4W
Fr: Wilson Ave (283rd. Ave.) To: Palo Verde Road (291st Ave)
7-14-82 Care   Sheet 14 of 31

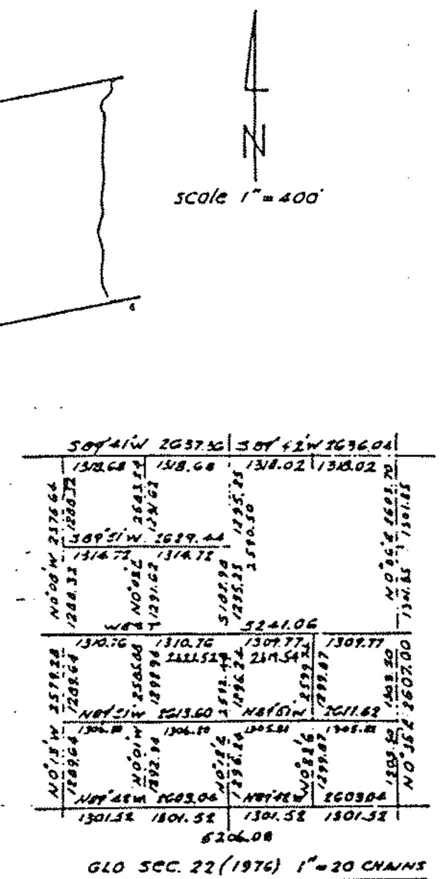
Rev. 2-28-89

SEC. 22-1S. 4W

Book 401, Map 4

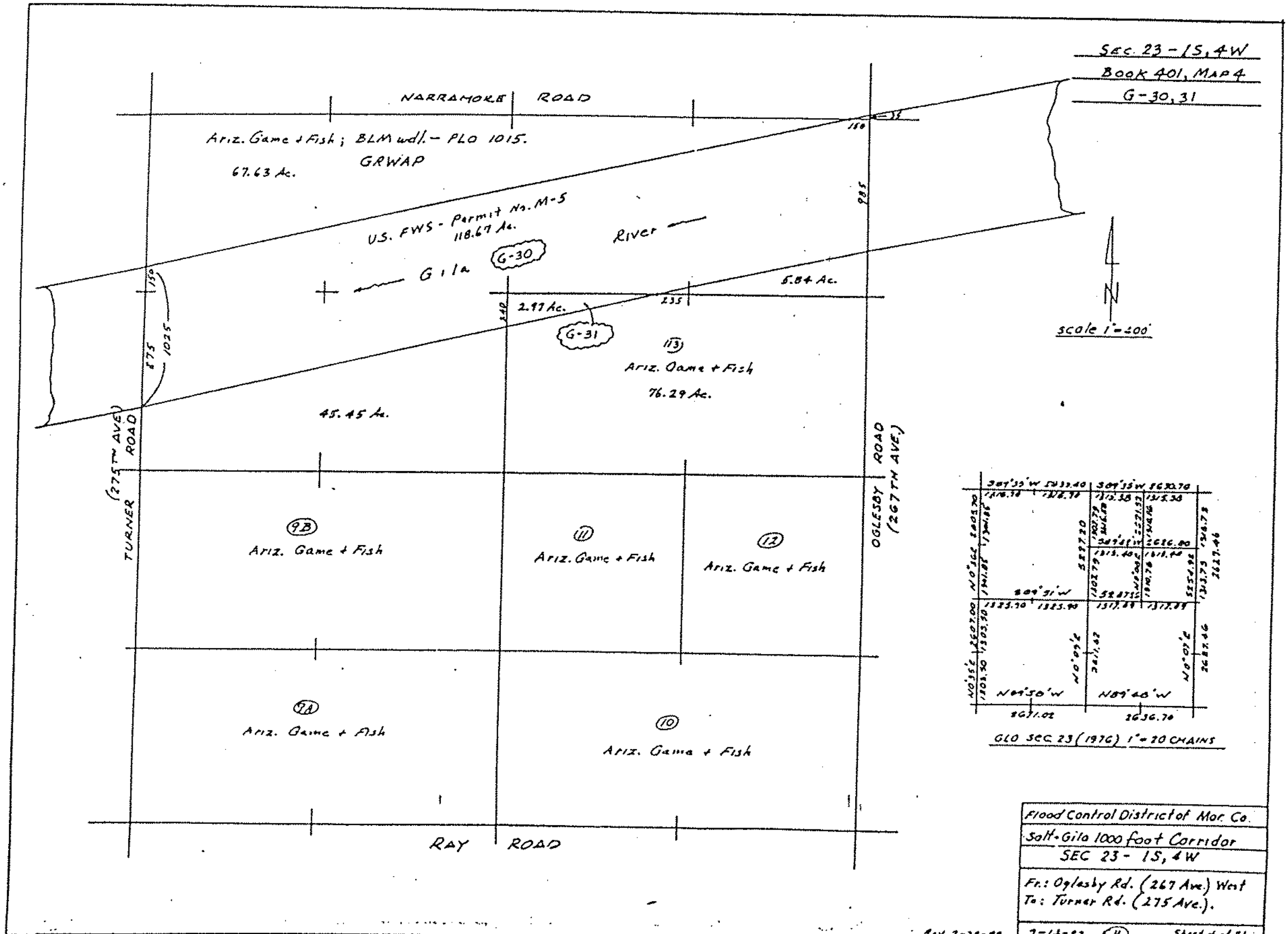
G-29



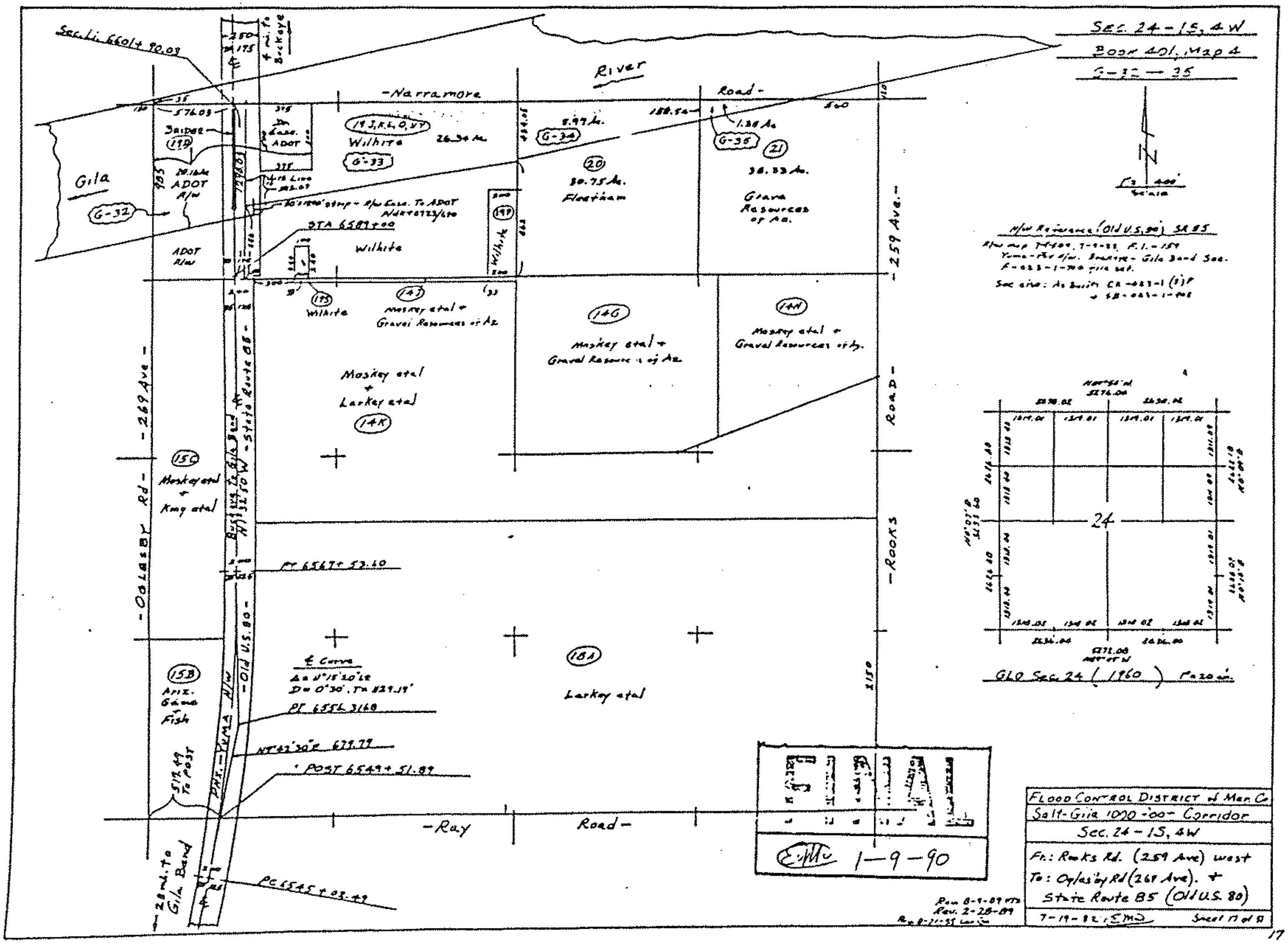


Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC. 22 - 1S, 4W
Fr: Turner Rd. (275 Ave) West To: Wilson Ave. (283 Ave.)
7-14-82 EHC Sheet 15 of 31

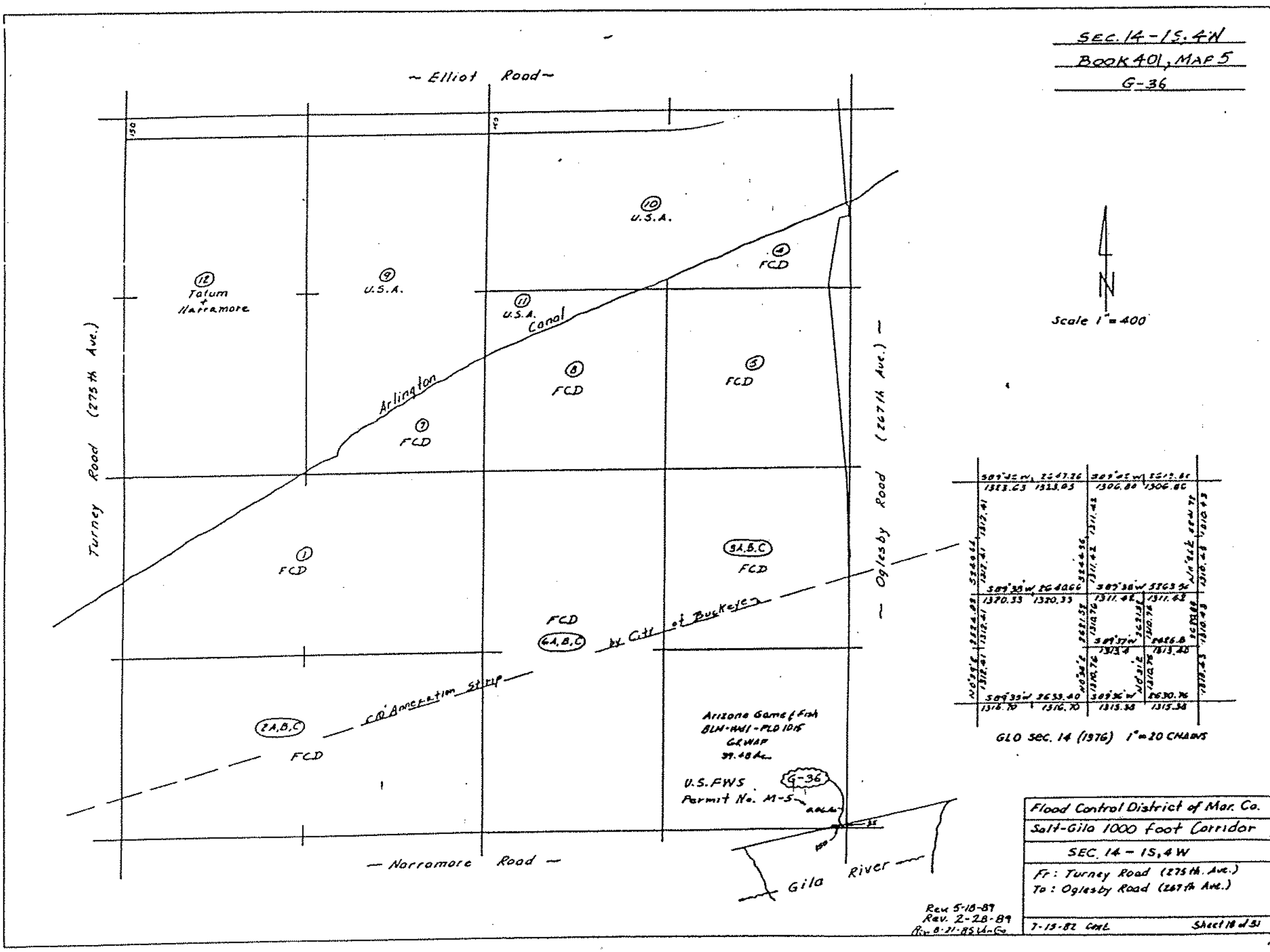
Rev. 2-28-89



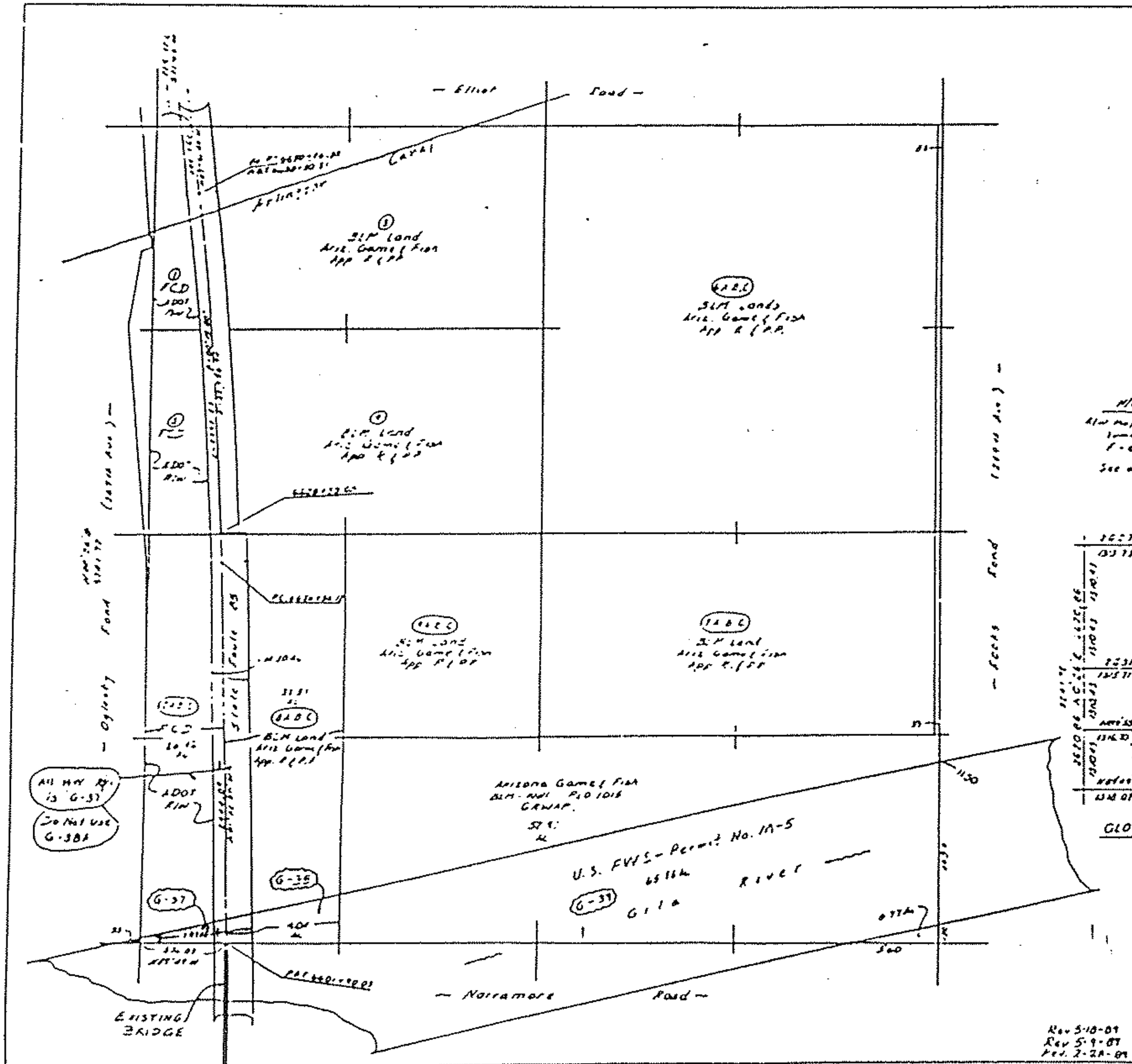
SEC. 23 - 1S, 4W
Book 401, MAP 4
G-30, 31
NARRAMORE ROAD
Ariz. Game + Fish; BLM wdl. - PLO 1015.
GRWAP
67.63 Ac.
U.S. FWS - Permit No. M-5
118.67 Ac.
G-30
Gila River
5.84 Ac.
2.97 Ac.
G-31
113
Ariz. Game + Fish
76.29 Ac.
45.45 Ac.
TURNER ROAD
(275TH AVE)
OGLESBY ROAD
(267TH AVE.)
9B
Ariz. Game + Fish
11
Ariz. Game + Fish
12
Ariz. Game + Fish
9A
Ariz. Game + Fish
10
Ariz. Game + Fish
RAY ROAD
scale 1" = 200'
N
GLO SEC 23 (1976) 1" = 20 CHAINS
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC 23 - 1S, 4W
Fr.: Oglesby Rd. (267 Ave.) West
To: Turner Rd. (275 Ave.).
Rev. 2-23-89
7-14-82
Sheet 16 of 31



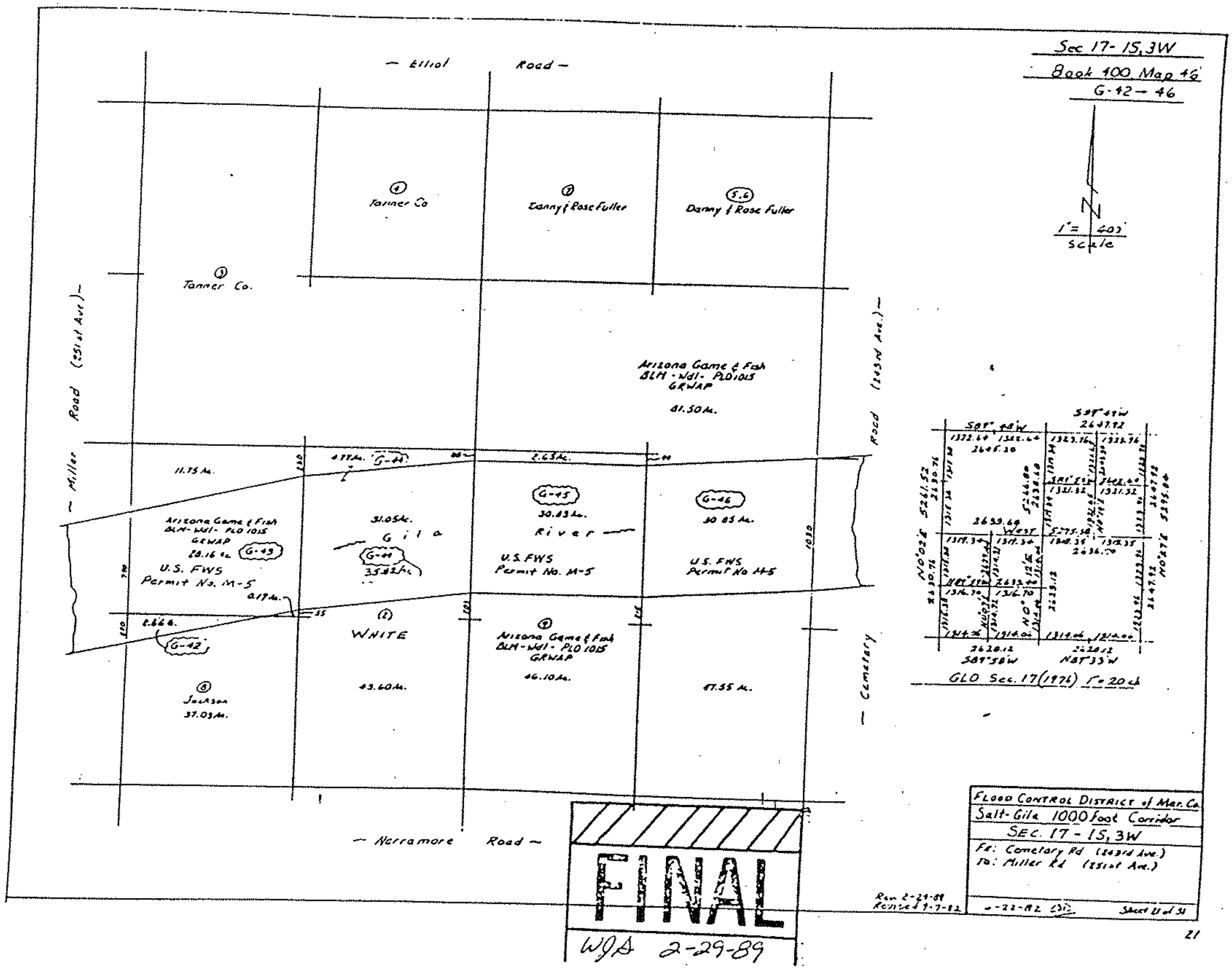
Sec. 24-1S, 4W
Book 401, Map 4
G-32 — 35
Gila
River
-Narramore
Road-
-259 Ave.
Road-
-Rooks
-Ray
Road-
-Oglesby Rd-
-269 Ave-
Old U.S. 80
State Route 85
Wilhite
Mosky etal + Gravel Resources of Az
Mosky etal + Larkey etal
Larkey etal
Moskey etal + King etal
Ariz. Game + Fish
Fleetham
Gravel Resources of Az.
Snider
ADOT R/W
STA 6589+00
PT 6567+53.60
PI 6556.3168
POST 6549+51.89
PC 6545+03.49
GLO Sec. 24 (1960)
FLOOD CONTROL DISTRICT of Mar. Co.
Salt-Gila 1090-00- Corridor
Sec. 24-1S, 4W
Fr: Rooks Rd. (259 Ave) west
To: Oglesby Rd (269 Ave). + State Route 85 (Old U.S. 80)
7-19-82, EMD
Sheet 17 of 51
1-9-90
17

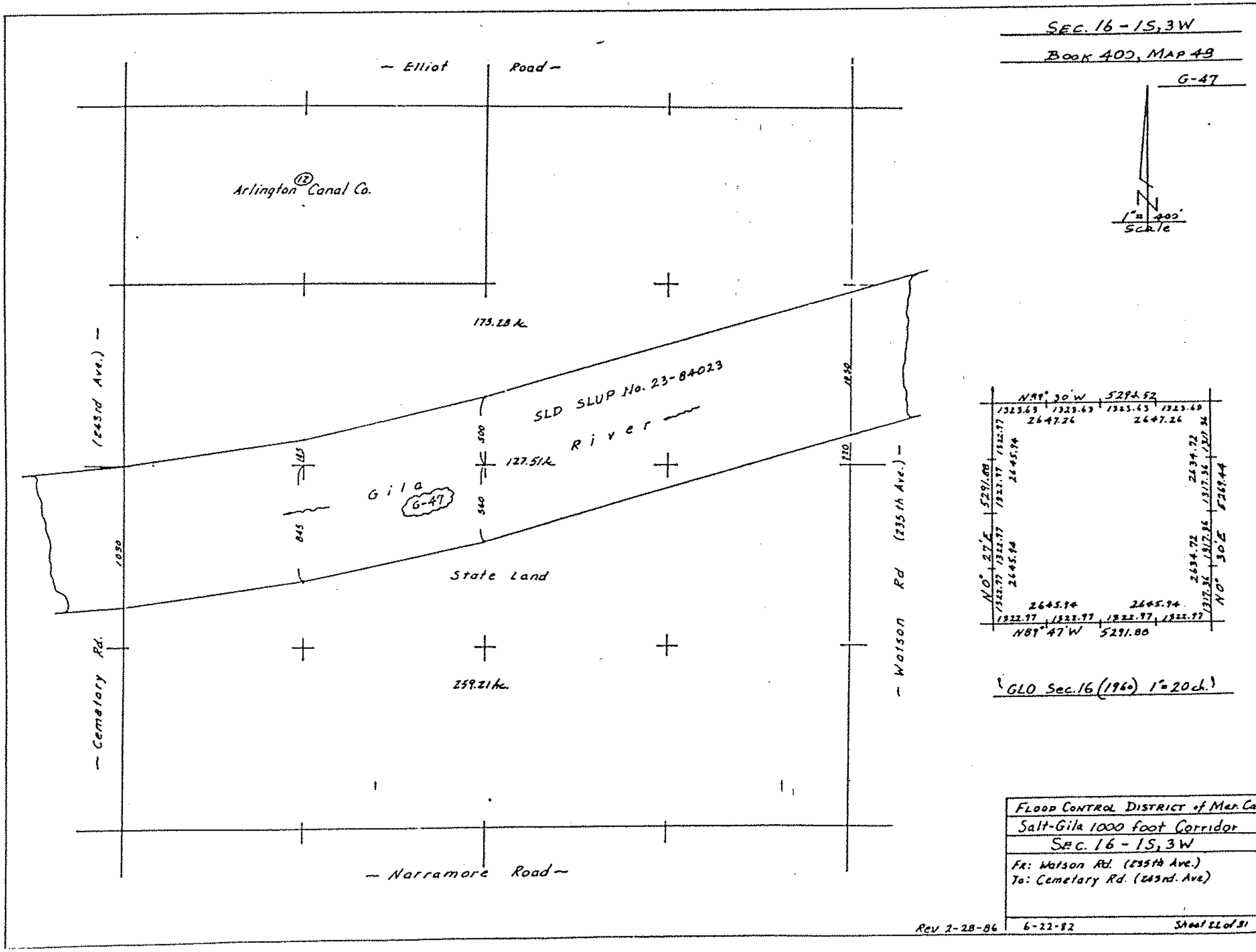

SEC. 14-1S,4W
BOOK 401, MAP 5
G-36
~ Elliot Road ~
Turney Road (275th Ave.)
Oglesby Road (267th Ave.)
— Narramore Road —
Gila River
Arlington Canal
⑫ Tatum + Narramore
⑨ U.S.A.
⑩ U.S.A.
⑪ U.S.A.
④ FCD
⑤ FCD
⑧ FCD
⑦ FCD
① FCD
3A,B,C FCD
6A,B,C FCD
2A,B,C FCD
by City of Buckeye
C.O. Annexation Strip
Arizona Game & Fish
BLM-AWI-PLD 1015
GRWAP
39.48 Ac.
U.S.FWS
Permit No. M-5
G-36
Scale 1" = 400'
GLO SEC. 14 (1976) 1" = 20 CHAINS
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC. 14 - 1S, 4 W
Fr: Turney Road (275th Ave.)
To: Oglesby Road (267th Ave.)
7-15-82 CML
Sheet 18 of 31
Rev. 5-18-89
Rev. 2-28-89

18



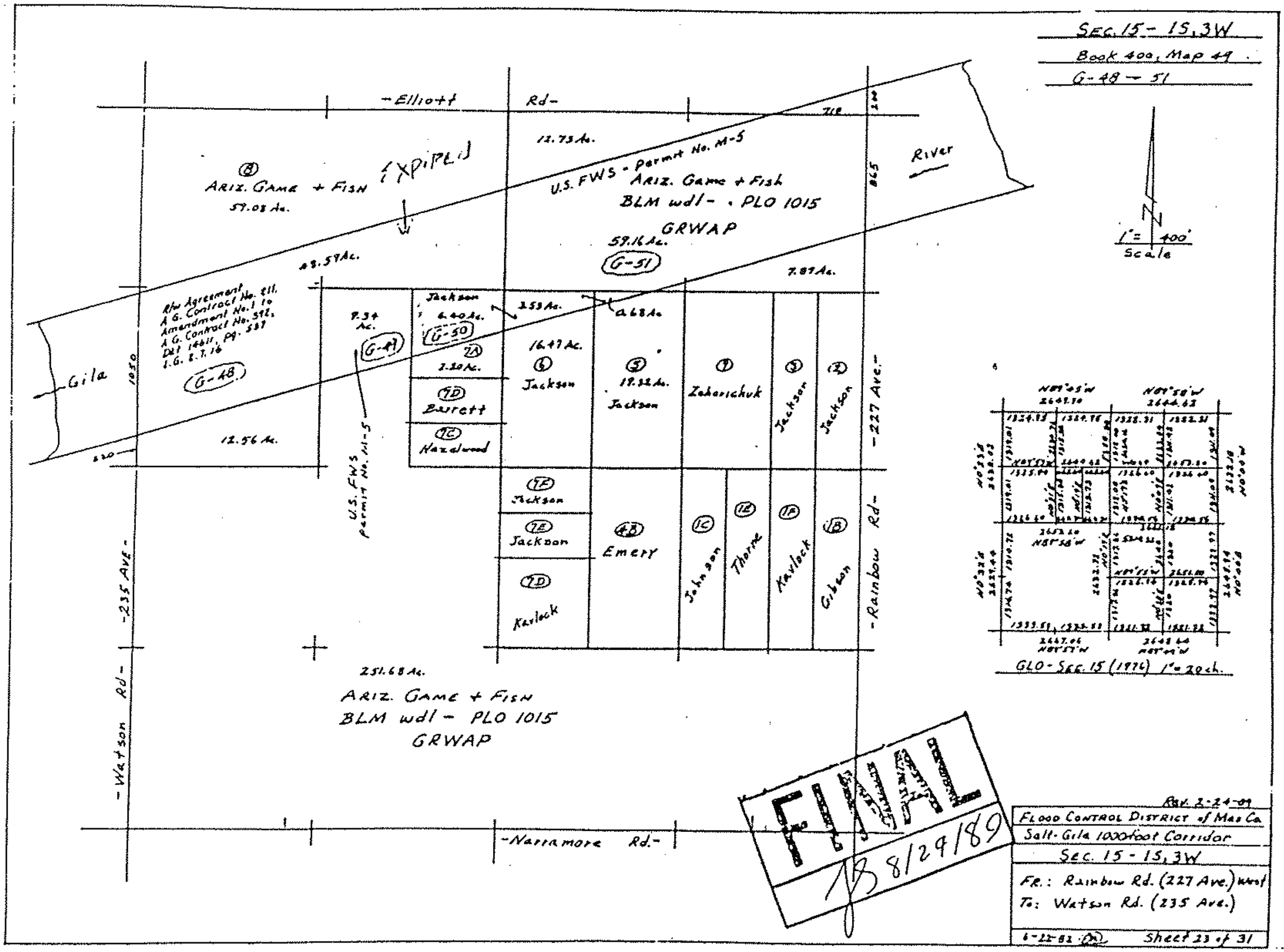
Flood Control District of Mar. Co.
Salt Gila 1000 Foot Corridor
SEC. 13 - 1S, 4W
Fr: Rooks Rd (259th Ave.) To: Oglesby Rd (267th Ave.)
Sheet 19 of 31


Sec 17-1S,3W
Book 100 Map 46
G-42 - 46
N
1" = 40' scale
— Elliot Road —
— Miller Road (251st Ave.) —
Road (243rd Ave.) —
— Narramore Road —
— Cemetary
④ Tanner Co
⑦ Danny & Rose Fuller
5.6 Danny & Rose Fuller
③ Tanner Co.
Arizona Game & Fish BLM - Wdl - PLD 1015 GRWAP 81.50 Ac.
11.75 Ac.
Arizona Game & Fish BLM - Wdl - PLD 1015 GRWAP 28.16 Ac.
G-43
U.S. FWS Permit No. M-5
G-44
31.05 Ac.
35.82 Ac.
G-45
30.83 Ac.
U.S. FWS Permit No. M-5
G-46
30.85 Ac.
U.S. FWS Permit No. M-5
Gila River
G-42
⑧ Jackson 37.03 Ac.
② WHITE 43.60 Ac.
⑨ Arizona Game & Fish BLM - Wdl - PLD 1015 GRWAP 46.10 Ac.
47.55 Ac.
GLO Sec. 17 (1976) 1" = 20 ch
FINAL
WJS 2-29-89
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 17 - 1S, 3W
Fr: Cemetary Rd (243rd Ave.)
To: Miller Rd (251st Ave.)
Rev 2-29-89
Revised 9-7-82
Sheet 21 of 31
21



Sec. 16 - 1S, 3W
Book 402, Map 49
G-47
1" = 400'
Scale
— Elliot Road —
Arlington (12) Canal Co.
173.28 k
SLD SLUP No. 23-84023
Gila (G-47) River
127.51 k
State Land
259.21 k
— Cemetary Rd. (243rd Ave.) —
— Watson Rd (235th Ave.) —
— Narramore Road —
1030
1850
220
500
540
845
N89° 30' W 5294.52
1323.63 1323.63 1323.63 1323.63
2647.26 2647.26
N89° 47' W 5291.88
2645.94 2645.94
1322.97 1322.97 1322.97 1322.97
N0° 27' E 5291.88
N0° 30' E 5269.44
2634.72 2634.72
1317.36 1317.36 1317.36 1317.36
GLO Sec. 16 (1960) 1" = 20 ch.
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 16 - 1S, 3W
Fr: Watson Rd. (235th Ave.)
To: Cemetary Rd. (243rd Ave)
Rev 2-28-86
6-22-82
Sheet 22 of 31

22.



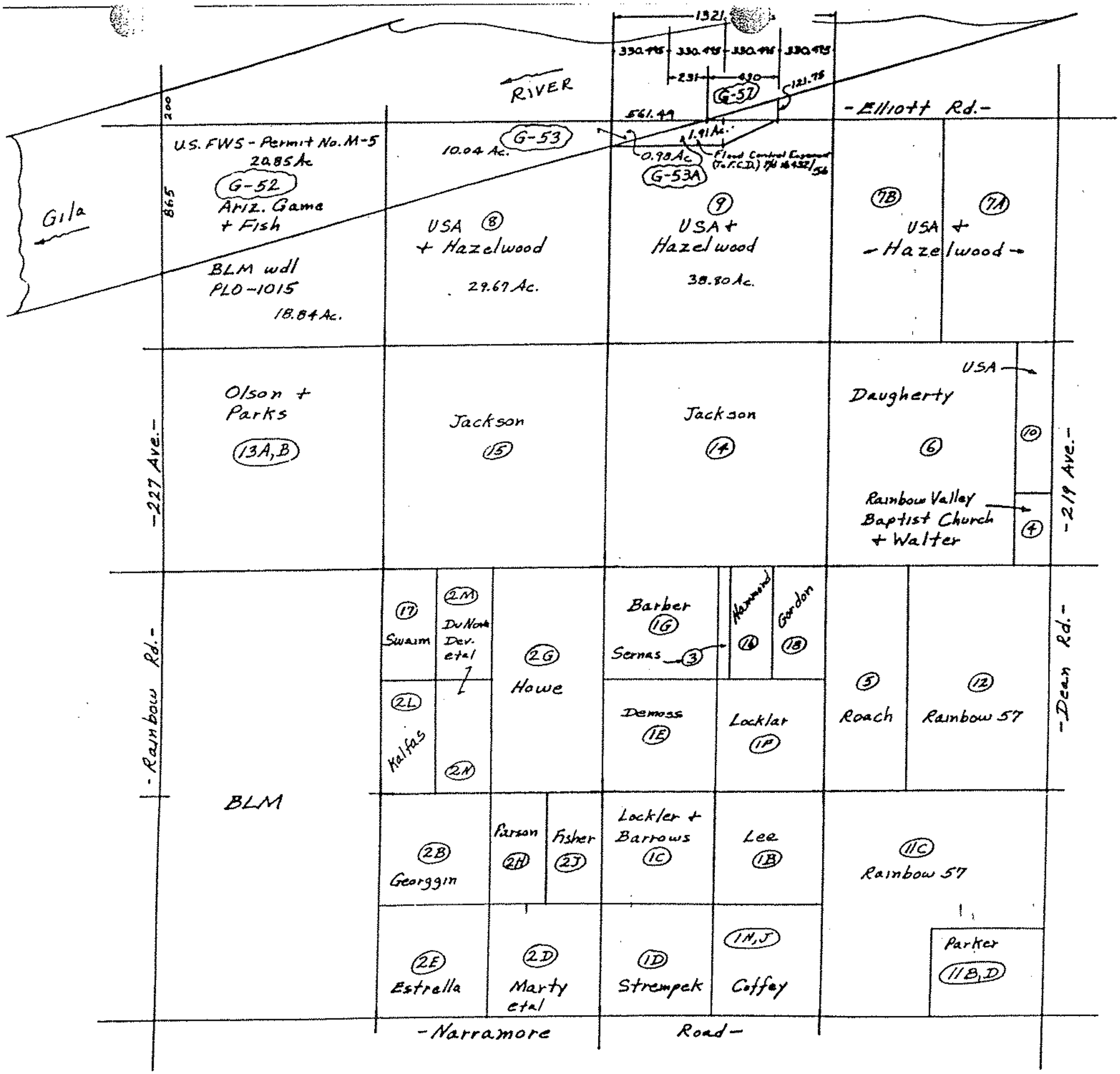
Sec. 15 - 15,3W
Book 400, Map 49
G-48 - 51
1" = 400'
Scale
- Elliott Rd -
River
Gila
U.S. FWS - Permit No. M-5
Ariz. Game + Fish
BLM wdl - PLO 1015
GRWAP
59.16 Ac.
G-51
12.73 Ac.
Ariz. Game + Fish
57.08 Ac.
EXPIRED
48.59 Ac.
R/w Agreement No. 811
A.G. Contract No. 1 to
Amendment No. 592,
A.G. Contract No. 592,
Dkt 14611, Pg. 587
I.G. 8.7.16
G-48
12.56 Ac.
7.34 Ac.
G-49
U.S. FWS
Permit No. M-5
Jackson
6.40 Ac.
G-50
2.20 Ac.
Barrett
Hazelwood
2.53 Ac.
16.47 Ac.
Jackson
0.68 Ac.
19.32 Ac.
Jackson
Zaharichuk
Jackson
Jackson
7.87 Ac.
Jackson
Jackson
Kavlock
Emery
Johnson
Thorne
Kavlock
Gibson
- 227 Ave. -
- Rainbow Rd. -
- 235 Ave. -
- Watson Rd. -
- Narramore Rd. -
251.68 Ac.
Ariz. Game + Fish
BLM wdl - PLO 1015
GRWAP
GLO - Sec. 15 (1976) 1" = 20 ch.
FINAL
8/29/89
Rev. 2-24-09
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 15 - 15,3W
Fr.: Rainbow Rd. (227 Ave.) West
To: Watson Rd. (235 Ave.)
6-22-82
Sheet 23 of 31

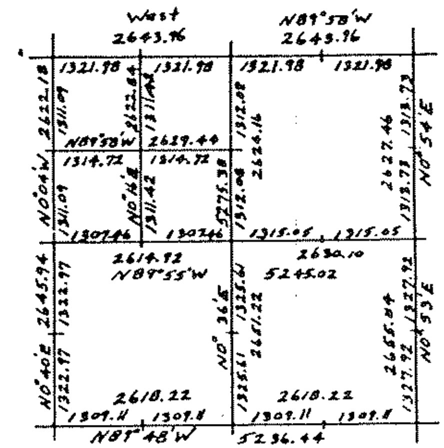
S. 14 5,3W

Book 400, Map 50

G-52, 53, 53A

1" = 400'
Scale

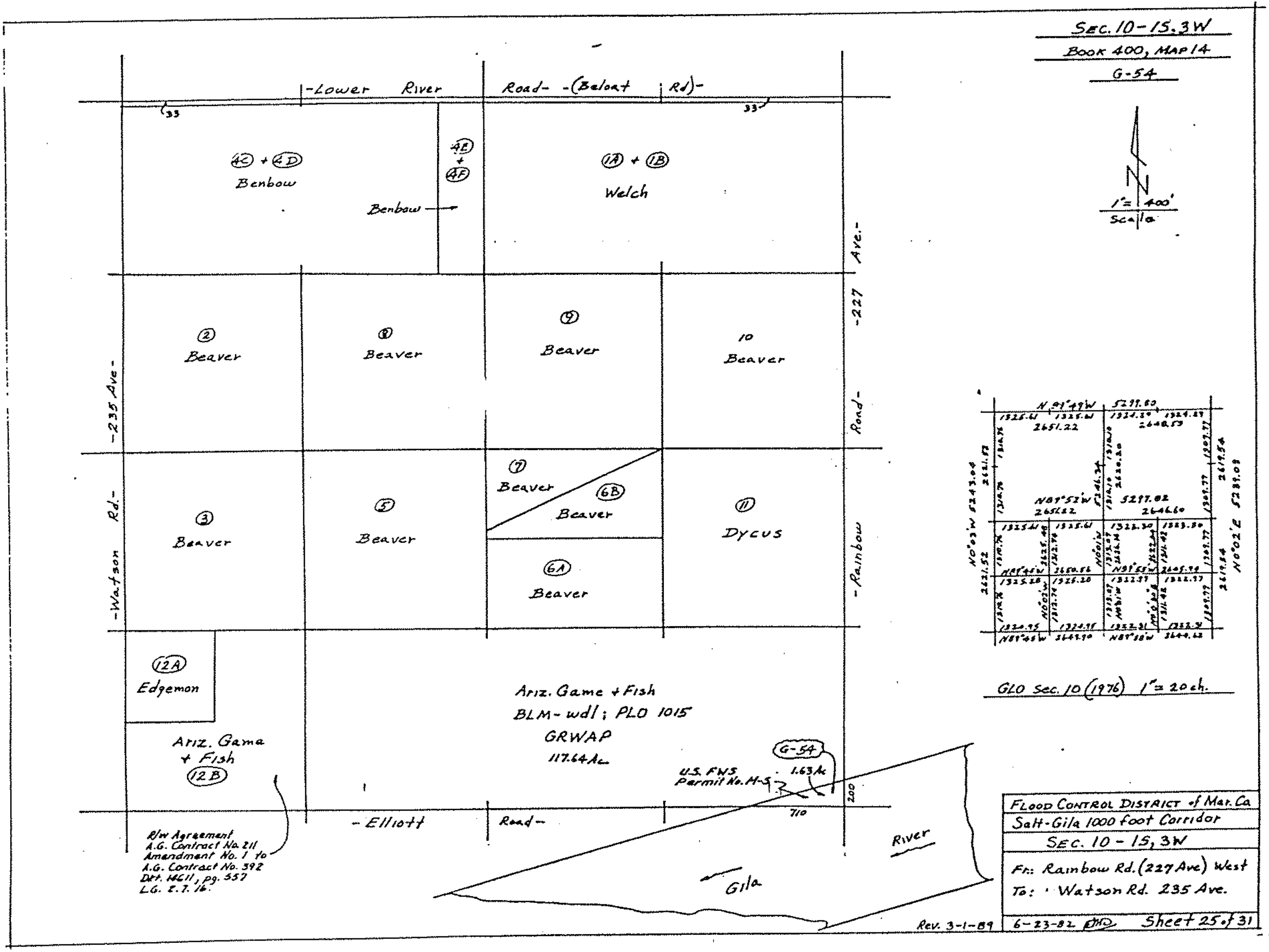




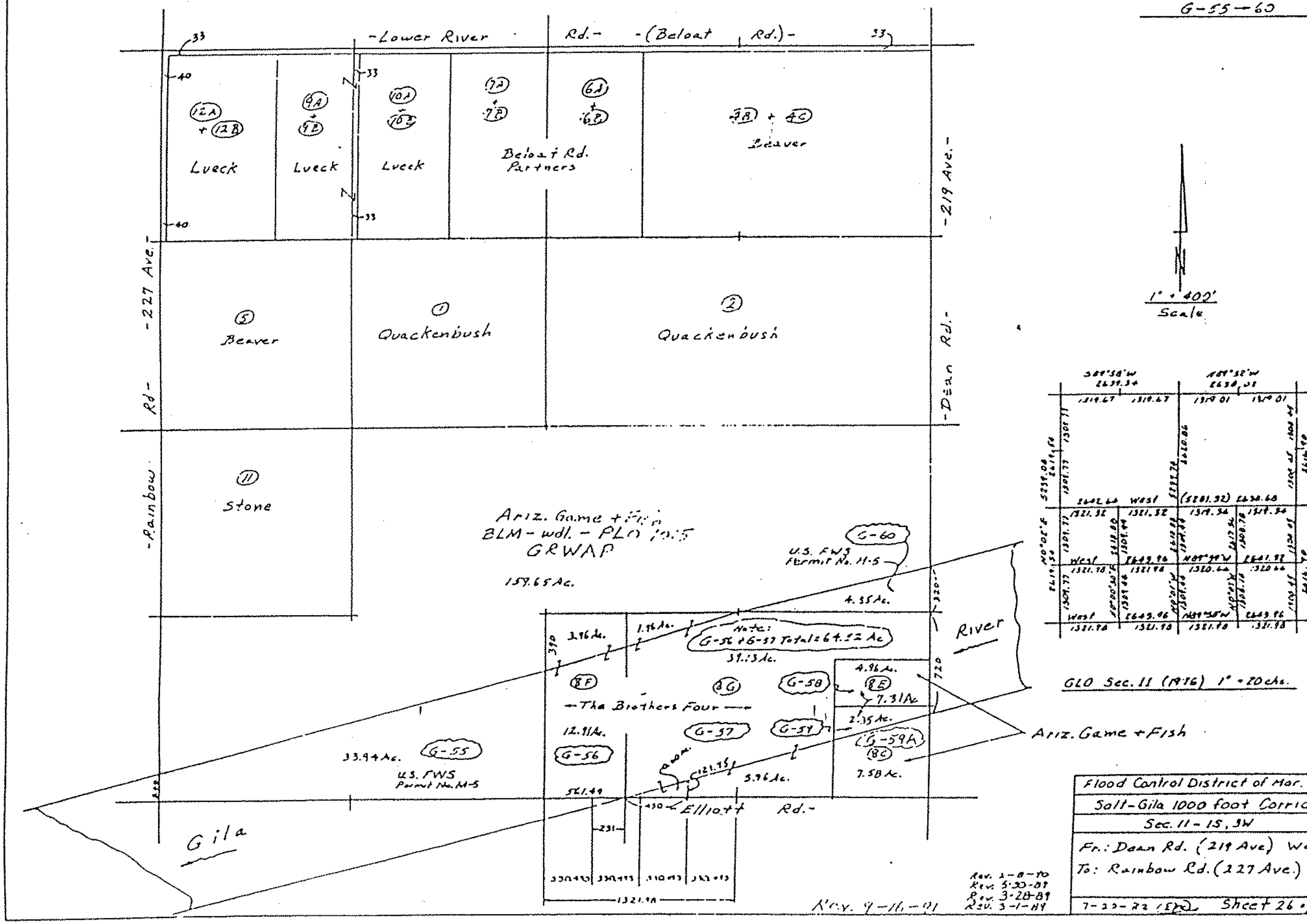
GLO Sec. 14 (1976) 1" = 20 ch.

Rev. 3-28-89
Rev. 3-23-89
Rev. 2-28-89

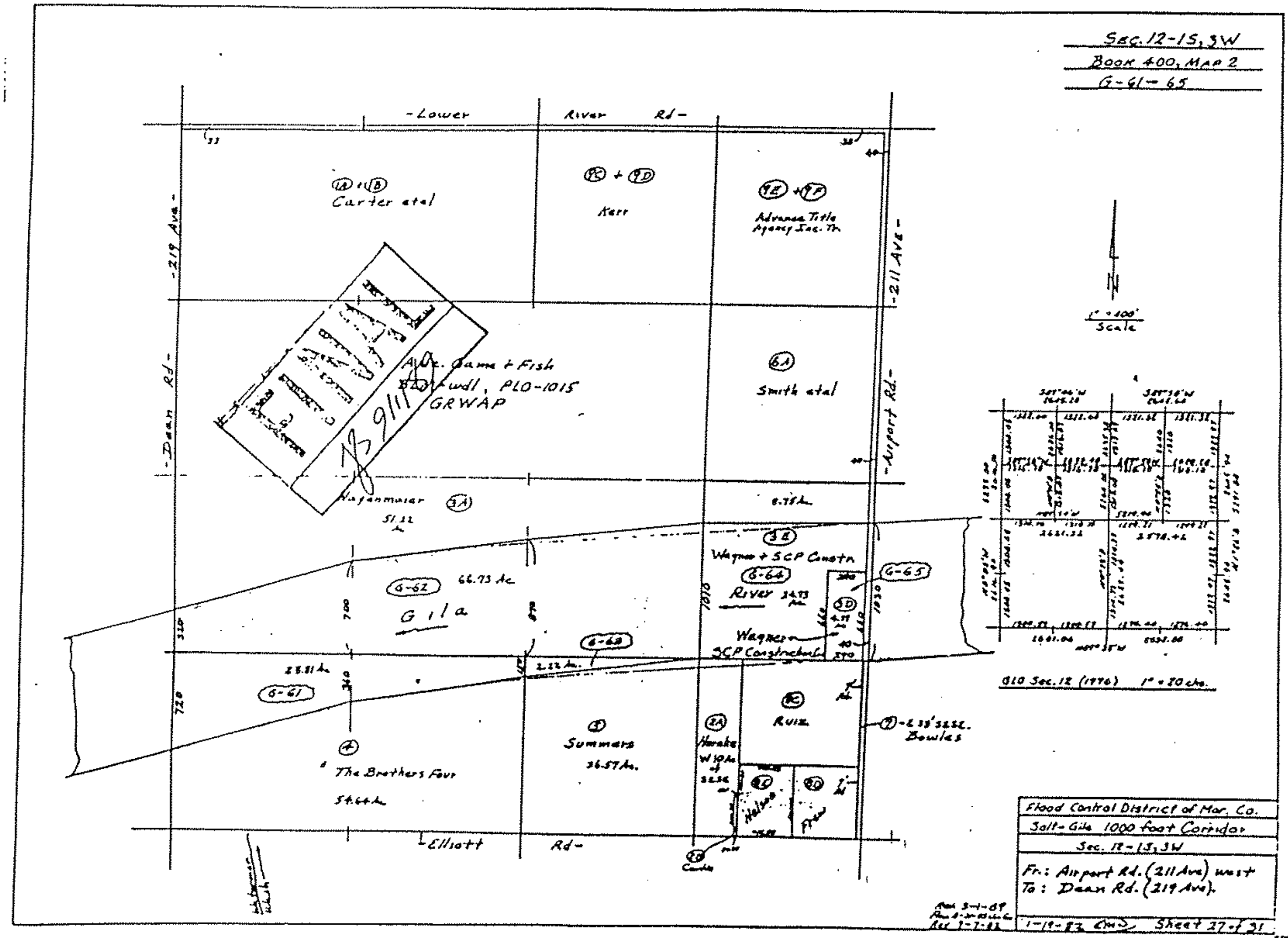
FLOOD CONTROL DISTRICT of Mar. Co
Salt-Gila 1000 foot Corridor
SEC. 14 - 15, 3W
Fr.: Dean Rd. (219 Ave.) West To: Rainbow Rd. (227 Ave.)
6-23-82 (21) Sheet 24 of 31

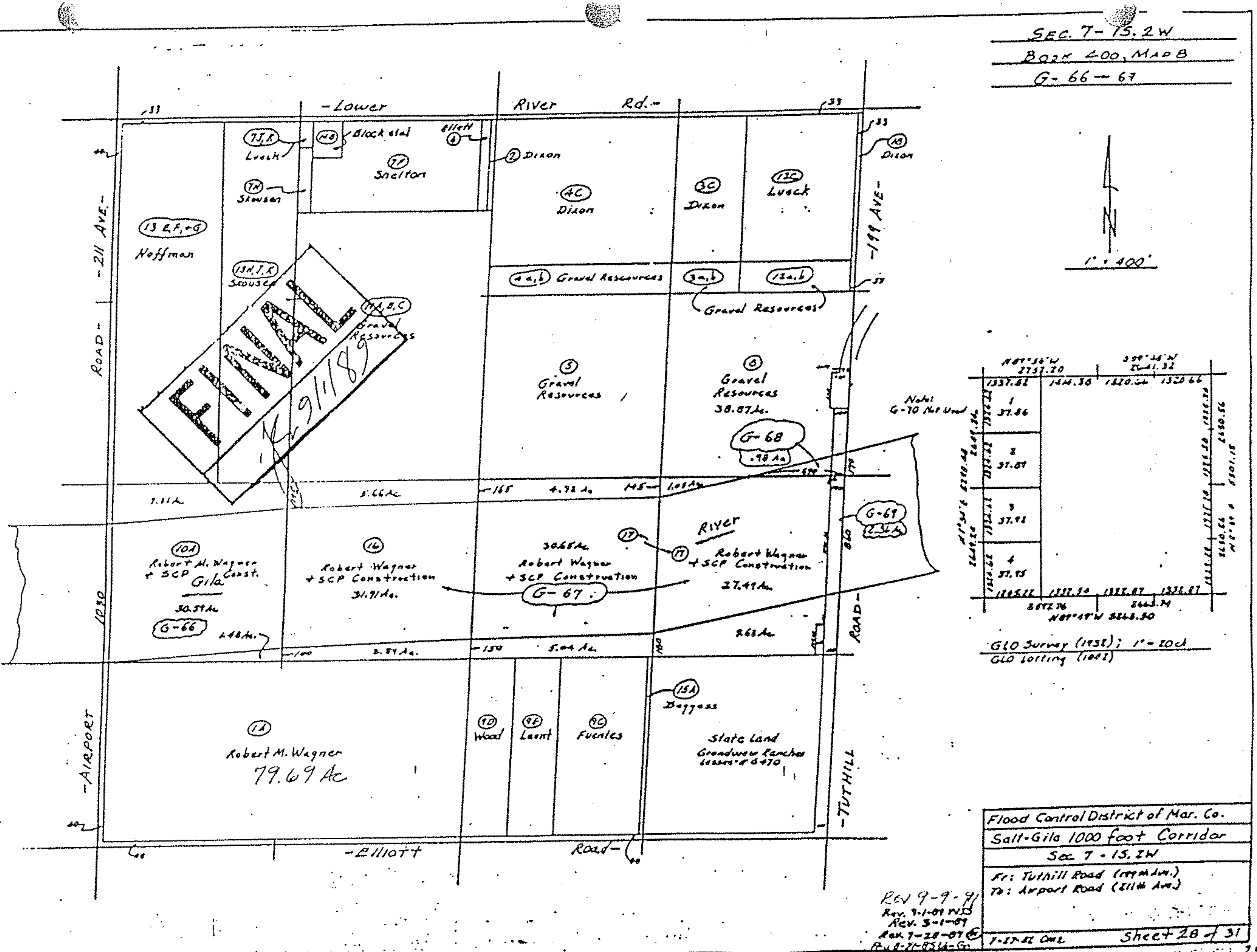

Sec. 10-1S,3W
Book 400, Map 14
G-54
1" = 400' Scale
-Lower River Road- -(Beloat Rd)-
33
33
4C + 4D Benbow
4E + 4F
Benbow
1A + 1B Welch
-235 Ave-
-Watson Rd.-
-227 Ave.-
-Rainbow Road-
2 Beaver
8 Beaver
9 Beaver
10 Beaver
3 Beaver
5 Beaver
7 Beaver
6B Beaver
6A Beaver
11 Dycus
12A Edgemon
Ariz. Gama + Fish 12B
Ariz. Game + Fish
BLM-wdl; PLO 1015
GRWAP
117.64 Ac.
G-54
1.63 Ac
U.S. FWS Permit No. M-S
200
710
- Elliott Road -
R/W Agreement
A.G. Contract No. 211
Amendment No. 1 to
A.G. Contract No. 392
Dkt. 14611, pg. 557
L.G. 2.7.16.
Gila
River
GLO Sec. 10 (1976) 1" = 20 ch.
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 10 - 1S, 3W
Fr.: Rainbow Rd. (227 Ave) West
To: Watson Rd. 235 Ave.
6-23-82
Sheet 25 of 31
Rev. 3-1-89

Sec. 11-1S, 3W
Book 400, Map 11
G-55-60



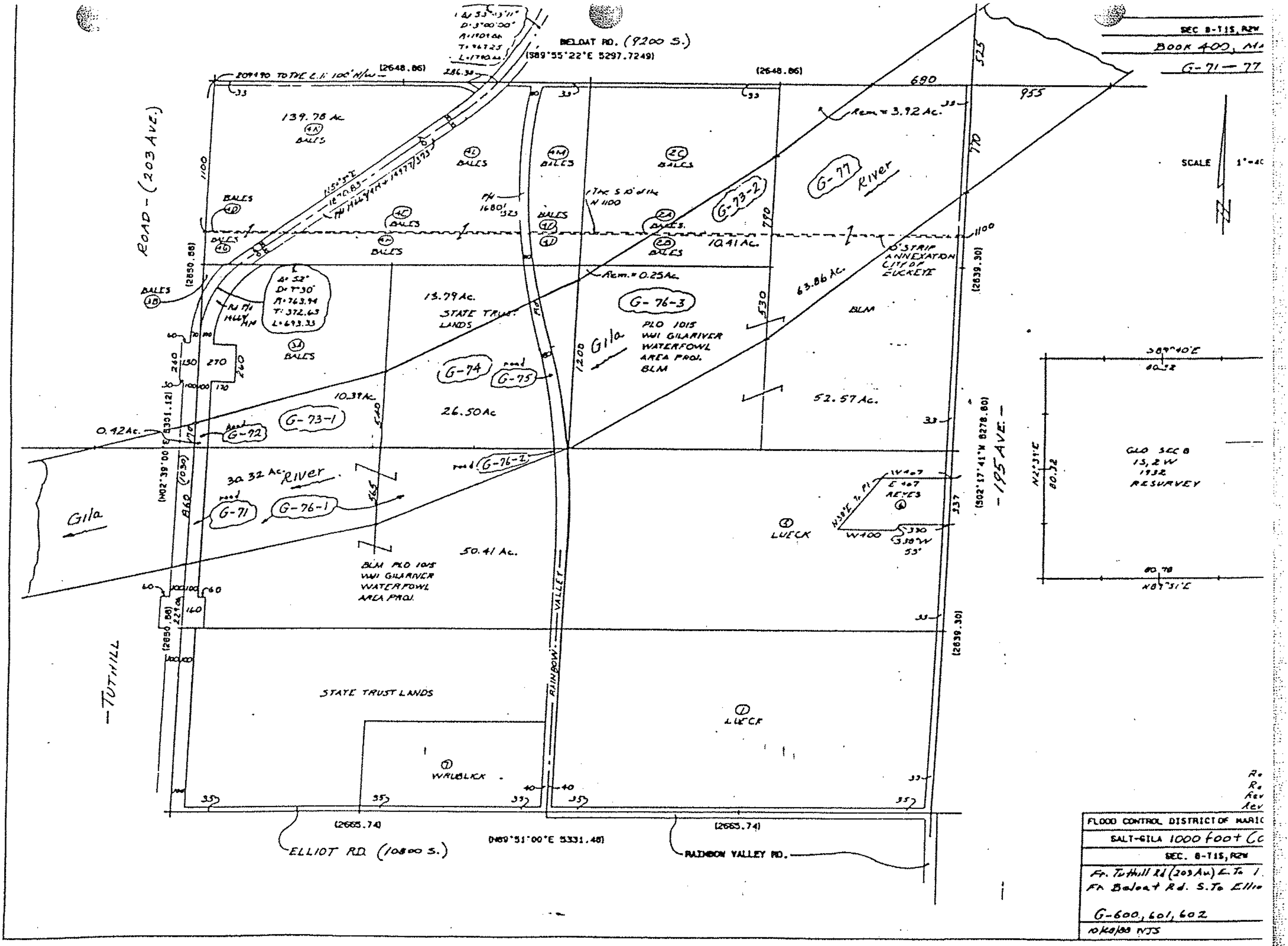
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 11-1S, 3W
Fr.: Dean Rd. (219 Ave) West
To: Rainbow Rd. (227 Ave.)
7-22-82 (SPD) Sheet 26 of 31

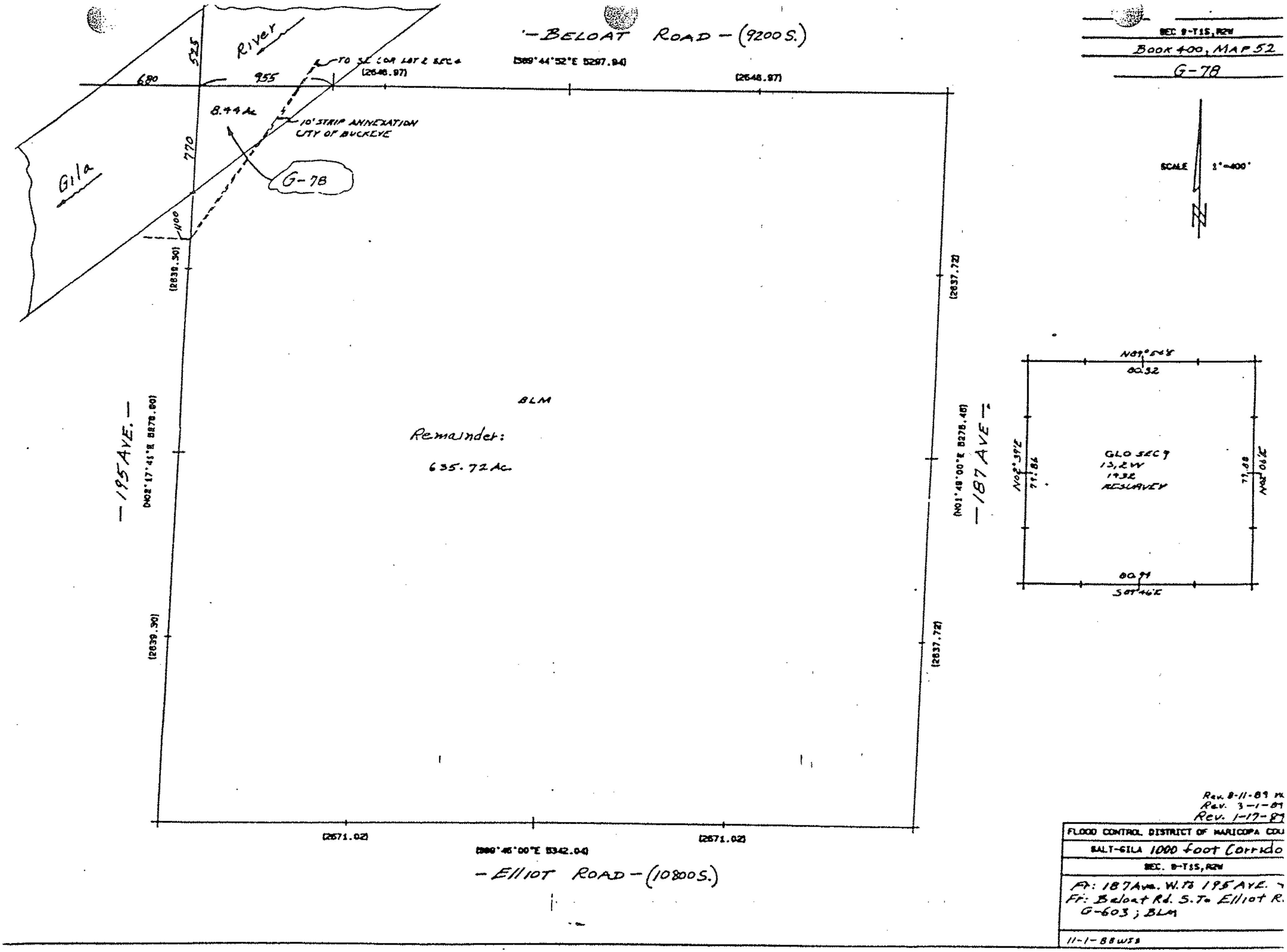

Sec. 12-1S, 3W
Book 400, Map 2
G-61 - 65
-Lower River Rd-
-219 Ave-
-Dean Rd-
-211 Ave-
-Airport Rd-
-Elliott Rd-
Carter etal
Kerr
Advance Title Agency Inc. Tr.
Smith etal
Ariz. Game + Fish
PLO-1015
GRWAP
Hagenmaier
51.12
6.75 Ac
Wagner + SCP Constn
G-64
River 34.93 Ac
G-65
G-62
66.73 Ac
Gila
G-63
Wagner SCP Construction
2.22 Ac
28.81 Ac
G-61
The Brothers Four
54.64 Ac
Summers
36.57 Ac
Ruiz
Bowles
Curtis
1" = 400'
Scale
GLO Sec. 12 (1996) 1" = 20 chs.
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 12-1S, 3W
Fr.: Airport Rd. (211 Ave) west
To: Dean Rd. (219 Ave).
1-19-83
Sheet 27 of 31
27

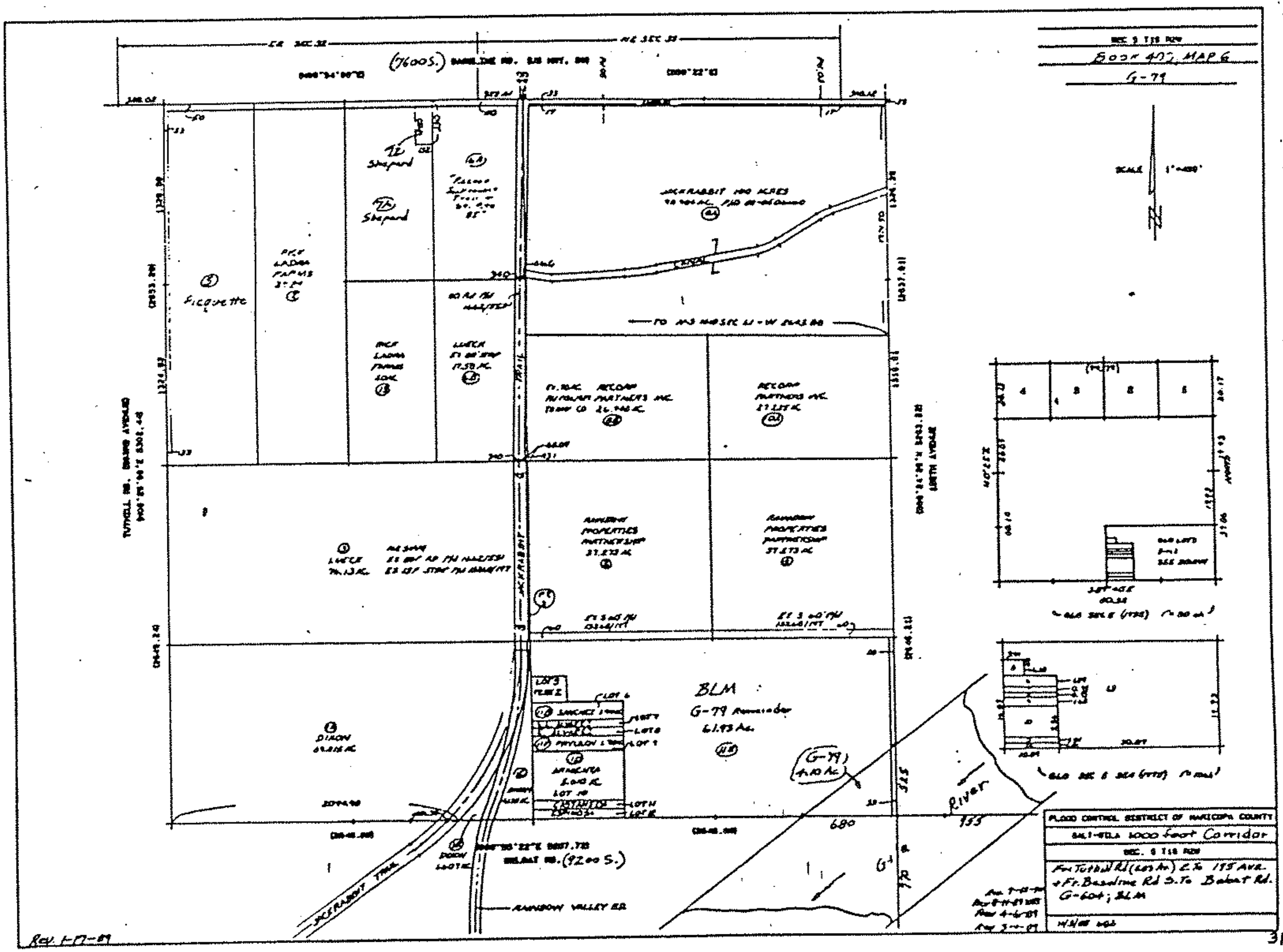


SEC. 7-1S.2W
BOOK 400, MAP 8
G-66 — 67
-Lower River Rd.-
-211 AVE. - ROAD-
-199 AVE-
-AIRPORT
-Elliott Road-
-TUTHILL ROAD-
1" = 400'
13 E,F,+G Hoffman
7J,K Lueck
7H Skousen
13H,I,K Skousen
7F Shelton
Block etal
Elliott
2 Dixon
4C Dixon
3C Dixon
12C Lueck
1B Dixon
4a,b Gravel Resources
3a,b
12a,b
Gravel Resources
11A,B,C Gravel Resources
5 Gravel Resources
6 Gravel Resources 38.87 Ac.
G-68 .98 Ac
Note: G-70 Not Used
G-69 2.36 Ac
River
10A Robert M. Wagner + SCP Gila Const. 30.59 Ac.
G-66
16 Robert Wagner + SCP Construction 31.91 Ac.
30.65 Ac. Robert Wagner + SCP Construction
G-67
17 Robert Wagner + SCP Construction 27.49 Ac.
1A Robert M. Wagner 79.69 Ac
9D Wood
9E Laent
9C Fuentes
15A Boggess
State Land Grandview Ranches Lessee # 6470
FINAL 9/11/89
GLO Survey (1938); 1" = 20ch
GLO Lotting (1882)
Rev 9-9-91
Rev. 9-1-89
Rev. 3-1-89
Rev. 7-28-87
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec 7 - 1S. 2W
Fr: Tuthill Road (199th Ave.)
To: Airport Road (211th Ave.)
7-27-87
Sheet 28 of 31

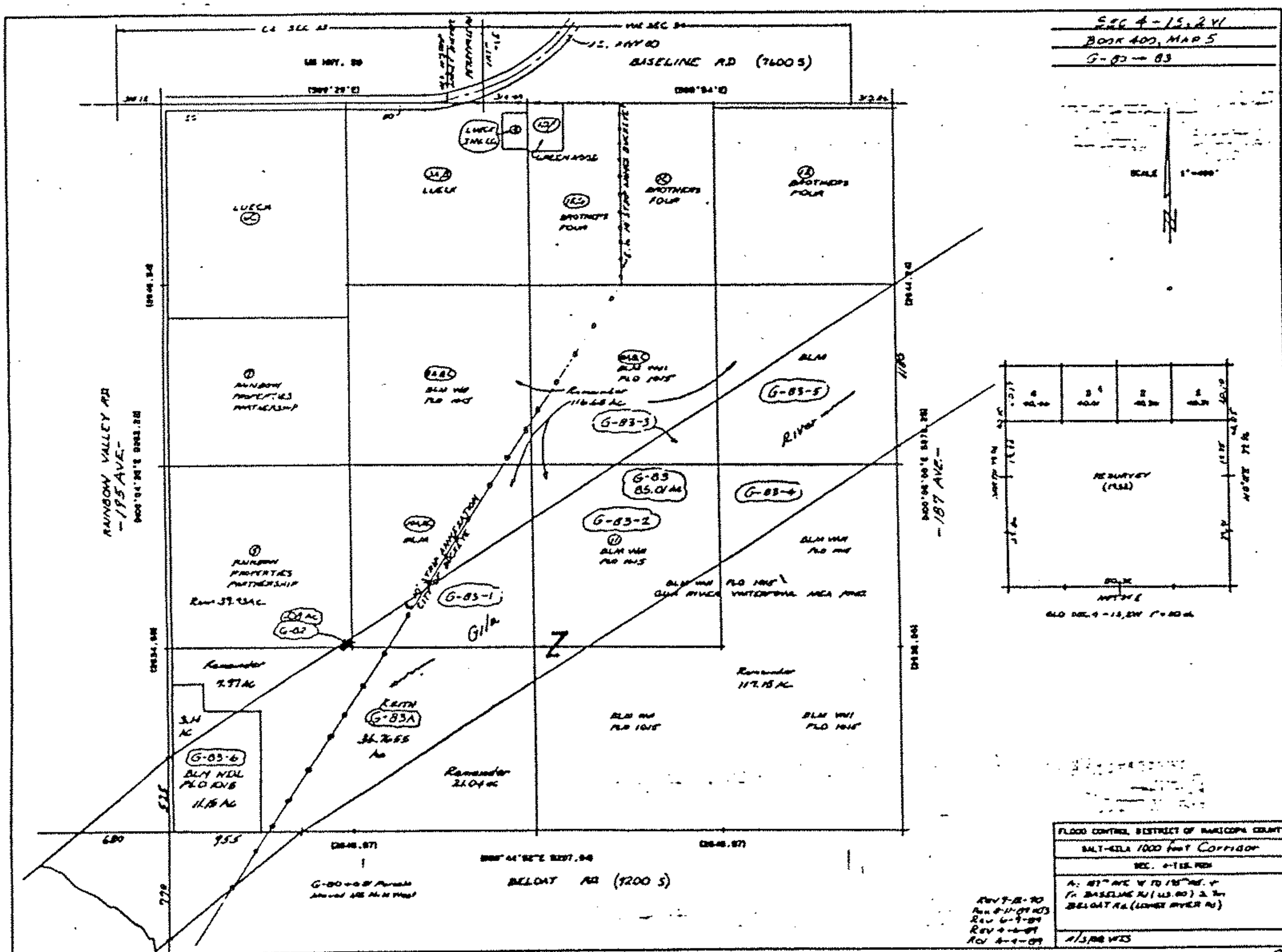
29


SEC 8-T1S, R2W
BOOK 400, M
G-71 — 77
SCALE 1"=4
BELOAT RD. (9200 S.)
(S89°55'22"E 5297.7249)
(2648.86)
139.78 Ac.
BALES
G-77
River
Rem = 3.92 Ac.
G-73-2
10.41 Ac.
Rem. = 0.25 Ac.
D'STRIP ANNEXATION CITY OF BUCKEYE
63.86 Ac.
BLM
G-76-3
PLO 1015
WWI GILA RIVER WATERFOWL AREA PROJ.
BLM
Gila
13.79 Ac.
STATE TRUST LANDS
G-74
G-75
10.39 Ac.
26.50 Ac.
52.57 Ac.
0.42 Ac.
G-73-1
G-72
G-76-2
30.32 Ac.
River
G-71
G-76-1
50.41 Ac.
BLM PLO 1015
WWI GILA RIVER WATERFOWL AREA PROJ.
LUECK
REYES
STATE TRUST LANDS
WRUBLICK
ROAD - (203 AVE.)
TUTHILL
- 195 AVE. -
(S02°17'41"W 5278.80)
(2639.30)
GLO SEC 8
1S, 2W
1932
RESURVEY
S89°40'E
N87°51'E
N2°31'E
RAINBOW VALLEY
(2665.74)
(N89°51'00"E 5331.48)
ELLIOT RD. (10800 S.)
RAINBOW VALLEY RD.
FLOOD CONTROL DISTRICT OF MARIC
SALT-GILA 1000 foot C
SEC. 8-T1S, R2W
Fr. Tuthill Rd (203 Av) E. To
Fr. Beloat Rd. S. To Ellio
G-600, 601, 602
10/10/88 NJS

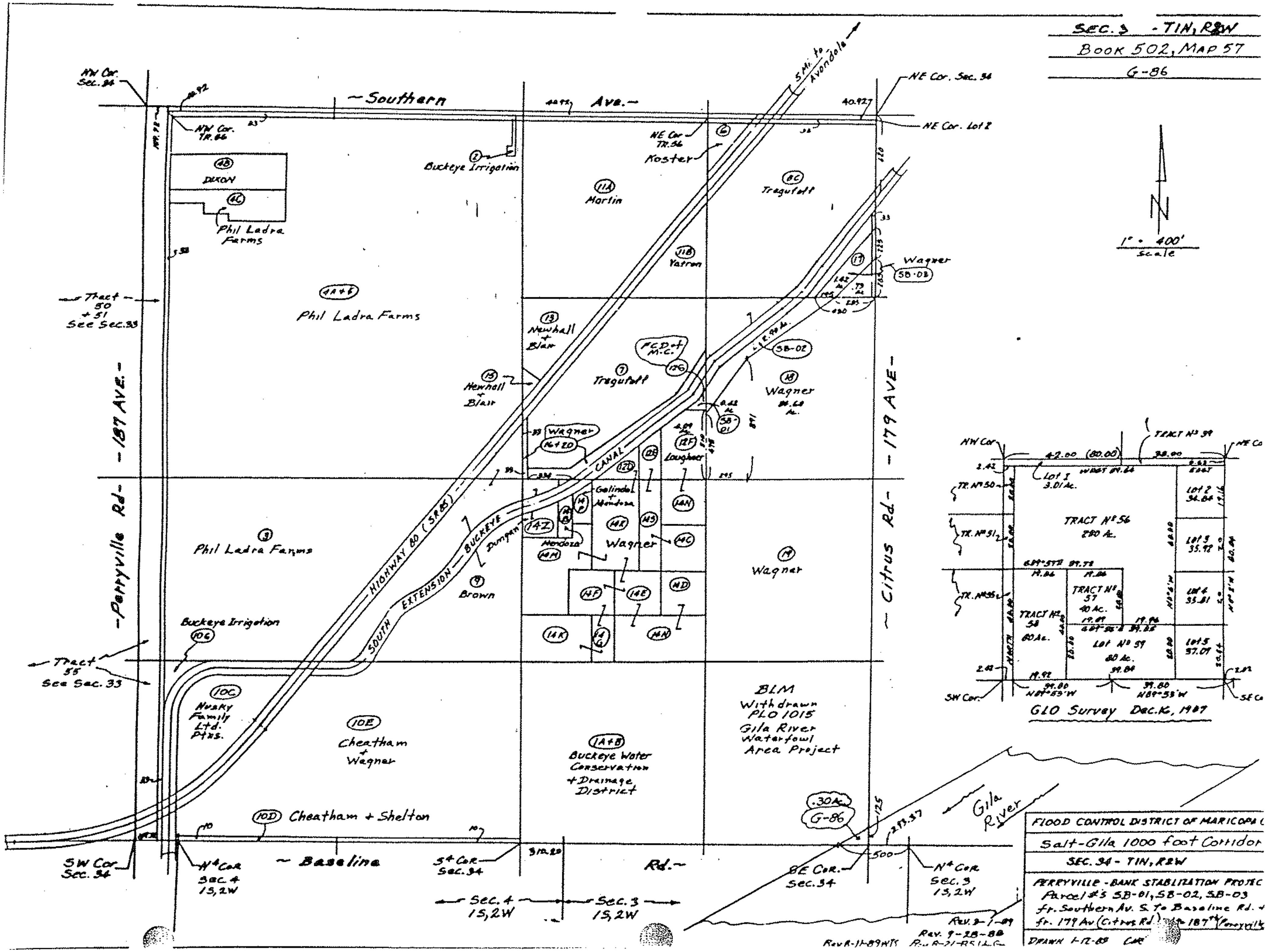

SEC. 9-T1S, R2W
Book 400, MAP 52
G-78
SCALE 1"=400'
- BELOAT ROAD - (9200 S.)
(S89°44'52"E 5297.94)
(2648.97)
(2648.97)
TO SE COR LOT 2 SEC 4
River
Gila
680
525
955
770
400
8.44 Ac
10' STRIP ANNEXATION CITY OF BUCKEYE
G-78
- 195 AVE. -
(N02°17'41"E 5278.60)
(2639.30)
(2639.30)
- 187 AVE -
(N01°48'00"E 5275.45)
(2637.72)
(2637.72)
BLM
Remainder:
635.72 Ac.
GLO SEC 9
1S, 2W
1932
RESURVEY
N89°54'W
80.32
80.94
S89°46'E
N02°39'E
79.86
79.88
N02°06'W
(2671.02)
(2671.02)
(S89°46'00"E 5342.04)
- Elliot ROAD - (10800 S.)
Rev. 8-11-89
Rev. 3-1-89
Rev. 1-17-89
FLOOD CONTROL DISTRICT OF MARICOPA COU
SALT-GILA 1000 foot Corrido
SEC. 9-T1S, R2W
Fr: 187 Ave. W. To 195 AVE.
Fr: Beloat Rd. S. To Elliot R.
G-603; BLM
11-1-88 WS

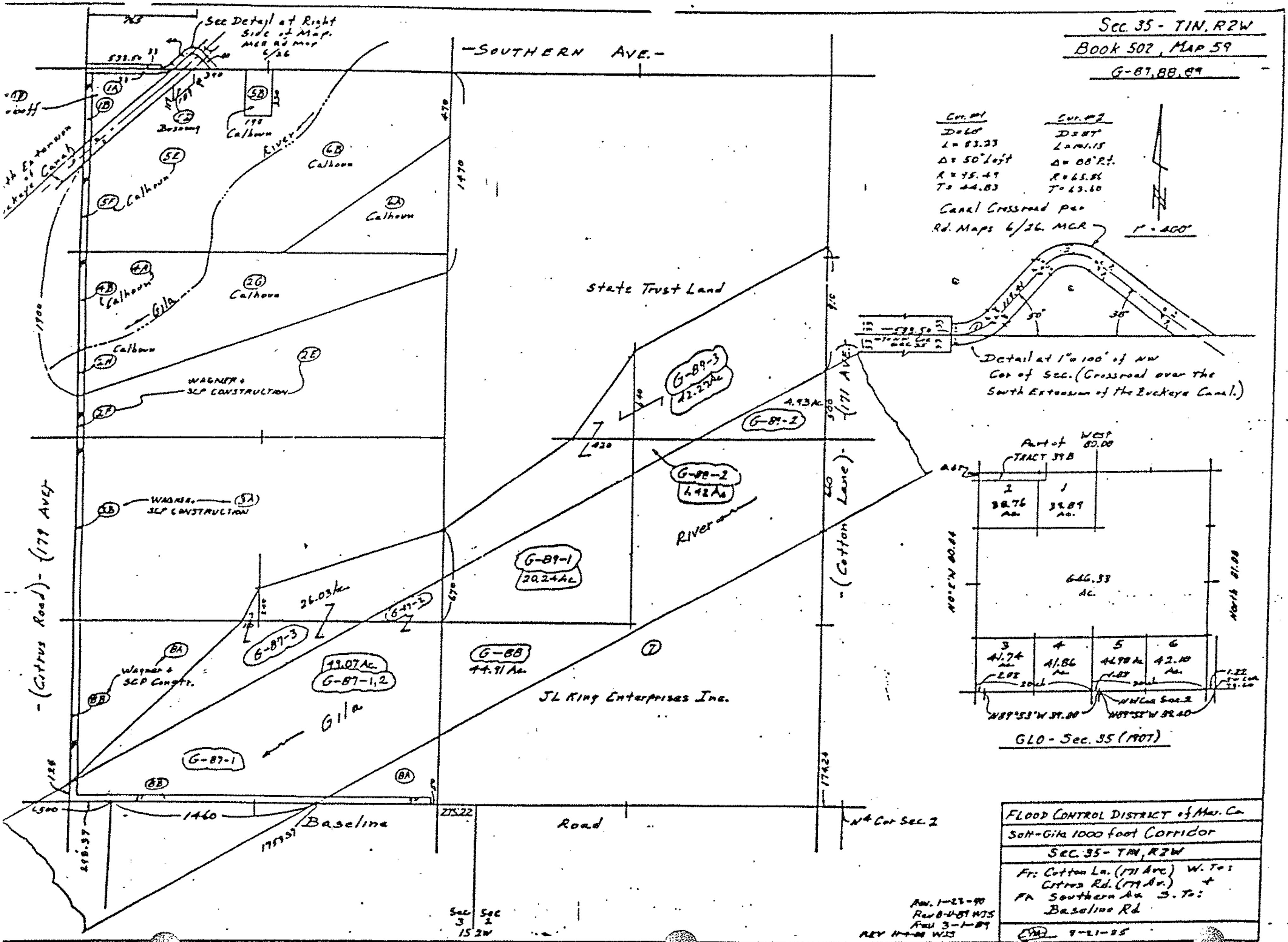

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SALT-GILA 1000 foot Corridor
SEC. 5 T1S R2W
Fr. Tuthill Rd (603 Av) E. To 175 Ave.
+ Fr. Baseline Rd S. To Baker Rd.
G-604 ; BLM
Book 407, MAP 6
G-79
BLM
G-79 Remainder
61.93 Ac.
G-79
4.10 Ac.
River
Jackrabbit Trail
Rainbow Valley Rd.
Dixon
Ficquette
Shepard
Rev. 1-17-89

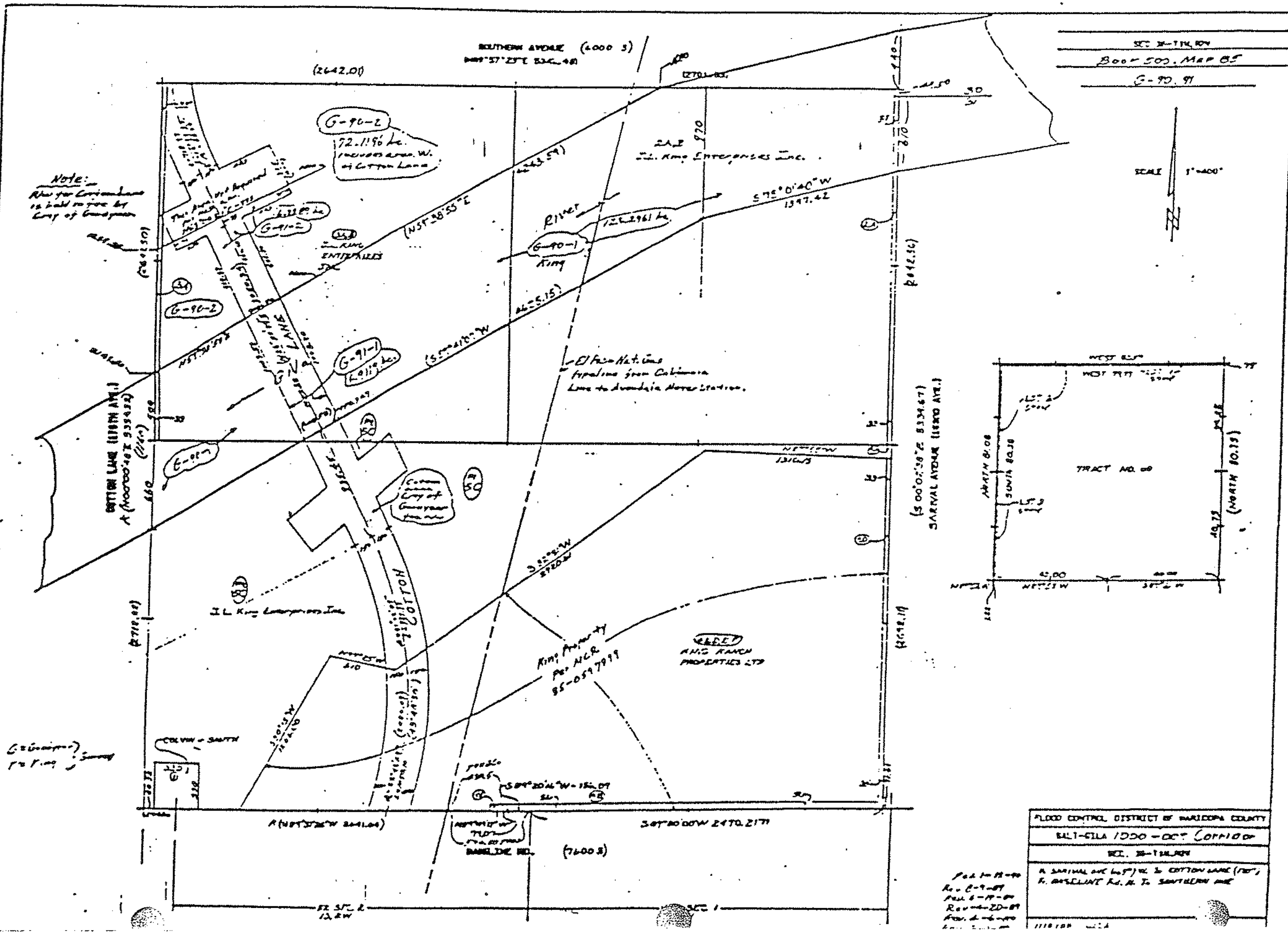
31



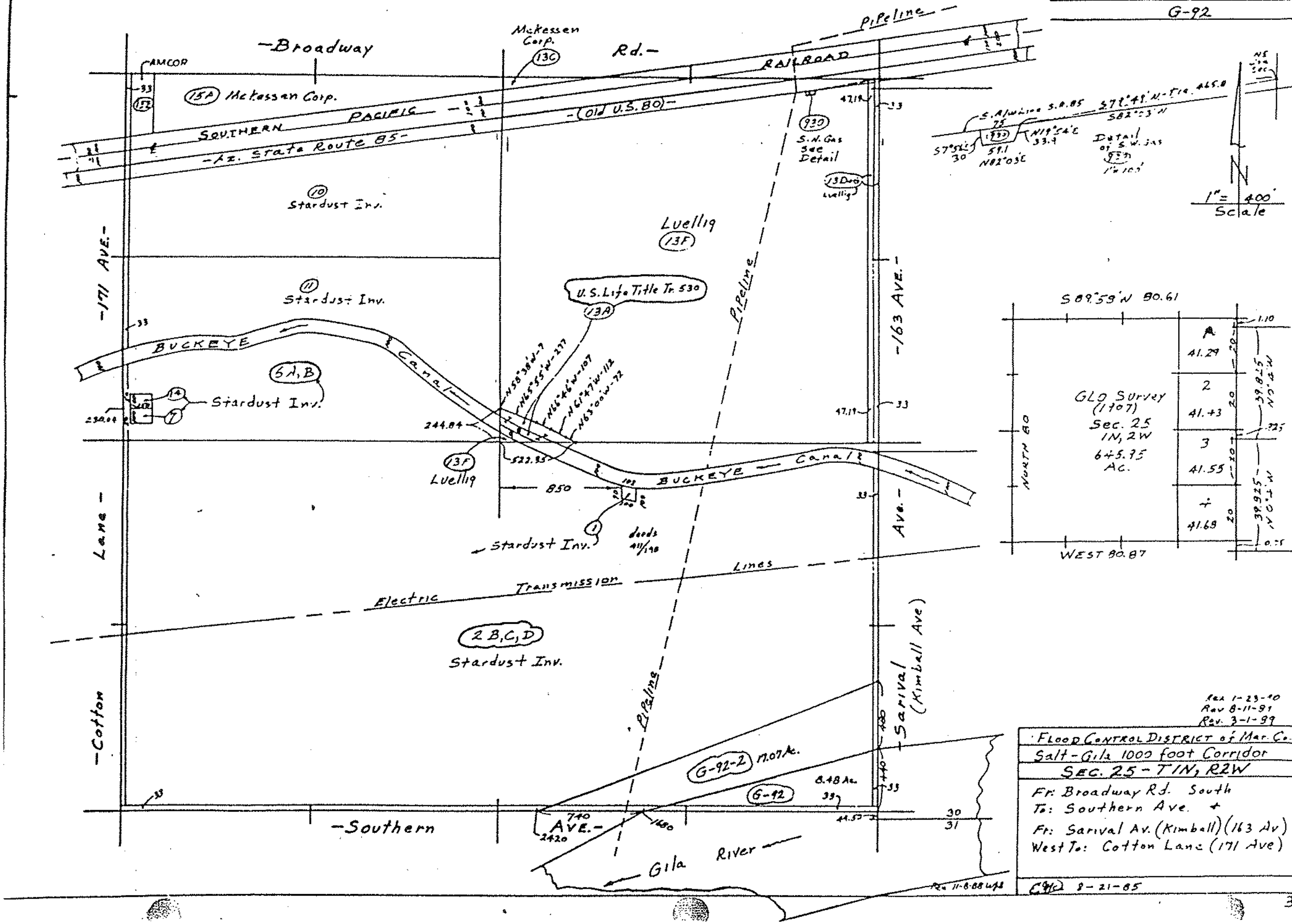
Sec 4-1S, 2W
Book 400, Map 5
G-83 → 83
BASELINE RD (7600 S)
RAINBOW VALLEY RD
-195 AVE-
-187 AVE-
BELOAT RD (9200 S)
LUECK
BROTHERS FOUR
RAINBOW PROPERTIES PARTNERSHIP
BLM
G-83-1
G-83-2
G-83-3
G-83-4
G-83-5
G-83-6
G-83A
G-83
85.01 Ac
KEITH
36.7655 Ac
Remainder
21.04 Ac
Remainder
117.18 Ac
Remainder
9.97 Ac
Remainder
116.68 Ac
BLM HDL
PLO 1015
11.15 Ac
Gila
River
1180
680
955
779
RESURVEY (1933)
SCALE 1"=400'
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SALT-GILA 1000 foot Corridor
A/S/88 WIS
Rev 9-18-90
Rev 6-9-89
Rev 4-4-89


SEC. 3 - T1N, R2W
Book 502, Map 57
G-86
~Southern Ave.~
-Perryville Rd- -187 AVE.-
-Citrus Rd- -179 AVE-
~Baseline Rd.~
NW Cor. Sec. 34
NE Cor. Sec. 34
NE Cor. Lot 2
SW Cor. Sec. 34
SE Cor. Sec. 34
S¼ Cor. Sec. 34
N¼ Cor Sec. 4 1S, 2W
N¼ Cor Sec. 3 1S, 2W
Sec. 4 1S, 2W
Sec. 3 1S, 2W
Tract 50 + 51 See Sec. 33
Tract 55 See Sec. 33
5 Mi. to Avondale
HIGHWAY 80 (SR 85)
SOUTH EXTENSION BUCKEYE CANAL
Phil Ladra Farms
Dixon
Buckeye Irrigation
Martin
Koster
Yatron
Tregufoff
Newhall + Blair
Wagner
Brown
Galindo + Mendoza
Mendoza
Dungen
Loughner
FCD of M.C.
Hasky Family Ltd. Ptrs.
Cheatham + Wagner
Cheatham + Shelton
Buckeye Water Conservation + Drainage District
BLM Withdrawn PLO 1015 Gila River Waterfowl Area Project
Gila River
1" = 400' Scale
TRACT Nº 56 280 Ac.
TRACT Nº 57 40 Ac.
TRACT Nº 58 80 Ac.
Lot Nº 59 80 Ac.
Lot 1 3.01 Ac.
GLO Survey Dec. K, 1987
FLOOD CONTROL DISTRICT OF MARICOPA C
Salt-Gila 1000 foot Corridor
SEC. 34 - T1N, R2W
PERRYVILLE - BANK STABILIZATION PROJEC
Parcel #'s SB-01, SB-02, SB-03
fr. Southern Av. S. To Baseline Rd.
fr. 179 Av (Citrus Rd.) to 187th (Perryville
DRAWN 1-12-89
Rev. 9-28-88
Rev. 2-1-89


Sec. 35 - T1N, R2W
Book 502, Map 59
G-87, 88, 89
-SOUTHERN AVE.-
See Detail at Right Side of Map. MCR Rd Map 6/26
Calhoun
River
Gila
State Trust Land
WAGNER & SCP CONSTRUCTION
Wagner & SCP Constr.
G-89-3
22.27 Ac
G-89-2
4.93 Ac
G-88-2
6.42 Ac
G-89-1
20.24 Ac
G-88
44.91 Ac.
49.07 Ac.
G-87-1,2
G-87-3
26.03 Ac
G-87-2
G-87-1
JL King Enterprises Inc.
-(Citrus Road)- (179 Ave)
-(Cotton Lane)- (171 Ave)
Baseline Road
N¼ Cor Sec. 2
Sec 3 | Sec 2
1S 2W
Cur. #1
D=60°
L=83.23
Δ=50° Left
R=95.49
T=44.83
Cur. #2
D=87°
L=101.15
Δ=88° Rt.
R=65.86
T=63.60
Canal Crossroad per Rd. Maps 6/26. MCR
1" = 400'
Detail at 1"=100' of NW Cor of Sec. (Crossroad over the South Extension of the Buckeye Canal.)
Part of TRACT 39B
West 80.00
666.33 Ac.
North 81.08
GLO - Sec. 35 (1907)
FLOOD CONTROL DISTRICT of Mar. Co.
Salt-Gila 1000 foot Corridor
Sec. 35 - T1N, R2W
Fr: Cotton La. (171 Ave) W. To: Citrus Rd. (179 Av.)
+ Fr: Southern Av. S. To: Baseline Rd.
9-21-85
Rev. 1-23-90
Rev 8-4-89 WJS
Rev 3-1-89
REV 11-4-88 WJS


SEC. 36-T1N-R2W
Book 500, Map 85
G-90, 91
SOUTHERN AVENUE (4000 S)
COTTON LANE (179TH AVE.)
SARIVAL AVENUE (182ND AVE.)
BASELINE RD. (7600 S)
COTTON LANE
Note:
SCALE 1"=400'
G-90-2
72.1196 Ac.
G-90-1
King
River
G-91-1
G-91-2
I.L. King Enterprises Inc.
King Property Per MCR 85-0597979
El Paso Nat. Gas Pipeline from California Line to Avondale Meter Station.
KHS RANCH PROPERTIES LTD
TRACT NO. 60
NORTH 80.35
NORTH 81.08
SOUTH 80.38
N58°38'55"E
S75°0'40"W
1397.42
S00°02'38"E 5334.67
S89°20'46"W-156.09
S89°20'00"W 2470.2171
SEC. 1
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SALT-GILA 1000-OCT CORRIDOR
SEC. 36-T1N-R2W

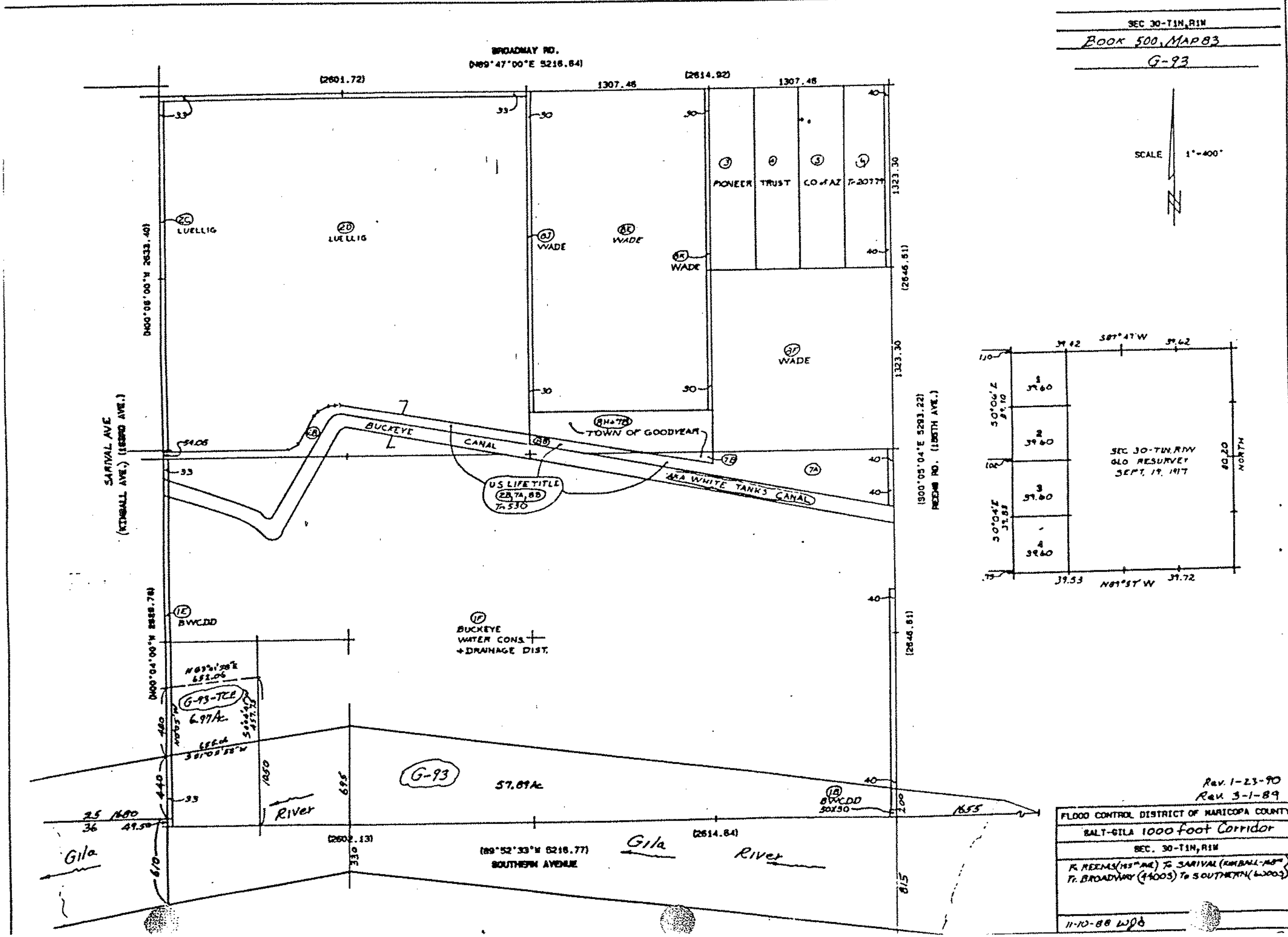
SEC. 25 - T1N, R2W
Book 500, Map 84
G-92



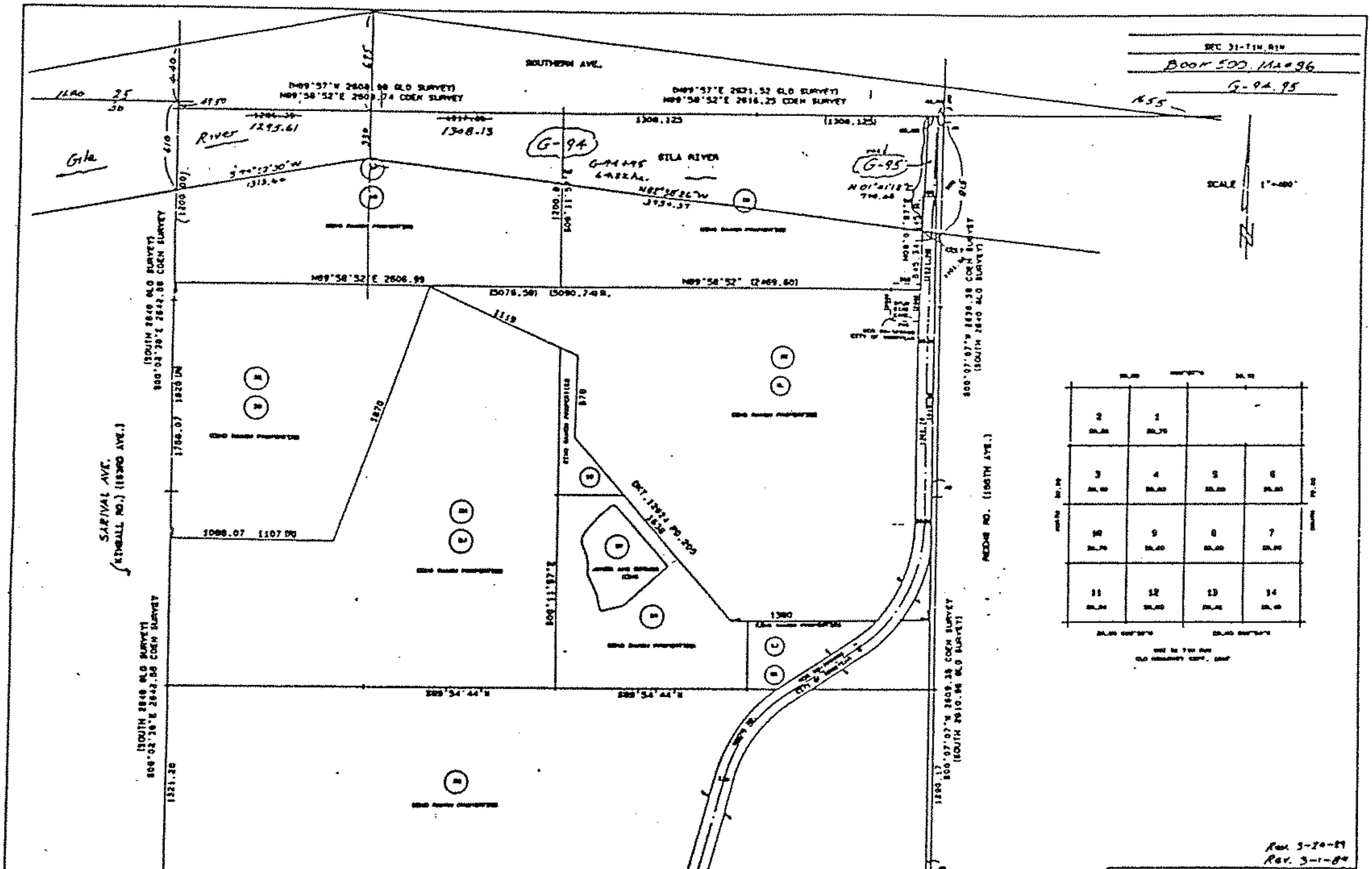
Rev 1-23-90
Rev 8-11-91
Rev. 3-1-99

FLOOD CONTROL DISTRICT of Mar. Co.
Salt-Gila 1000 foot Corridor
SEC. 25 - T1N, R2W
Fr: Broadway Rd. South
To: Southern Ave. +
Fr: Sarival Av. (Kimball) (163 Av)
West To: Cotton Lane (171 Ave)

CGW 8-21-85



SEC 30-T1N,R1W
Book 500, Map 83
G-93
SCALE 1"=400'
BROADWAY RD.
(N89°47'00"E 5216.84)
(2601.72)
1307.48
(2614.92)
1307.48
PIONEER TRUST CO of AZ T-20777
LUELLIG
WADE
TOWN OF GOODYEAR
BUCKEYE CANAL
AKA WHITE TANKS CANAL
US LIFE TITLE
Tr.530
SARIVAL AVE
(KIMBALL AVE.) (163RD AVE.)
(N00°08'00"W 2633.40)
(N00°04'00"W 2559.78)
BWCDD
BUCKEYE WATER CONS. + DRAINAGE DIST.
G-93-TCE
6.97Ac.
G-93
57.89Ac
River
Gila
(2602.13)
(89°52'33"W 5216.77)
SOUTHERN AVENUE
(2614.84)
(S00°05'04"E 5293.22)
REEMS RD. (155TH AVE.)
1323.30
(2646.81)
SEC 30-T1N,R1W
GLO RESURVEY
SEPT. 19, 1917
NORTH
Rev. 1-23-90
Rev. 3-1-89
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SALT-GILA 1000 foot Corridor
SEC. 30-T1N,R1W
Fr. REEMS (155th Ave) To SARIVAL (KIMBALL-163rd)
Fr. BROADWAY (4400S) To SOUTHERN (4200S)
11-10-88 WDB



Rev. 3-24-89
Rev. 3-1-89

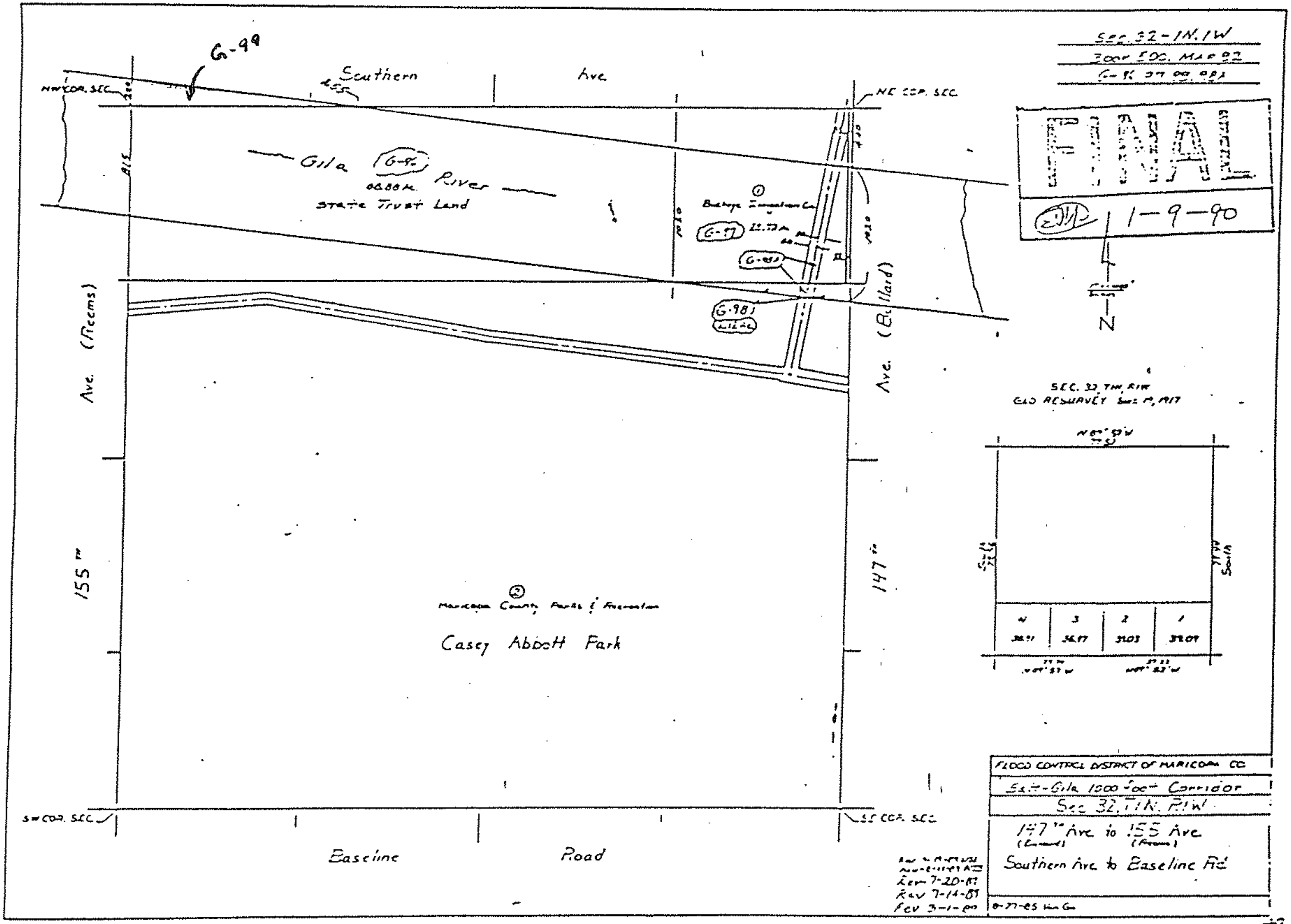
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

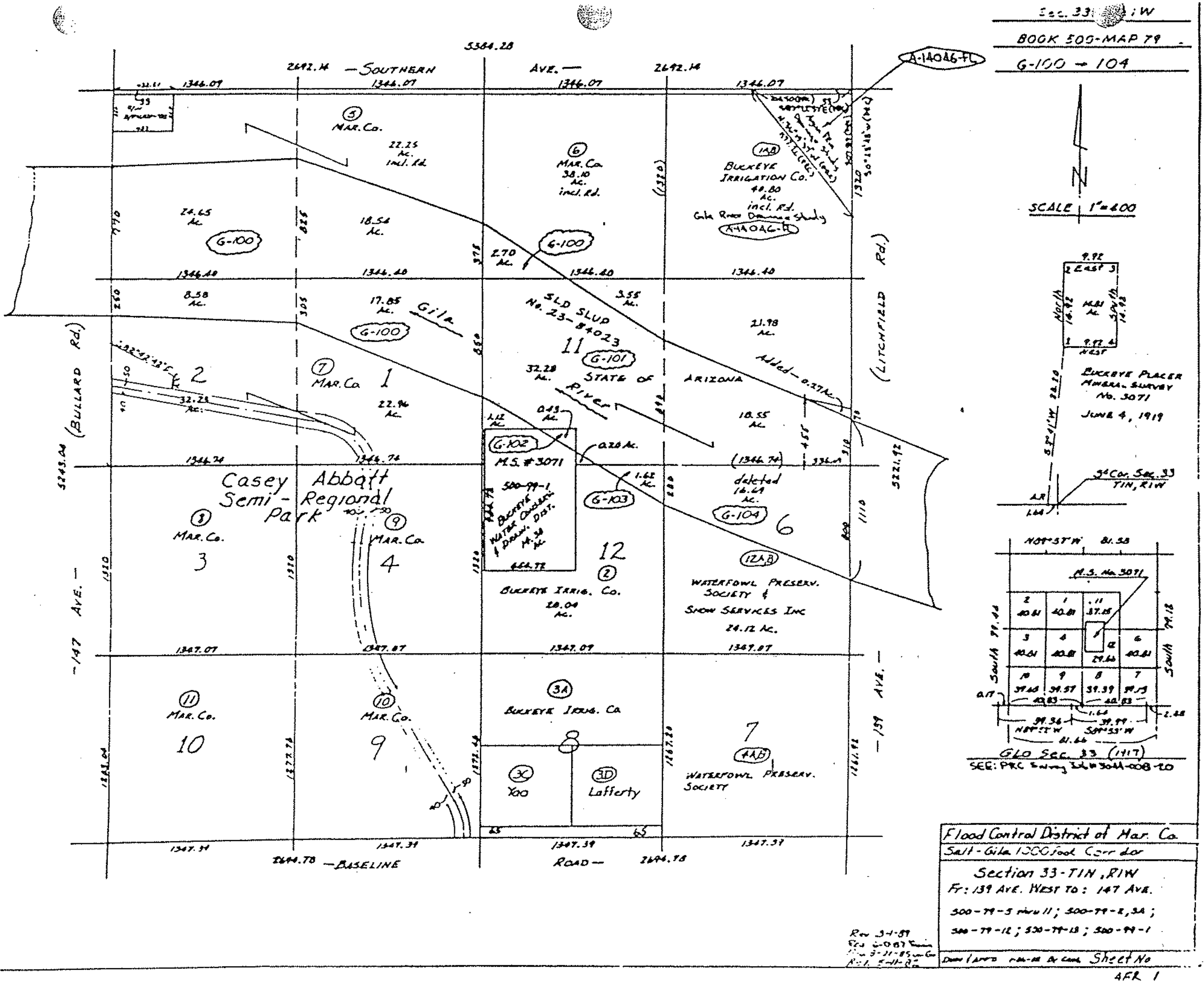
SALT-GILA 1000 foot Corridor

SEC. 31-T1N,R1W

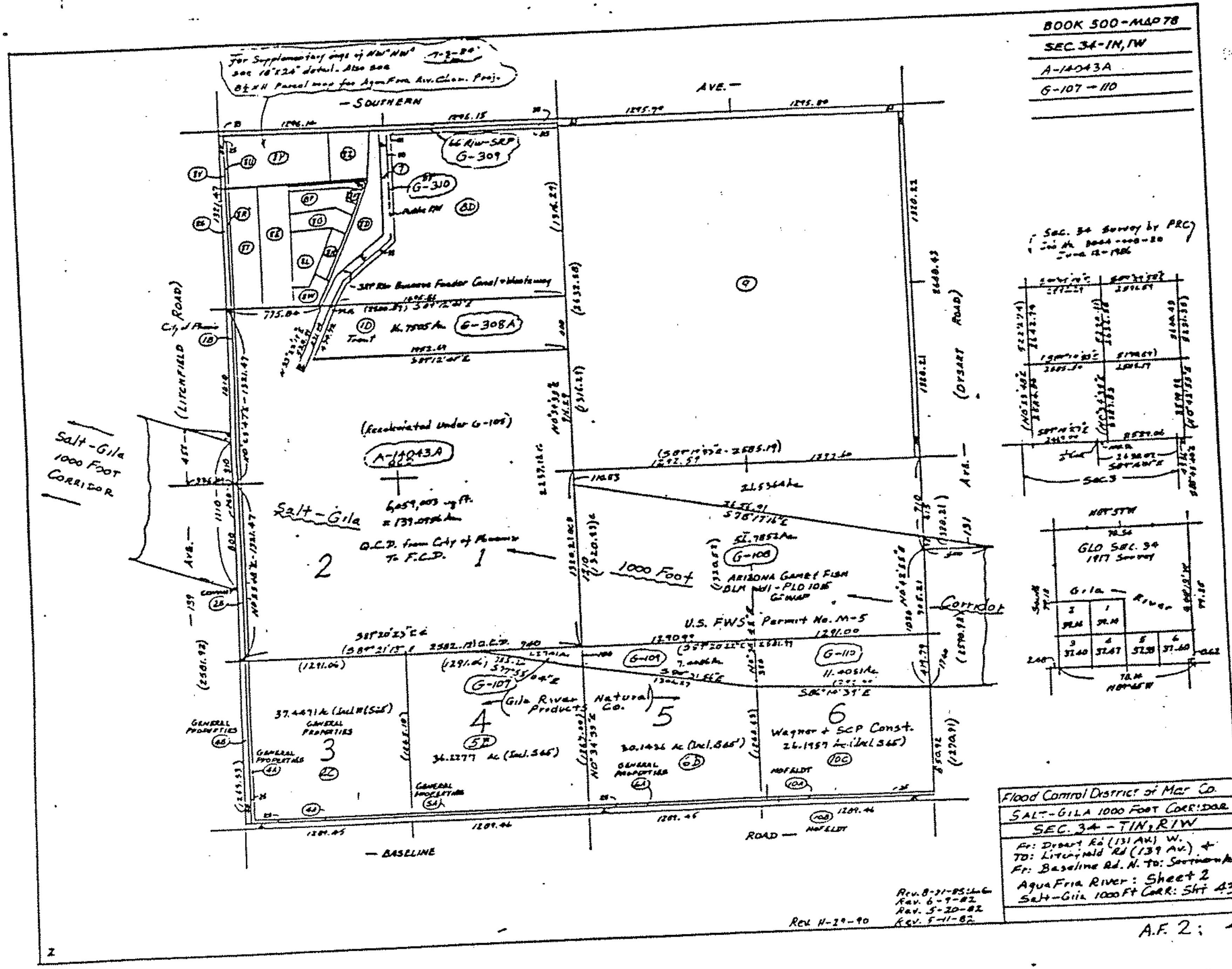
155TH AVE. TO 163RD AVE.
(RECKER RD) (KIMBALL AVE)
SOUTHERN AVE. TO BASELINE RD.

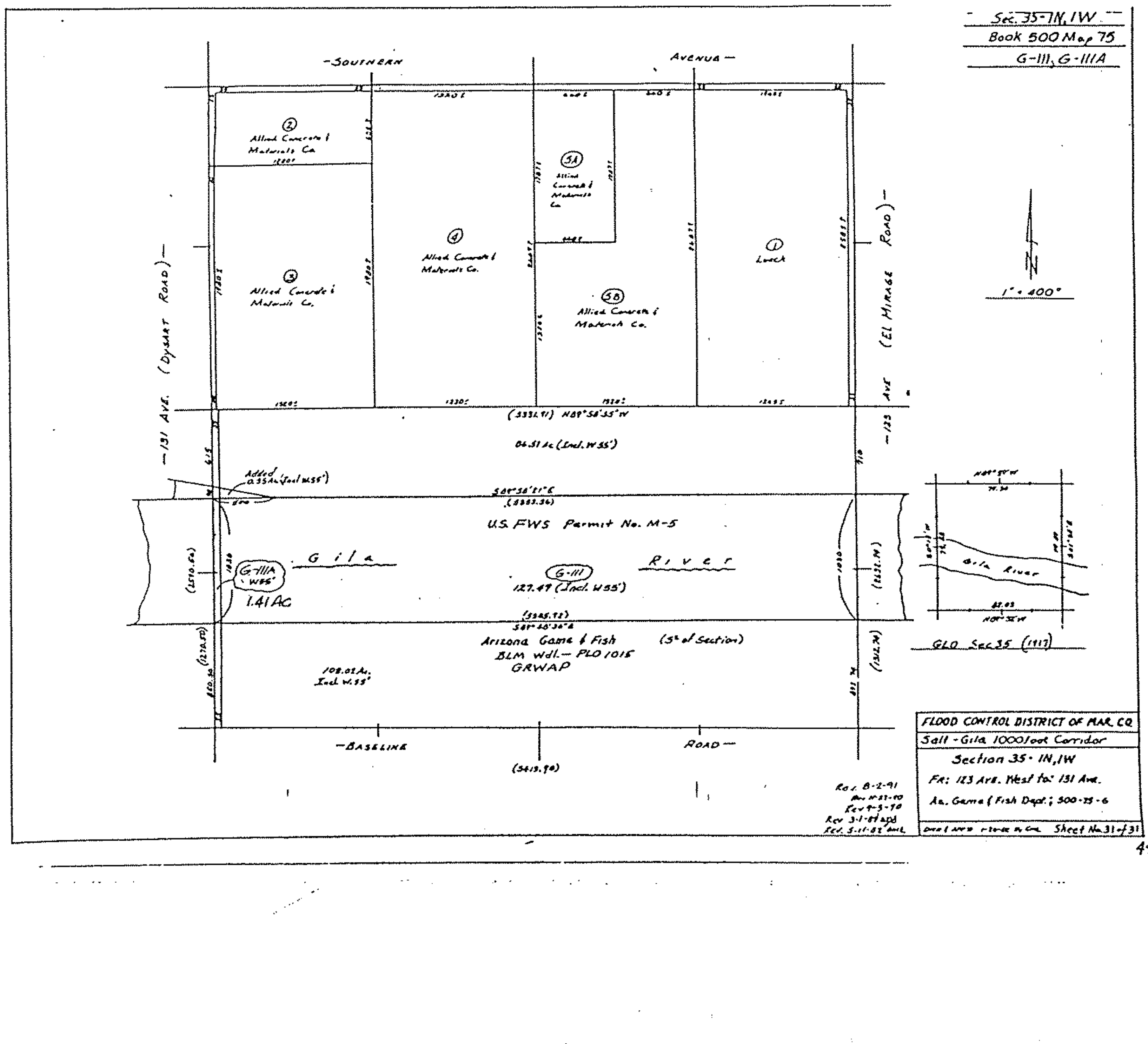
10-27-88 FRAME E3904 : T8C3804

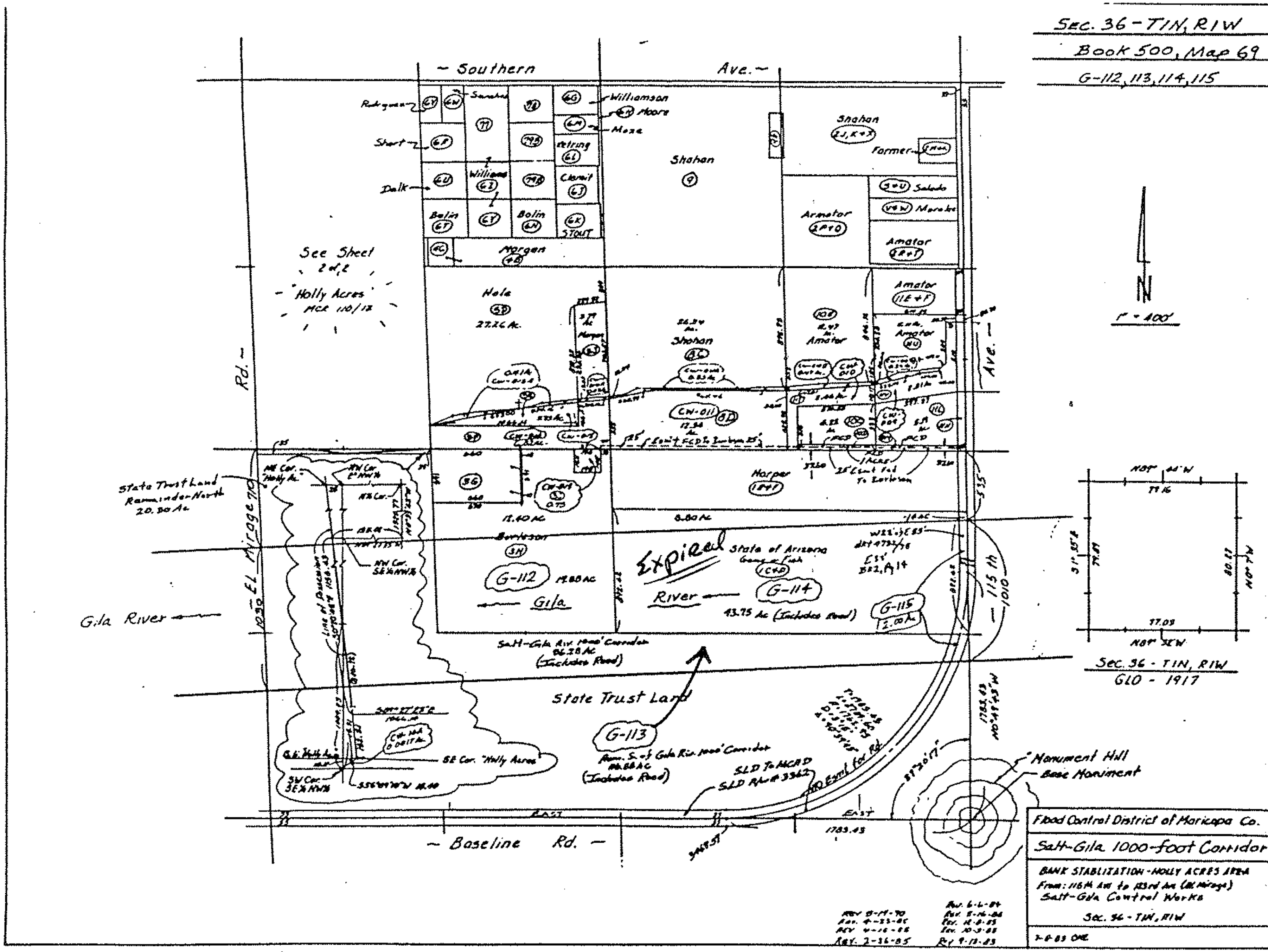

Sec. 32-1N.1W
G-99
Southern
Ave
NW COR. SEC.
NE COR. SEC.
Gila
G-96
River
State Trust Land
FINAL
1-9-90
①
Buckeye Irrigation Co.
G-97
G-981
G-981
N
SEC. 32 T1N, R1W
GLO RESURVEY 1917
4
3
2
1
Ave. (Reems)
155th
Ave. (Bullard)
147th
②
Maricopa County Parks & Recreation
Casey Abbott Park
SW COR. SEC.
SE COR. SEC.
Baseline
Road
Rev 7-20-87
Rev 7-14-89
Rev 3-1-89
FLOOD CONTROL DISTRICT OF MARICOPA CO
Salt-Gila 1000 Foot Corridor
Sec 32, T1N, R1W
147th Ave to 155 Ave
(Bullard) (Reems)
Southern Ave to Baseline Rd



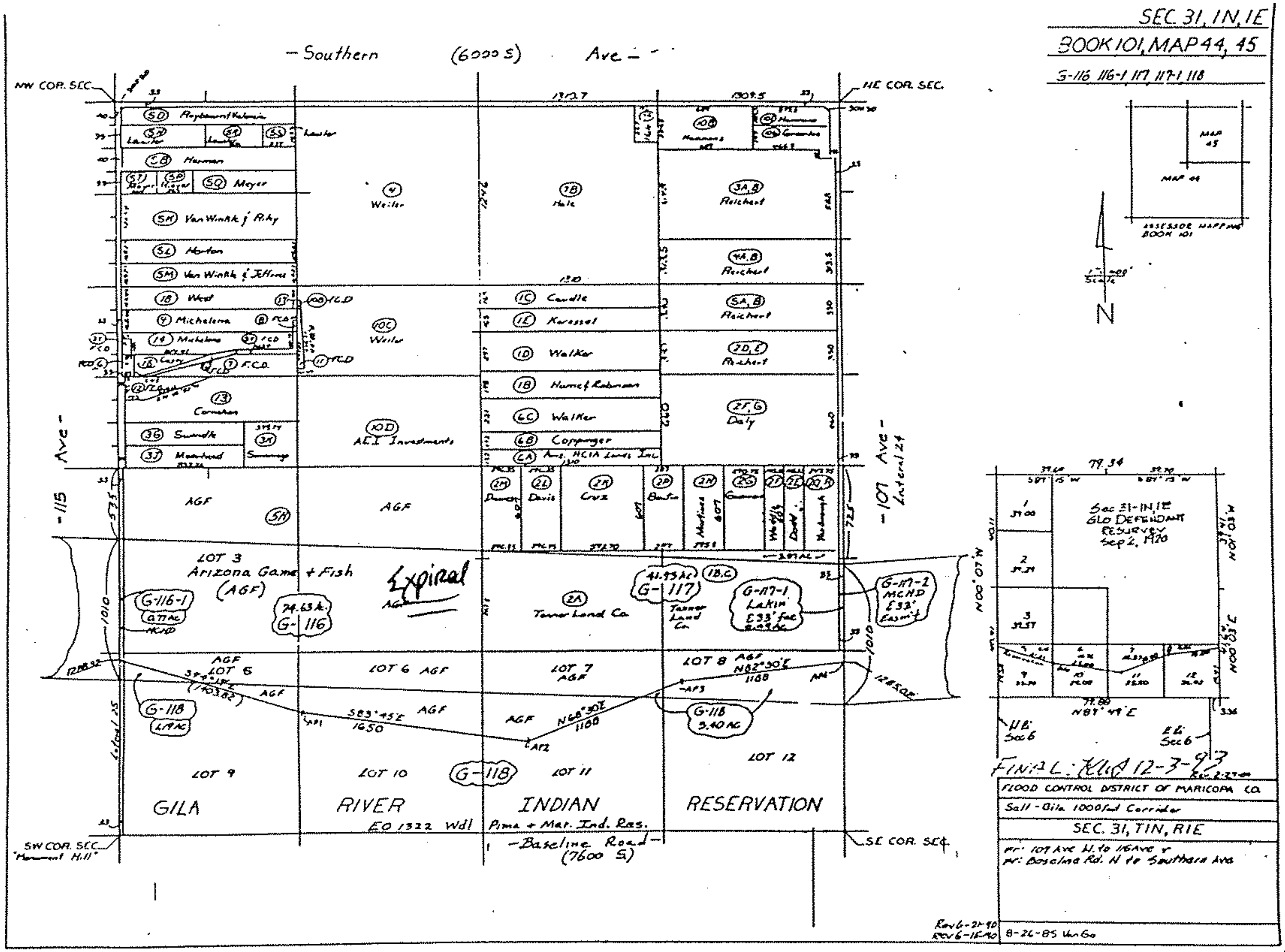
BOOK 500-MAP 79
G-100 → 104
SCALE 1"=400
BUCKEYE PLACER MINERAL SURVEY No. 3071
JUNE 4, 1919
SOUTHERN AVE.
BASELINE ROAD
(BULLARD Rd.)
-147 AVE.
(LITCHFIELD Rd.)
-159 AVE.
MAR. Co.
BUCKEYE IRRIGATION Co.
Gila River Drainage Study
A-1404G-FL
SLD SLUP No. 23-84023
STATE OF ARIZONA
Gila River
Casey Abbott Semi-Regional Park
M.S. #3071
500-99-1
BUCKEYE IRRIG. Co.
WATERFOWL PRESERV. SOCIETY & SNOW SERVICES INC
WATERFOWL PRESERV. SOCIETY
BUCKEYE IRRIG. Co.
Yoo
Lafferty
M.S. No. 3071
GLO Sec. 33 (1917)
Flood Control District of Mar. Co.
Salt-Gila 1000 foot Corridor
Section 33-T1N, R1W
Fr: 139 AVE. WEST TO: 147 AVE.
500-99-5 thru 11; 500-99-2, 3A; 500-99-12; 500-99-13; 500-99-1
Sheet No
AFR 1


BOOK 500-MAP 78
SEC. 34-1N,1W
A-14043A
G-107 → 110
SOUTHERN
AVE.
LITCHFIELD ROAD
DYSART ROAD
BASELINE
ROAD
Salt-Gila 1000 Foot Corridor
Salt-Gila
1000 Foot
Corridor
G-309
G-310
G-308A
G-108
G-109
G-110
G-107
ARIZONA Game & Fish
U.S. FWS Permit No. M-5
Gila River Products
Natural Co.
Wagner + SCP Const.
GENERAL PROPERTIES
O.C.D. from City of Phoenix To F.C.D.
GLO SEC. 34 1917 Survey
SEC. 3
Flood Control District of Mar Co.
SALT-GILA 1000 FOOT CORRIDOR
SEC. 34 - T1N, R1W
Aqua Fria River: Sheet 2
Salt-Gila 1000 Ft CORR: Sht 43
Rev. 11-29-90
A.F. 2


Sec. 35-1N,1W
Book 500 Map 75
G-111, G-111A
-SOUTHERN
AVENUE-
-131 AVE. (DYSART ROAD)-
(EL MIRAGE ROAD)
-123 AVE
② Allied Concrete & Materials Co.
③ Allied Concrete & Materials Co.
④ Allied Concrete & Materials Co.
5A Allied Concrete & Materials Co.
5B Allied Concrete & Materials Co.
① Loeck
(5331.91) N89°58'35"W
86.51 Ac (Incl. W 55')
Added 0.35 Ac (Incl W55')
S89°58'21"E
(5333.36)
U.S. FWS Permit No. M-5
G i l a
R i v e r
G-111
127.49 (Incl. W55')
G-111A 'W55'
1.41 AC
(5345.72)
S89°40'30"E
Arizona Game & Fish
BLM Wdl.— PLO 1015
GRWAP
(S½ of Section)
108.02 Ac. Incl. W.55'
-BASELINE
ROAD-
(5415.90)
1" = 400'
Gila River
GLO Sec 35 (1917)
Rev. 8-2-91
Rev 9-3-90
Rev 3-1-89
Rev 3-11-88
FLOOD CONTROL DISTRICT OF MAR. CO.
Salt-Gila 1000 foot Corridor
Section 35 - 1N,1W
Fr: 123 Ave. West to: 131 Ave.
Az. Game & Fish Dept.; 500-75-6
Sheet No. 31 of 31
44


Sec. 36 - T1N, R1W
Book 500, Map 69
G-112, 113, 114, 115
~ Southern Ave. ~
~ Baseline Rd. ~
Rd. ~
Ave. ~
115 th
1010
El Mirage
Gila River
Shahan
Amator
Morgan
Hole
27.26 Ac.
Harper
Williamson
Moore
Moza
Rodriguez
Short
Dalk
Bolin
Williams
Stout
Former
Salado
Morales
See Sheet 2 of 2
"Holly Acres"
MCR 110/12
State Trust Land
Remainder North
20.30 Ac
Burleson
G-112
Gila
Expired
State of Arizona
Game & Fish
G-114
River
43.75 Ac (Includes Road)
G-115
2.00 Ac
Salt-Gila Riv. 1000' Corridor
86.28 Ac
(Includes Road)
State Trust Land
G-113
Rem. S. of Gila Riv. 1000' Corridor
(Includes Road)
SLD To MCRD
SLD R/W #3362
SE Cor. "Holly Acres"
"Monument Hill
Base Monument
1" = 400'
N
Sec. 36 - T1N, R1W
GLO - 1917
Flood Control District of Maricopa Co.
Salt-Gila 1000-foot Corridor
BANK STABILIZATION - HOLLY ACRES AREA
From: 115th Ave to 123rd Ave (El Mirage)
Salt-Gila Control Works
Sec. 36 - T1N, R1W
REV. 2-26-85

46



SEC. 31, 1N, 1E
BOOK 101, MAP 44, 45
G-116 116-1 117 117-1 118
ASSESSOR MAPPING BOOK 101
MAP 44
MAP 45
N
- Southern (6000 S) Ave -
NW COR. SEC.
NE COR. SEC.
SW COR. SEC. "Monument Hill"
SE COR. SEC.
- 115 Ave -
- 107 Ave - Lateral 24
LOT 3 Arizona Game + Fish (AGF)
Expired
G-116-1
G-116
G-117
G-117-1 Lakin
G-117-2 MCHD
G-118
Tanner Land Co.
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
GILA RIVER INDIAN RESERVATION
EO 1322 Wdl
Pima + Mar. Ind. Res.
- Baseline Road - (7600 S)
Sec 31-1N,1E GLO DEFENDANT RESURVEY Sep 2, 1970
FLOOD CONTROL DISTRICT OF MARICOPA CO.
Salt-Gila 1000 foot Corridor
SEC. 31, T1N, R1E
fr: 107 Ave W. to 116 Ave &
fr: Baseline Rd. N to Southern Ave
8-26-85

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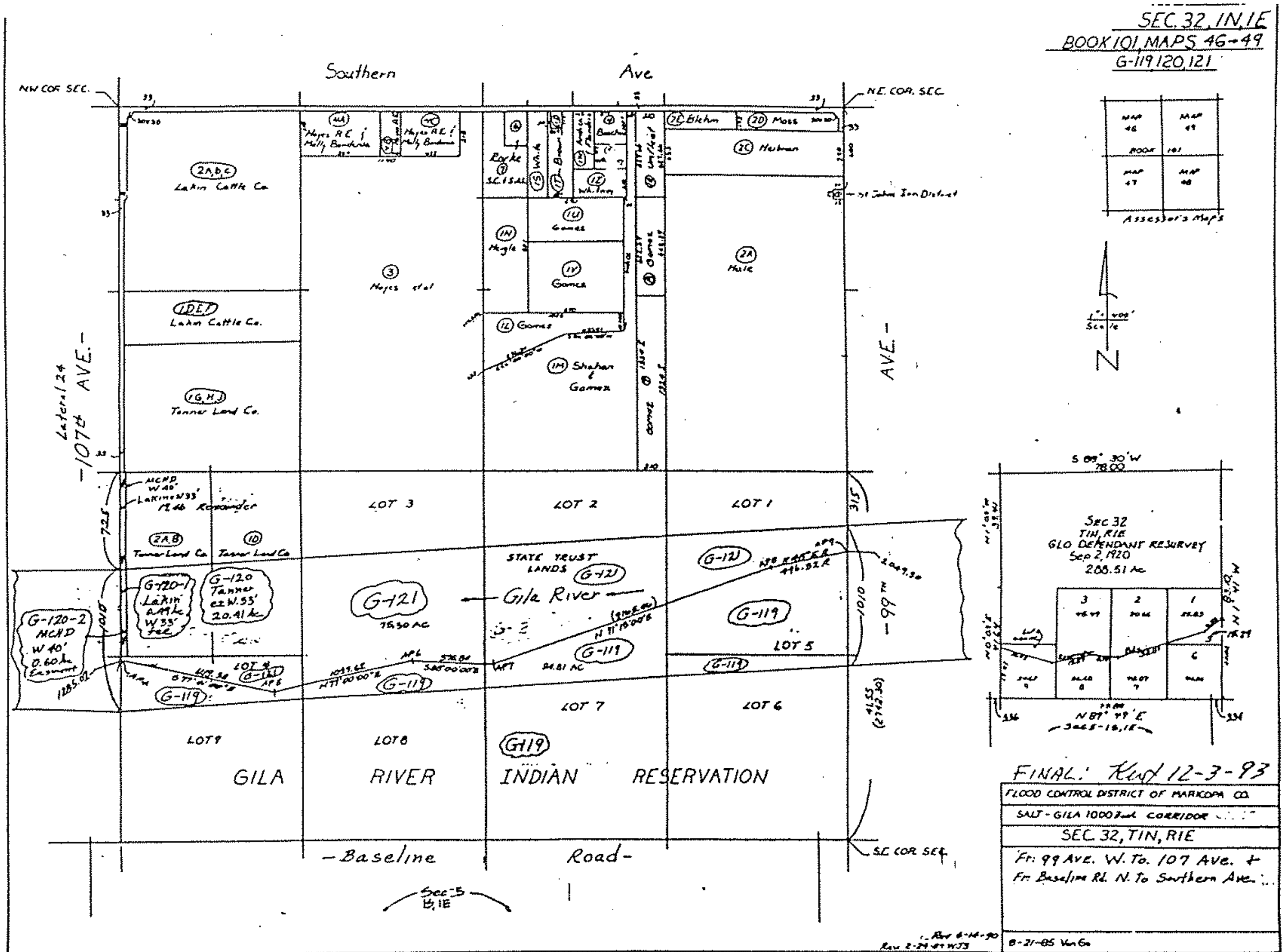
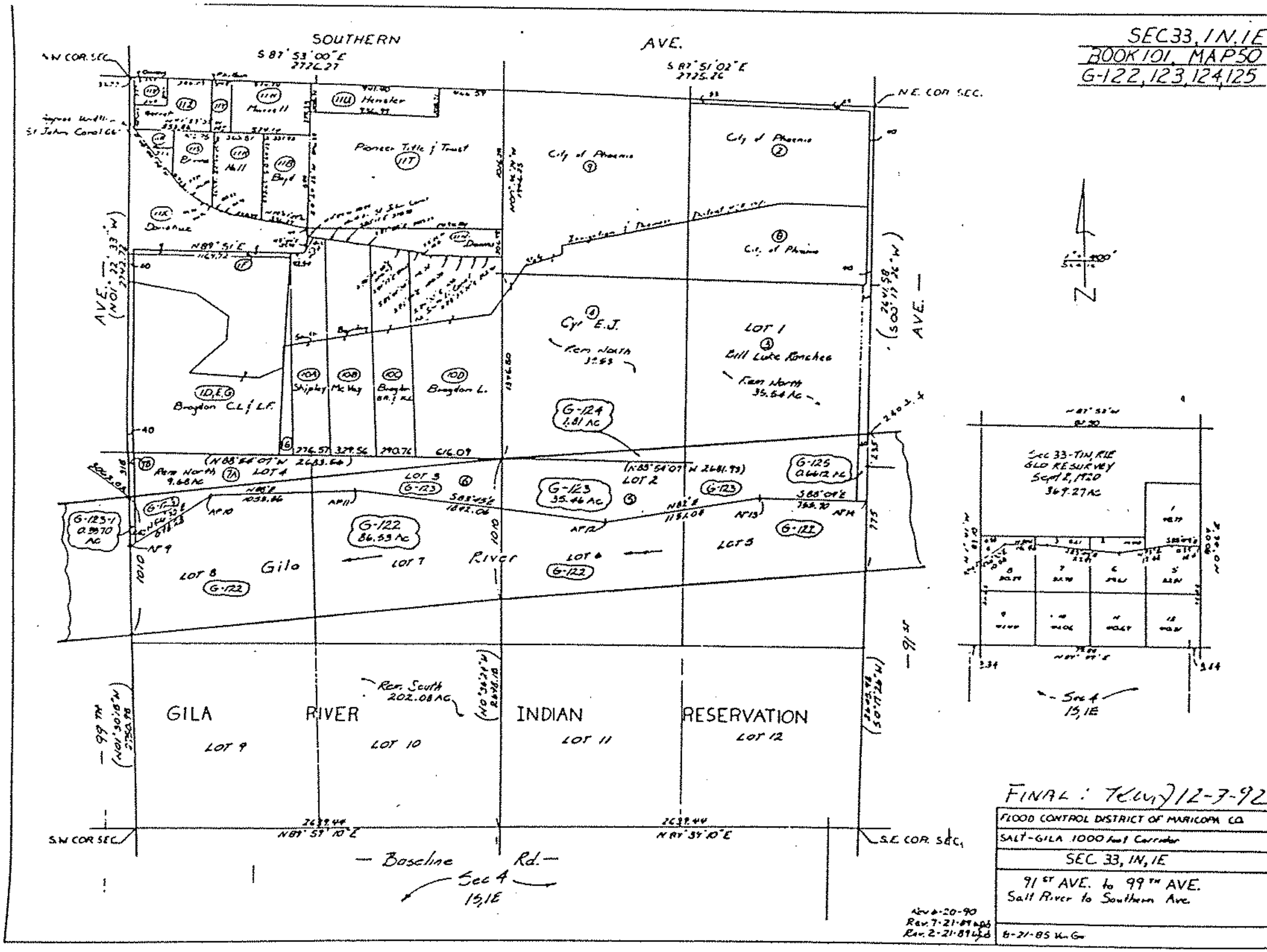

SEC. 32, 1N, 1E
BOOK 101, MAPS 46-49
G-119, 120, 121
Southern Ave
NW COR SEC.
NE COR. SEC.
-107th AVE.-
Lateral 24
-99th AVE.-
Lakin Cattle Co.
Tanner Land Co.
Hayes et al
Gomez
Shahan & Gomez
Hugle
Hale
Helman
Moss
Elchm
LOT 1
LOT 2
LOT 3
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
STATE TRUST LANDS
Gila River
G-119
G-121
G-120 Tanner
G-120-1 Lakin
G-120-2 MCHD W 40' 0.60 Ac Easement
GILA RIVER INDIAN RESERVATION
-Baseline Road-
SE COR SEC.
Sec 5 1S, 1E
Assessor's Maps
MAP 46
MAP 47
MAP 48
MAP 49
BOOK 101
Scale
N
Sec 32 T1N, R1E GLO DEPENDANT RESURVEY Sep 2, 1920 288.51 Ac
FINAL: 12-3-93
FLOOD CONTROL DISTRICT OF MARICOPA CO.
SALT-GILA 100 Yr. CORRIDOR
SEC. 32, T1N, R1E
Fr: 99 Ave. W. To 107 Ave. + Fr: Baseline Rd. N. To Southern Ave.
8-21-85

48



FINAL: 12-7-92

FLOOD CONTROL DISTRICT OF MARICOPA CO.
SALT-GILA 1000 foot Corridor
SEC. 33, IN, IE
91 ST AVE. to 99 TH AVE.
Salt River to Southern Ave.
6-21-85

48

AG. CONTRACT NO. 1527

PERMIT (M-5)
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
GILA RIVER WILDLIFE MANAGEMENT AREA
MARICOPA COUNTY, ARIZONA

THE SECRETARY OF THE INTERIOR, through his authorized representative, the Regional Director, U.S. Fish and Wildlife Service (FWS), Albuquerque, New Mexico, herein referred to as "Regional Director", in accordance with regulations published October 1, 1981 in 50 CFR 29.21; applicable authorities; and with the concurrence of the Arizona Game and Fish Department (AGFD), does hereby grant to the FLOOD CONTROL DISTRICT OF MARICOPA COUNTY (FCD), herein referred to as "permittee," a permit to improve the Gila River floodway channel across lands of the Gila River Wildlife Management Area in Maricopa County, Arizona. The lands authorized for clearing and maintenance of a 1,000-foot-wide corridor are included in the 6,896.14 acres that were withdrawn by the Secretary of the Interior under Public Land Order No. 1015 to be managed by the AGFD and are particularly described in exhibit B and located on maps (exhibit C) attached to and made a part of this permit.

By accepting this permit, the permittee agrees to abide by the following terms and conditions as well as the general terms and conditions contained in attached exhibit A:

(1) The DIRECTOR, AGFD is the coordinating official having immediate jurisdiction over and administrative responsibility for the premises.

(2) This permit is granted for a period of 25-years commencing on May 15, 1982, and may be renewed subject to regulations existing at the time of renewal and such other terms and conditions deemed necessary to protect the public interest. Expires May 14, 2...

(3) This permit reserves to the Secretary of the Interior, or his lawful delegate, the right to grant additional rights-of-way, easements, or permits for compatible uses over, under, or adjacent to the land involved in this grant.

(4) This permit is granted for the clearing of a 1,000-foot-wide corridor of vegetation from and along the Gila River in accordance with FWS preferred "Alternative 1," as stated in the final Environmental Impact Statement (EIS) of November 1981.

(5) The permittee agrees to complete mitigation measures concurrently with implementation of the project in accordance with the approved mitigation plan, as specified in the final EIS of November 1981.

(6) The failure of the United States to require strict performance of the terms, covenants, agreements, and conditions of this right-of-way permit shall not constitute a waiver or relinquishment of the right of the United States to strictly enforce, thereafter, such terms, covenants, agreements, or conditions which shall, at all times, continue in full force and effect.

File

(7) Any transfer or assignment of this permit to another entity must be approved by the Regional Director prior to the transfer.

IN WITNESS THEREOF, the signatures have been affixed on the respective dates indicated.

THE UNITED STATES OF AMERICA

6/21/82
Date

By Jerry L. Stegman
Acting Regional Director
U.S. Fish and Wildlife Service

ARIZONA GAME AND FISH DEPARTMENT

5/6/82
Date

By Bud Bristow
Director

ACCEPTED
COUNTY

FLOOD CONTROL DISTRICT OF MARICOPA

5-6-82
Date

By D E Sagramoso
Chief Engineer and General Manager

APPROVED AS TO FORM
this 18 day of October, 1982
BOB CORBIN
Attorney General
By Joseph C. Woff
Assistant Attorney General

SUPPLEMENT
PERMIT (M-5)
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
GILA RIVER WILDLIFE MANAGEMENT AREA
MARICOPA COUNTY, ARIZONA

GILA AND SALT RIVER MERIDIAN

T1S, R5W, Sec. 27, NW¼SE¼SE¼ G-13 AG&F
T1S, R4W, Sec. 21, S½SE¼ G-27 AG&F
T1S, R4W, Sec. 23, S½NE¼ G-31 AG&F
T1S, R4W, Sec. 13, Portion SE¼SW¼SW¼ G-38 BLM
T1S, R3W, Sec. 11, SE¼SE¼SE¼; S2NE¼SE¼SE¼ G-58,59 GSA

The above added parcels shall comply with the applicable "Right-of-Way General Terms and Conditions" of Exhibit "A" attached to Permit (M-5).

IN WITNESS THEREOF, the signatures have been affixed on the respective dates indicated;

ARIZONA GAME AND FISH DEPARTMENT

9.3.82
Date

By [signature]
Director

ACCEPTED
COUNTY

FLOOD CONTROL DISTRICT OF MARICOPA

3-16-83
Date

By [signature]
Chief Engineer And General Manager

Oct 27, 1982
Date

By [signature]
Regional Director
U.S. Fish and Wildlife Service

APPROVED AS TO FORM
This 18 day of October, 1982
BOB CORBIN
Attorney General

By [signature]
Assistant Attorney General

EXHIBIT A

RIGHT-OF-WAY
GENERAL TERMS AND CONDITIONS

(a) The permittee shall comply with State and Federal laws and existing regulations applicable to the project and to refuge lands which are included in the right-of-way.

(b) The permittee shall clear and keep clear the lands within the right-of-way to the extent and in the manner directed by the Director, AGFD. The permittee shall dispose of all vegetation and other material cut, uprooted, or otherwise accumulated during the construction and maintenance of the project, in such a manner as to prevent fire hazards.

(c) The permittee shall do everything reasonably within his power, both independently and upon request of any duly authorized representative of the United States, to prevent and suppress fires on or near lands to be occupied under the right-of-way. Construction and maintenance forces, reasonably obtainable, shall be made available for the suppression of such fires.

(d) The permittee shall not disturb or remove any public land survey monument or refuge boundary monument unless and until the applicant has requested and received, from the Regional Director, approval of measures to be taken to perpetuate the location of aforesaid monument.

(e) The permittee shall take soil and resource conservation and protection measures on the land covered by the right-of-way as requested by the Director, AGFD. This shall include weed control.

(f) The permittee shall rebuild and repair roads, fences, structures, and trails destroyed or injured by construction work. Upon written request by the Regional Director, permittee shall build and maintain necessary and suitable crossings for all roads and trails that intersect the works constructed, maintained, or operated under the right-of-way.

(g) The permittee shall pay the United States the full value for all damages, to the lands or other property of the United States, caused by him or by his employees, contractors, or employees of the contractors, and to indemnify the United States against any liability for damages to life, person, or property arising from the occupancy or use of the lands under the right-of-way; except where a right-of-way is granted to a State or other Goverment agency which has no legal power to assume such a liability with respect to damages caused to lands or property, such agency, in lieu thereof, agrees to repair all such damages.

(h) The permittee shall notify the Director, AGFD of the amount of merchantable timber, if any, which will be cut, removed, or destroyed in the construction and maintenance of the project. Permittee agrees to pay the United States, in advance of construction, the sum of money determined by the Director, AGFD to be the full stumpage value of the timber to be so cut, removed, or destroyed.

(i) All or any part of the right-of-way may be terminated by the Regional Director for: failure to comply with any or all of the terms or conditions of this permit; non-use for a 2-year period; or abandonment of the right-of-way.

In the event of noncompliance, the Regional Director will notify the permittee, in writing, of the corrections needed. The permittee shall have a 60-day period to complete corrective action from the date of notification. However, in the event of extenuating circumstances--such as adverse weather conditions, disturbance of wildlife during periods of peak concentrations, or other compelling reasons--the Regional Director may grant an extension of time, which in his judgment is reasonably necessary. A written notice of termination will be furnished to the permittee in the event of termination for noncompliance, non-use, or abandonment.

(j) The permittee shall restore the land to its original condition, so far as it is reasonably possible to do so, upon revocation and termination of the right-of-way, unless this requirement is waived in writing by the Regional Director.

(k) The permittee shall keep the Director, AGFD informed of his address, or in the case of corporations, of the address of its principal place of business, and names and addresses of its principal officers.

(l) The issuance of this right-of-way shall be subject to the express condition that the exercise thereof will not unduly interfere with the United States' management, administration, or disposal of the land affected thereby. The permittee agrees and consents to the occupancy and use by the United States, its grantees, permittees, or lessees of any part of the right-of-way not actually occupied or required by the permittee for the purpose of the granted rights or the full and safe utilization thereof.

(m) Constructed facilities shall not conflict with authorized use or occupancy of the land under the authority of the United States. The right-of-way shall be subject to the express covenant that any facility constructed will be modified or adapted, if such is found to be necessary by the Regional Director. Such modification or adaptation will be without liability or expense to the United States.

(n) Upon completion of construction, the permittee agrees to maintain all surface facilities and sites in a clean and orderly condition.

(o) Upon completion of construction, the permittee agrees to provide "as built" drawings of constructed facilities to the Regional Director.

(p) The right-of-way shall be issued with the understanding and upon the express condition that the permittee shall respect and protect all prior and proper rights granted to any corporation, agency, or persons. The permittee shall coordinate its planning, construction, use, and maintenance with such parties and obtain any necessary agreements for use of such facilities.

(q) The permittee shall not discriminate on the basis of race, creed, color, or national origin in hiring employees for the construction, operation, and maintenance of the project; and shall require an identical provision to be included in all subcontracts.

(r) The permit shall be for the specific use described and may not be construed to include the further right to authorize any other use within the right-of-way, unless approved in writing by the Regional Director.

EXHIBIT B

Gila River Wildlife Management Area
Maricopa County, Arizona

Gila and Salt River Meridian

T. 1 N., R. 1 W.
sec. 34, N½SE¼ G-108
sec. 35, S½ G-111

T. 1 N., R. 2 W.
sec. 34, Lot 5 G-86

T. 1 S., R. 2 W.
sec. 3, Lots 1, 2, ~~S½SW¼, SW¼SE¼~~ G-86A
sec. 4, SW¼NE¼, ~~SE¼NW¼, NE¼SW¼,~~ SE¼ G-83-3,83-2
sec. 5, S½SE¼ — — — — — — G-79
sec. 8, SW¼NE¼, N½SW¼ — — — — G-76-3,76-1

T. 1 S., R. 3 W.
sec. 10, ~~SE¼SW¼~~, S½SE¼ — — — — — — G-54
sec. 11, ~~NE¼SW¼~~, S½SW¼, N½SE¼ — — — — — G-55,60
~~sec. 12, SW¼NE¼, S½NW¼~~
sec. 14, NW¼NW¼ — — — — — — — G-52
sec. 15, N½NE¼, W½SE¼NW¼, ~~SW¼, S½SE¼~~ — — — — G-51,49
sec. 17, ~~S½NE¼~~, NW¼SW¼, SE¼ — — — — — — G-43,45-46
sec. 18, Lots 3, 4, E½SW¼, ~~S½NE¼~~, W½SE¼, NE¼SE¼ G-40

T. 1 S., R. 4 W.
sec. 13, SE¼SW¼, S½SE¼ — — — — — — G-39
sec. 14, SE¼SE¼ — — — — — — — — G-36
~~sec. 19, S½SE¼~~
sec. 20, S½S½, NE¼SE¼ — — — — — — G-26
sec. 21, S½NE¼, ~~SE¼NW¼~~ N½S½, S½SW¼ — — G-28
sec. 22, NE¼, ~~NE¼NW¼~~, S½NW¼, N½SW¼, NW¼SE¼ G-29
sec. 23, N½NE¼, NW¼ G-30
~~sec. 27, SW¼~~
~~sec. 28, NW¼, S½~~
sec. 29, N½N½, ~~SE¼NE¼~~ — — — — — — G-25
sec. 30, Lots ~~1~~, ~~2~~, 6, 7, NE¼, E½NW¼, ~~SE¼SE¼~~ — — G-24

T. 1 S., R. 5 W.
sec. 25, N½SW¼, ~~SW¼SW¼~~ — — G-19
sec. 26, S½ — — — — — — G-18
sec. 27, NE¼SE¼ — — — — G-15
sec. 33, E½SE¼ — — — — G-9,10
sec. 34, NW¼NE¼, NW¼, W½SW¼ G-11

T. 2 S., R. 5 W.
sec. 4, Lot 2, SW¼NE¼, W½SE¼ G-7
sec. 9, NW¼NE¼, S½NE¼, SE¼ G-5
sec. 21, E½, ~~SE¼NW¼, E½SW¼~~ G-3

The area described aggregates 6,896.14 acres.

When recorded mail to:
FLOOD CONTROL DISTRICT
2801 W. Durango
Phoenix, Arizona 85009

OFFICIAL RECORDS OF
MARICOPA COUNTY RECORDER
HELEN PURCELL

Recording Number
92-0450596

08/17/92 10:38

1 of 1 LILIAN

LAND USE PERMIT GRANTED
TO FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FROM ARIZONA STATE LAND DEPARTMENT

DO NOT REMOVE

This is part of the official document.

Arizona
State Land Department
1616 WEST ADAMS
PHOENIX, ARIZONA 85007

...E SYMINGTON
...OVERNOR

M.J. HASSELL
STATE LAND COMMISSIONER

92 450596

PERMIT FOR LAND USE
PURSUANT TO A.R.S. 37-461 (C)
29-52259

The Arizona State Land Department (hereinafter the "Department"), with regard to any interest the State of Arizona may have based on navigability of the Salt River and Gila River as of February 14, 1912, hereby authorizes the Flood Control District of Maricopa County (hereinafter the "Permittee") to use the land, as determined from the Salt/Gila 1000 Foot Corridor Project map Exhibit "A", attached hereto and incorporated herein, for the construction, operation, and maintenance of a flood control project, including all incidental purposes consistent therein.

This permission shall be in effect only so long as the land is used solely for the purpose for which permission is authorized, i.e., the construction, maintenance, and operation of a thousand foot wide floodway channel from 91st Avenue to Gillespie Dam. The Department specifically denies retaining any duty to control, supervise, or inspect the Permittee's use or actions on said lands.

Date: 6/5/92

M J Hassell
M.J. Hassell
ARIZONA STATE LAND COMMISSIONER

92 450596

PERMIT INDEMNITY AGREEMENT
29-52259

The Permittee hereby expressly agrees to indemnify and hold the Department and the State of Arizona (hereinafter the "State") harmless, or to cause the State to be indemnified and held harmless from and against all liabilities, obligations, damages, penalties, claims, causes of action, costs, charges and expenses, which may be imposed upon or incurred by or asserted against the State by reason of the following: (a) any accident, injury, or damage to any persons or property occurring on or about the lands as determined from the Salt/Gila 1000 foot Corridor Project map Exhibit "A", or any portion thereof, resulting from or arising out of the use of the lands by Permittee, (b) any use or non-use or condition of the lands or any portion thereof resulting from actions or negligence of the Permittee, (c) any failure on the part of the Permittee to comply with any of the provisions of this permit, (d) any failure of the State to control, inspect, or supervise Permittee's actions on the lands, and (e) any failure of the State to perform any other duty, if any, it may have or retain relative to said lands by virtue of its ownership or by virtue of the operation of law.

The Permittee also hereby expressly agrees to protect, defend, indemnify, and hold the State harmless, or cause the State to be protected, defended, indemnified, and held harmless from and against all liabilities, obligations, losses, environmental response and cleanup costs, charges and expenses, including attorney's fees and costs arising out of or related to the presence or existence of any substance regulated under any applicable federal, state, or local environmental laws, regulations or ordinances or any additions or amendments thereto because of: (a) any such substance that came to be located on said lands during any use or occupancy of the lands by Permittee before or after the issuance of this permit; or (b) any release, threatened release, escape, seepage, leakage, spillage, discharge, or emission of any substance in, on, under or from said lands subsequent to when substance came to be located on the lands.

Permittee agrees that this indemnity is in addition to and neither excludes, supersedes, supplants, nor otherwise modifies any rights which the State might have under common law theories of implied indemnity. Those common law rights may be asserted together with rights the State may have under the express provisions of this agreement and the State shall not be required to choose between remedies, but may assert such remedies.

Permittee agrees that the State is entitled to recover attorney's fees and costs incurred in enforcing any of its rights under the terms of this indemnity agreement.

Approved:

RECOMMENDED FOR APPROVAL:

6/20/92

for Stanley L. Smith, Jr., P.E. Date
Acting Chief Engineer and
General Manager

6/19/92

for Jim L. Schwartzmann Date
Chief, Land Management Division

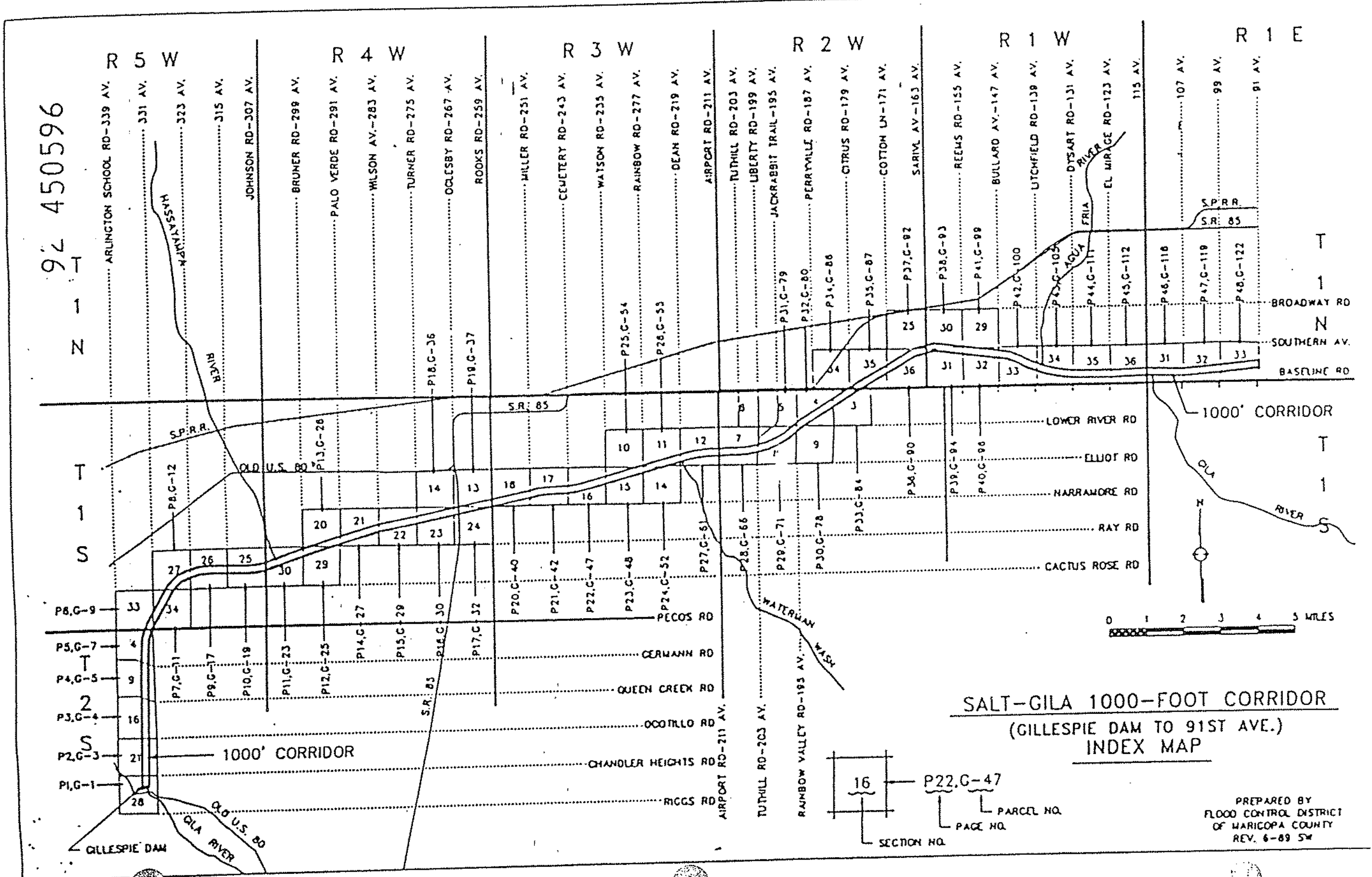
ACCEPTED AND APPROVED:

Betsey Bayless
Chairman of the Board

ATTEST:

Clerk of the Board

Date: 6/22/92


92 450596
R 5 W
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
T 1 N
T 1 S
T 2 S
ARLINGTON SCHOOL RD-339 AV.
331 AV.
323 AV.
315 AV.
JOHNSON RD-307 AV.
BRUNER RD-299 AV.
PALO VERDE RD-291 AV.
WILSON AV.-283 AV.
TURNER RD-275 AV.
OGLESBY RD-267 AV.
ROOKS RD-259 AV.
MILLER RD-251 AV.
CEMETERY RD-243 AV.
WATSON RD-235 AV.
RAINBOW RD-277 AV.
DEAN RD-219 AV.
AIRPORT RD-211 AV.
TUTHILL RD-203 AV.
LIBERTY RD-199 AV.
JACKRABBIT TRAIL-195 AV.
PERRYVILLE RD-187 AV.
CITRUS RD-179 AV.
COTTON LN-171 AV.
SARIVAL AV-163 AV.
REEMS RD-155 AV.
BULLARD AV.-147 AV.
LITCHFIELD RD-139 AV.
DYSART RD-131 AV.
EL MIRAGE RD-123 AV.
115 AV.
107 AV.
99 AV.
91 AV.
HASSAYAMPA RIVER
S.P.R.R.
OLD U.S. 80
S.R. 85
AGUA FRIA RIVER
GILA RIVER
WATERMAN WASH
GILLESPIE DAM
BROADWAY RD
SOUTHERN AV.
BASELINE RD
LOWER RIVER RD
ELLIOT RD
NARRAMORE RD
RAY RD
CACTUS ROSE RD
PECOS RD
GERMANN RD
QUEEN CREEK RD
OCOTILLO RD
CHANDLER HEIGHTS RD
RIGGS RD
AIRPORT RD-211 AV.
TUTHILL RD-203 AV.
RAINBOW VALLEY RD-195 AV.
1000' CORRIDOR
1000' CORRIDOR
P1,G-1
P2,G-3
P3,G-4
P4,G-5
P5,G-7
P6,G-9
P7,G-11
P8,G-12
P9,G-17
P10,G-19
P11,G-23
P12,G-25
P13,G-26
P14,G-27
P15,G-29
P16,G-30
P17,G-32
P18,G-36
P19,G-37
P20,G-40
P21,G-42
P22,G-47
P23,G-48
P24,G-52
P25,G-54
P26,G-55
P27,G-61
P28,G-66
P29,G-71
P30,G-78
P31,G-79
P32,G-80
P33,G-84
P34,G-86
P35,G-87
P36,G-90
P37,G-92
P38,G-93
P39,G-94
P40,G-96
P41,G-99
P42,G-100
P43,G-105
P44,G-111
P45,G-112
P46,G-116
P47,G-119
P48,G-122
N
0 1 2 3 4 5 MILES
SALT-GILA 1000-FOOT CORRIDOR
(GILLESPIE DAM TO 91ST AVE.)
INDEX MAP
16
P22,G-47
SECTION NO.
PAGE NO.
PARCEL NO.
PREPARED BY
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
REV. 6-89 SW

92 450596

State Land Permit #29-52259
Salt/Gila 1000 Foot Corridor

Section 31, 32, 33	T1N	R1E
Section 30, 29, 31, 32 33, 34, 35, 36	T1N	R1W
Section 25, 34, 35, 36	T1N	R2W
Section 3, 4, 5, 6, 7, 8, 9,	T1S	R2W
Section 10, 11, 12, 14, 15, 16, 17, 18	T1S	R3W
Section 13, 14, 20, 21, 22, 23, 24, 29, 30	T1S	R4W
Section 25, 26, 27 33, 34	T1S	R5W
Section 4, 9, 16, 21, 28	T1S	R5W

Exhibit "A"

2

96 - 003 - 002

GILA RIVER

01

ORIGINAL

Gila River

RECEIVED 8-30-96

Exhibits submitted by Arizona Center for Law in the Public Interest

August 29, 1996

REC&FITNESS

CALENDAR

BIATHLON

FOUNTAIN OF YOUTH 7 a.m. Sunday: 5-mile run, 19-mile bike at Fountain Hills. Call: 949-1633.

BIKING

LE GRANDE BICYCLE TOUR Saturday: Sponsored by Arizona Parks and Recreation. Call: 267-7246.

FAMILY FUN RIDE 1 p.m. Saturday: Starts at Rumsey Park, Payson. Benefits the American Heart Association. Call: 474-5354.

MAYOR'S CUP II 9:15 a.m. Sunday: Held at Rumsey Park, Payson. Benefits the American Heart Association. Call: 474-3144.

TOUR DE CURE Sunday: Ride benefits American Diabetes Association. Call: 995-1515.

SPRINGFEST TOUR OF TEMPE 7 a.m. Sunday: Free family bike ride beginning at Kiwanis Park, Tempe. Call: 350-5200.

PRESCOTT BIKE RIDE PLUS May. 9: Takes place at Hilltop Campground, Prescott. Benefits American Diabetes Association. Call: 1-800-283-CAMP.

GOLF

KIDS KAMP GOLF CLASSIC 7:30 a.m. May 16: Held at Stonecreek, the Golf Club, Paradise Valley. Call: 274-4789.

RACQUETBALL

CACTUS CLASSIC: (Entry deadline Sunday) May 2. Divisions for men and women at all levels. Call: 644-2149.

RUNNING

LAKE POWELL MARATHON AND 10K Saturday: Call: 1-800-835-4671.

CLEAN AIR CHALLENGE May 3: 10K run, 5K walk, 5K skate and aerobathon. All events begin and end at the Pointe Hilton Resort on South Mountain. Proceeds support the Arizona Lung Association. Call: 258-7505.

SOFTBALL

SUMMER SOFTBALL LEAGUES Starts Monday: Held at Esteban Park and Hayden Park. Call: 495-5381.

CINCO DE MAYO SOFTBALL TOURNAMENT: May 2-3: The tournament will be held at Cave Creek Park, with divisions for men and women. Call 262-6483.

SWIMMING

EARLY BIRD DIP 'N SWIM Classes start May 4 and June 1, 6 a.m.: Held at Kiwanis Park Recreation Center. Call: 350-5201.

TRIATHLON

PHOENIX BUD LIGHT TRIATHLON: May 17: 1.5K swim, 40K bike, 10K run held at Estrella Park. Call: 619-221-5555.

Gila River has ballerina's grace

By Carol Sowers
The Arizona Republic

The upper Gila River is like an aging ballerina.

She moves gracefully through the towering box canyons she has carved over the centuries in southeastern Arizona. But like a practiced dancer, she is strong and athletic, and still can surprise her river-running guests with a twirl or two through her playful waters.

On a recent two-day raft trip through the upper Gila, Andy Dennerback, a Cimarron River Co. oarsman, eyed the peppy water boiling around a boulder and told his five passengers: "I think we may bounce off that one."

We did, but it was an amiable bump and there were only the passengers on our other raft and two accompanying kayaks to cheer and jeer.

That is the beauty of the Gila. There is hardly anyone there. The river is what Cimarron owners call a "seldom visited wilderness river." She is remote and known better to local boaters. But in the past few years, commercial companies such as Cimarron have begun exploring her expanses of serene water and huge helpings of quiet.

Staff Sgt. Denise Potett, stationed at Luke Air Force Base, said she welcomed the calm, brown waters of the Gila.

"I've been on other trips where I had to spend all my time paddling," she said. "Here I can just pay attention to the scenery."

And the scenery did not disappoint.

Wise old tamarack trees grow like gentle guardians from the banks, and mud swallows flicker in and out of their nests bulging from cliff walls. Hawks are silently overhead, tracing an invisible route in the blue desert sky.

Float begins with camp

Our quiet voyage with Scottsdale's Cimarron River Co. — the only company to hold a federal permit to commercially raft the Gila — began on a Friday afternoon in Phoenix, where we boarded a van trailing our two 18-foot rafts and two rubber kayaks en route to Clifton in southern Greenlee County. We camped just outside Clifton along the Gila at a campground called the "Old Bridge Site," named in honor of a span across the river built in 1918.

Saturday morning, fueled with pancakes and bacon from the Cimarron crew's expansive outdoor kitchen, we aired up the rafts and the kayaks, loaded our waterproof gear bags onto the boats and pushed gingerly off into the water for two days and 20 miles of floating toward our put-out point near Safford.

Dennerback guided us over the rippling water, keeping his eye on the four passengers in the two-man kayaks, who paddled and bobbed ahead, or behind, the monster rafts.

The first day we passed riverside ranches and hiked up to an old water wheel and abandoned house where oarsman Scott Hynes insisted he saw Elvis.

"He's up there," he said.

We stopped for lunch at the hot springs, where 8-year-old John Riddle flirted with the smoking water boiling up from under the beaches.

"Try it," he said, inviting his mother, Dorothy, to tiptoe through water so hot it sent our 160-degree thermometer into a tailspin.

Dorothy, an accomplished kayaker and veteran mother, declined.

River unusually lush

A mile farther, we squished through the quicksand where the San Francisco River meets the Gila. We washed off in the Gila's warm pools, made deep and inviting by this winter's generous rain and snow.

The Gila is not always so lush. Dave Insley of Cimarron said that some springs on the Gila are not deep enough for commercial rafters, but still is tempting for small boats such as canoes. This year, Cimarron's oarsmen said the Gila may be running enough to play host to boaters through June.

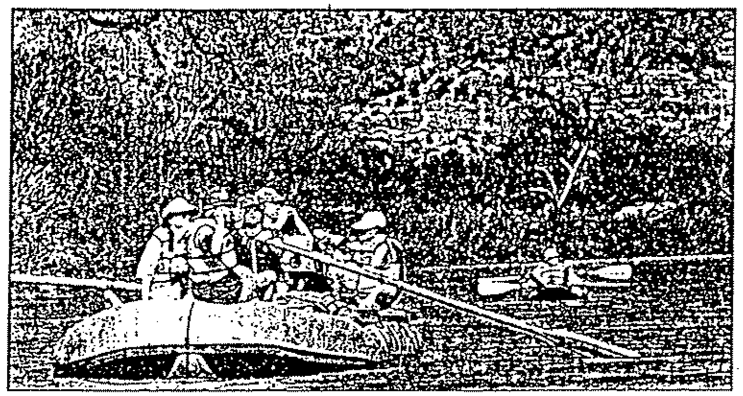
Our group camped Saturday night on the sandy beaches where Eagle Creek's blue waters blend with the dowdy brown of the Gila. Atop the bluffs rising above the river, remnants of stone utensils used to grind corn offered faded reminders of an ancient Indian civilization that lived along the Gila.

Floating is hungry work, so the crew fed us barbecued steak and salmon. And oarsman Chris Pomeroy read us the comic poem, *The Cremation of Sam McGee*, as we sat around the campfire and waited for a carrot cake to bake in a Dutch oven.

The next morning, Katie Cassidy of Phoenix took her first laugh-a-minute ride with Dorothy Riddle piloting a rubber kayak. Dipping her paddle into the river, and occasionally whirling the boat sideways, Cassidy said, "I feel like a kid again."

The two-day $230 adventure was over by 5 p.m. Sunday, when we lifted the boats out just beyond the clear, bubbly waters of Bonita Creek near Safford.

The Riddle youth, who splashed up the cool creek waters in his bare feet, said what everyone else was thinking: "I don't want it to be over with."



Rafters and kayakers relax along a stretch of serene water and enjoy some of the plentiful scenery along the Gila River in southeastern Arizona.

Suzanne Starr/The Arizona Republic

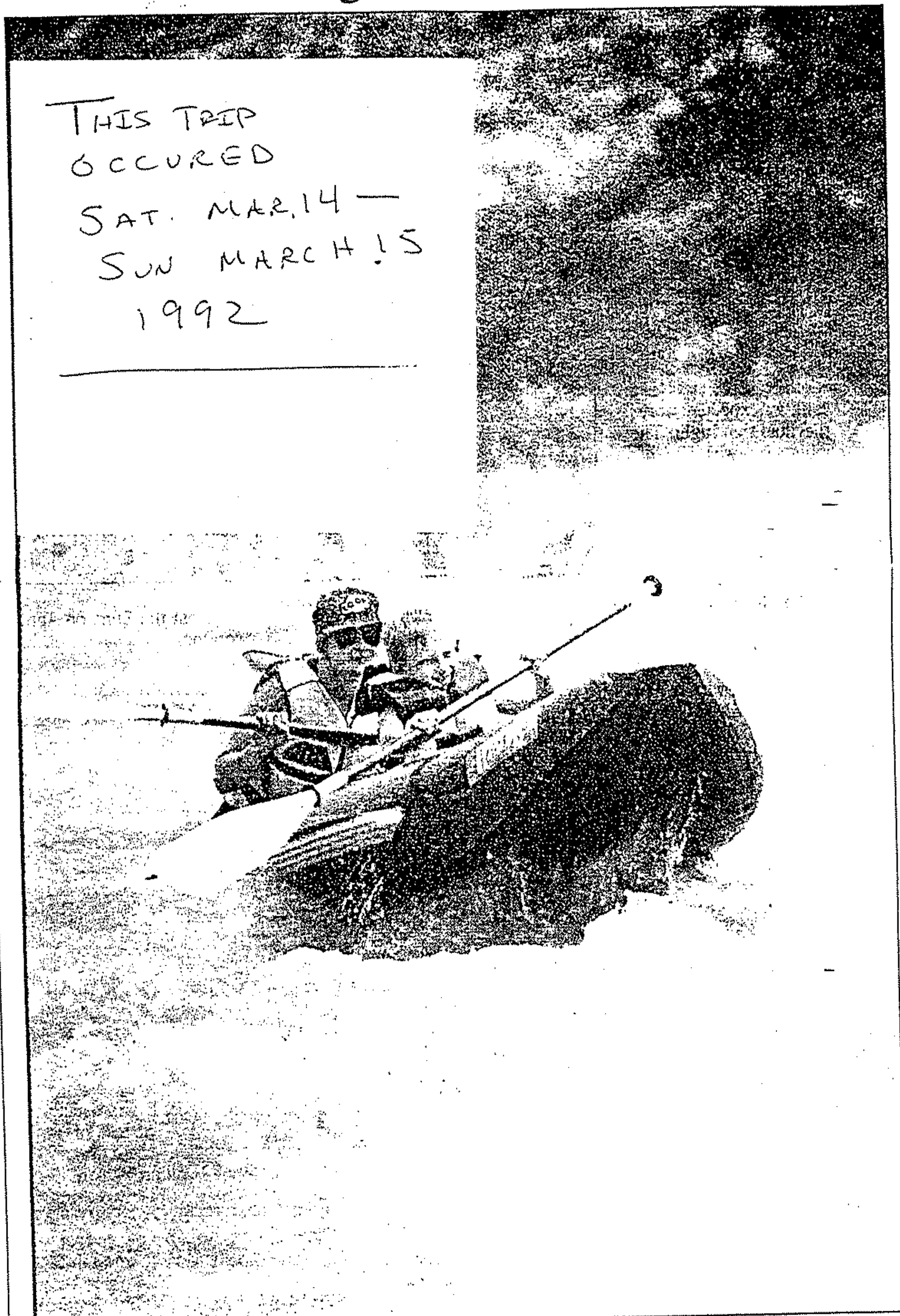
America³ bests Stars & Stripes

The Associated Press

APRIL 23, 1992 AZ. REPUBLIC SPORTS SECTION

Wild ride through wilderness

THIS TRIP OCCURED SAT. MAR. 14 — SUN MARCH 15 1992



Suzanne Starr/The Arizona Republic

River runners in a two-man kayak paddle and bob along the brown waters of the "seldom-visited wilderness" along the Gila River, which rafting companies have begun to explore in recent years. Story, E6.

Swift as can be.

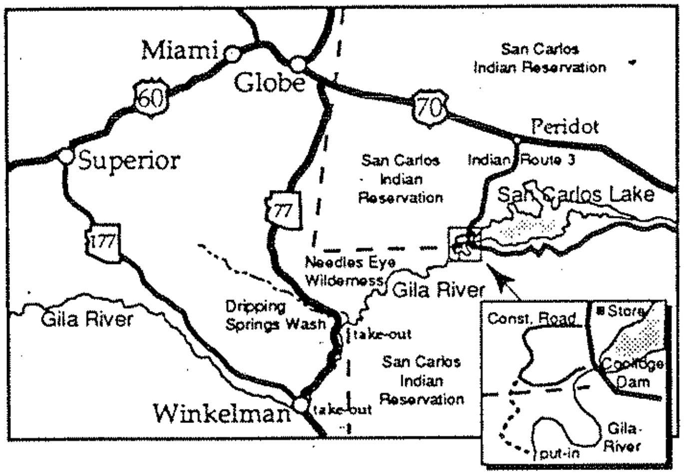
96-003-002

Gila River
02

Desert Waves

CENTRAL ARIZONA PADDLERS CLUB

Volume 7, Issue 2



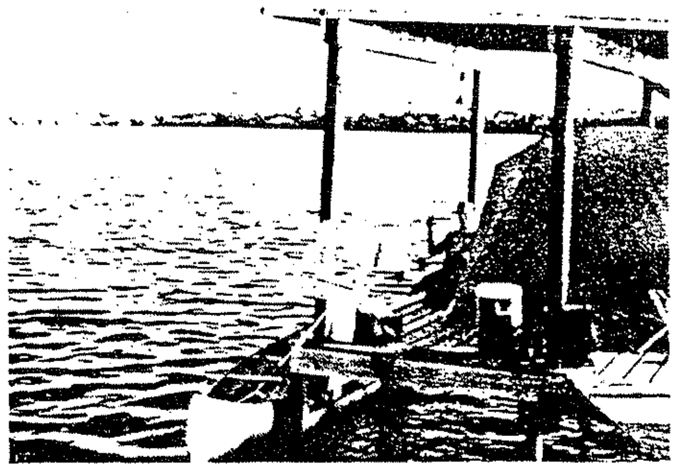
Shuttle map for the Gila River Trip below Coolidge Dam.
Map by Jim McComb and Jack Carlson

The Needles Eye Wilderness
Gila River below Coolidge Dam
by Jim McComb

Below San Carlos Lake, the controlled flow of the Gila River passes through the recently designated Needles Eye Wilderness. To the south, the river serves as a boundary between the Wilderness and the San Carlos Indian Reservation. The north bank is BLM land extending in a pie-slice shaped area roughly 16 miles long with the pointed end at Coolidge Dam and the broad end toward Highway 77 near Dripping Springs Wash. The river prior to the flood of 1993 was choked with trees and brush, frequently obstructing the river channel, and at high water flows (over 500 cfs) was a real threat to life.

I first made the run in 1982 and after wrapping two canoes, swore I'd never go back. However, with the flood and rumor that the trees had all been flushed out, I went back the weekend of February 19, 1994 for a three day trip at low water (150 cfs). We took Highway 60

see Gila, page 5



Typical "chickee" campsite in the Everglades National Park.
Photograph by Dave Ela

A Meander Through Florida's Wilderness Waterway by Sea Kayak
by Tom and Irma Suplee

The *Wilderness Waterway* is a well marked 100 mile course through the 10,000 island segment of Everglades National Park. It is necessary to preselect and reserve campsites and the choices made will do much to determine the pace of your float. I do suspect that night paddling in this featureless maze would be memorable, so it is best to avoid long days that could result in nighttime paddling.

Paddling is flatwater with both current and depths tidally determined. Part of the first and second day were in periodic company of a couple from Cincinnati in a 20' Old Town Tripper XL and an older couple from Orlando in a Phil Bolger designed Gloucester Light Pulling Dory equipped with spritsail. Both considered tidal direction and current a significant planning factor in some of the rivers. Our big sea kayak was not appreciably affected. Generally the inland route is characterized by large open lake-like bays joined by rivers or narrow creeks. The water

see Florida, page 7

Inside this issue...

MARK YOUR CALENDAR!
Next Meeting
Tuesday April 5, 1994
Squaw Peak Park, 7:00 PM
Mohave Ramada   bring a log for the fire

Safety, continued from page 4

7. When a person is pinned in a head-up, stable position, his condition will probably not deteriorate before rescue begins, so take a little extra time and care to *set up a well planned and equipped rescue*. Obtain optimum manpower and make back up plans in case your first rescue attempt fails.

8. *Good communication* is essential between people in the rescue party, and between the victim and rescuers. After the rescue is complete good communication continues to be important so that others don't get into trouble trying a rescue after it is already completed (which may not be obvious from all positions on the river). Take a few extra seconds to communicate the rescue plans to everyone involved, instead of haphazardly going about a rescue.

Good communication is essential

---

9. Paddlers should *wear proper cold water protection*. Many rescues of pinned paddlers have failed due to improper clothing and hypothermia.

10. When swimming in Class V water, the *swimmer should try to eddy out* or get on a rock as soon as possible and not try to swim the rapid.

11. On dam controlled rivers, remember that a possible rescue alternative is to *have the water shut off* at the dam. ♦

Gila, continued from page 1

from Phoenix to Globe, then followed Highway 70 east to Route 3. Coolidge Dam is thirteen miles south on Route 3.

Things have dramatically changed in ten years. There is major construction work at Coolidge Dam and the old road has been destroyed. The access to the river is now on the new "expressway" for construction vehicles that leaves Indian Route 3 to the right a mile before reaching Coolidge Dam. After two miles of smooth dirt road, the fun begins as the construction road is blocked by a locked gate. A newly bladed soon-to-be four wheel drive trail goes right at the gate. As near as I can tell, this road was put in for mining purposes and marks the eastern boundary of the wilderness. We left the reservation approximately one mile before reaching the river. The hillside to the east has been bulldozed and stripped for whatever minerals that might be there. Although the road is currently in pretty good shape and passable in a two wheel drive vehicle with good clearance, there are some steep grades and several wash crossings. I expect that with a little wet weather it will become strictly a four wheel drive road.

Mescal Creek offers great hiking up to a warm spring

The current put-in is about four miles downstream of Coolidge Dam and is totally off the reservation, so no camping permit is required. However, it is suggested that you purchase *Access Permits* for $5.00 to cross the reservation land to the river.

Indeed, the flood has removed much of the choking streamside vegetation, but the river still has substantial logs and strainers. Anyone trying this run at the usual summer time flow of 1000 cfs had better be prepared for a challenge. At low water with my ten year old son paddling bow, we had no problems. The Gila passes through two dramatic box canyons in the wilderness with cliffs rising 2,000 feet. The climax is *The Needles Eye* where the cliffs are barely 50 feet apart, rising to over 4,000 foot peaks while the river squeezes through a maze of automobile size boulders. Fortunately, what tree limbs and stumps remain do not obstruct the obvious path through the rocks.

The second box is less dramatic, but is punctuated by a series of clear-water springs and creeks that come out of the mountainside on river right. Mescal Creek offers great hiking up to a warm spring, and although the area is marred by the presence of a power line and old four wheel drive trails, it is still beautiful.

The only significant rapid occurs at Dick Springs Canyon located in the first box about 3.5 miles into the trip. It is easily lined river left. For those who are more macho than I with a loaded canoe, run it if you will, but watch out for the wrap rock dead center, bottom of the chute. There are concrete supports and debris from an old bridge about three-fourths mile downstream from the put-in, but these hazards are easily avoided compared to the strainers that still exist.

The final four miles of river is a bit of a drag as the riverbed wanders and the current slows. The dramatic cliffs of the box canyon give way to the rolling flats of desert cattle country. However, even at low water, we made good time (two miles per hour) and did not have to walk or portage the boat.

see Gila, page 6

Announcement

by Diane Basile

I'm Expecting a Delivery.
Is it a boy?
Is it a girl?

It's a Boat!

Type:	AIRE Cataraft
Name:	Ocelot
Length:	16 feet
Weight:	68 Lbs.
Color:	Yellow

WhiteWater Rescue Clinic for CAPC Members
Instruction by: Bill Bishop and Mark Trainor

Lecture: Tuesday March 29th, 1994
Time: 7:00pm to 10:00pm
Location: Desert Mountain Sports, 2824 E. Indian School

River Clinic: Weekend of April 16 and 17
Location: Upper Salt River Canyon (Rafters Put-in)
Clinic time: 9:00am to 11:30am • Skill Session
Noon to late afternoon • Paddle the River
$10 donation suggested - Proceeds to American Rivers
Mark Trainor (602) 827-0713

Paddler's Profile: Dave Ela

by Paul Strominger

CAPC president Dave Ela's roots in boating go way back. In 1840 his great-great-great-great grandfather, John Bradbury Follett, built the first steamboat in Texas and launched it on the Brazos River. Dave and Larry Wild, 145 years later, became the first in recorded history to paddle the entire 687 miles of the Brazos within the state of Texas.

Dave was born in 1949 in Houston, Texas. His family moved to Massachusetts in 1954, and Dave had his first exposure to canoes during family vacations to Maine. After moving back to Texas in the early 1980s, he decided to get into paddling more seriously. Dave tells me that this occurred after he saw some sharp boaters while tubing on the Guadalupe River in Texas.

At first he would go out for three or four days on the San Marcos or Brazos rivers with his dog, paddling solo in a tandem canoe. He learned paddling techniques by reading books and watching other boaters. In the early 1980s he became involved with paddling clubs in Houston. This renewed interest in paddling and the outdoors led him to take training in whitewater kayaking, river rescue, outdoor leadership and attend a solo paddling symposium.

In 1984 Dave began supplementing his carpenter's income by guiding for a commercial outfitter in Texas, Brazos Outdoor World. He took groups to the Everglades Wilderness Waterway, the Upper and Lower canyons of the Rio Grande, Big Thicket National Wildlife Preserve and other Texas rivers. Unfortunately this business dried up after the Texas economy crashed in 1987.

In 1986 Dave was a member of the Texas Official Sesquicentennial Rio Grande Expedition, a thousand mile trip from Presidio to the Gulf of Mexico. In 1988 Dave moved to Boston and began paddling with and serving on the Safety and Rescue Committee of the Canoe Committee of the Boston Chapter of the Appalachian Mountain Club.

Dave has paddled whitewater and wilderness touring on rivers in the Southwest, Colorado, Arkansas and New England. His knowledge of paddling includes whitewater canoeing and kayaking, freestyle canoeing, wilderness cruising and racing techniques.

As a canoeist myself, I asked Dave about freestyle canoeing. He described it as the achievement of maneuvers that could get you wet on flatwater, such as leaning the canoe over to take in a teacup full of water and not more. Filling the canoe entirely would also be a valid freestyle move. The style incorporates control of leans with dynamic paddle strokes. Dave promised to show me the *Hanging Bow Draw* the next time we meet on the river.

Dave's other outdoor interests include hiking, mountaineering, cross-country skiing, winter camping, orienteering, food preparation for groups and rock climbing.

As president of CAPC, Dave would like to encourage paddlers to volunteer to help with the work of the committees and to act as mentors for new boaters. ♦

If you have suggestions for other *Paddler's Profile* candidates, call Paul Strominger. ♦

Gila, continued from page 5

The traditional take-out at Reese Ranch (Dripping Springs Wash) has suffered major flood damage. Although I was able to negotiate the running creek bed to the river with four wheel drive, it is probably best to paddle down another mile or two until you reach the river access road off Highway 77, or you can continue down river along the route of the Gila River Race to Winkleman.

This is a very beautiful weekend trip (15 miles of river) with a long 65 mile shuttle. I would strongly urge that only experienced paddlers attempt it. The canyon is very remote and the number of strainers make it more dangerous than most rivers. At low water it is much safer. At summer flows I am uncertain how *pushy* the water will become in tight areas. Since the river is dam-controlled, accurate flow information is available from Doug Mason, watermaster at Coolidge Dam. The telephone number is (602) 723-5408. ♦

Conservation, from page 3

Aircraft Noise at the Grand Canyon. Principal CAPC contact is Bob Marley.

There were meetings in Flagstaff involving the National Park Service, the FAA and representatives of certain groups on March 14-16 to discuss this issue. When this article was written, we hadn't heard anything on the outcome. More later.

Wild and Scenic Rivers Bill for Arizona. Principal CAPC contact is Dave Huizingh.

The latest information we have is that the introduction of a bill in congress may be delayed, possibly even until next year. As the most likely sponsors are the Democratic members of Arizona's delegation in the House (especially Rep. Karen English of Flagstaff), it's more important than ever to call or write them (Representatives English, Coppersmith, and Pastor) to express your support for the introduction of such a bill to protect Arizona's rivers, streams, and wetlands. ♦

Streambeds

96-003-002

Gila River
63

Desert Waves

CENTRAL ARIZONA PADDLERS CLUB

Volume 6, Issue 3

Two Trips in One

By Douglas Rhodes

In March several of us set out to run the Gila Box and the San Francisco River, a tributary of the Gila River. Either can be run separately but due to the drive time we chose to combine them. Although they have a short season, these multi-day, mild whitewater runs remain well kept gems among rivers in Arizona and New Mexico.

The San Francisco run starts at the hot springs below Pleasonton and can end in Clifton. Continuing on, it merges with the Gila and ends near Safford. The San Francisco river has nary a straight spot in it as it drops from pine country, winding through a narrow canyon in rugged, remote country. Choosing a raft is no problem as fourteen footers, small catarafts, inflatables and even canoes are acceptable (experience necessary). The major hazards are downed trees which may stretch from bank to bank. Remember, the weather necessitates dressing for cold and possible rain. Last year we scraped the frost off the boats at the hotsprings before putting in. Round trip shuttle time to Clifton: 3 hours over paved roads. Don't go unless you want a 54 mile river run to yourself with unmatched wilderness beauty (don't tell California boaters about this one!).

The Gila River can be run as an extension of the San Francisco or you can put in at the US 666 bridge. The shuttle time here is again 3 hours round trip, but this 24 mile run is worth it. Boating is easier as the river is wider and straighter with Class II rapids, with larger boats being acceptable. The canyon is wider yet remote with the same impressive scenery. The elevation is lower and high desert wildlife abounds. Don't take this area for granted as off road vehicle enthusiasts want to make it a run for dune buggies at low water. Contact Dorothy Riddle to see how you can help save this rare riparian habitat.

So, if you're looking for something new, give these wilderness rivers a try in the early spring.

MARK YOUR CALENDAR!
Next Meeting
September 9, 1993
Pyle Adult Center, 7:00 PM

A once majestic cottonwood shows passing boaters the tremendous power of water.

Gila River Classic Scheduled for September 19th

Winkelman, Arizona will remember the devastating flood of 1993, the town was changed forever, but the race goes on. The Gila River Classic, is a four-mile, point-to-point, down river scramble against the clock. The flood could only delay the race, but what it left is a far better river for this year's event.

Conditions are ideal to make this event even better than last year's first Gila River Classic which attracted over 75 racers, had prizes and gifts from over 10 sponsors, and raised money for the Winkelman Town Council. The Gila River Classic, a race for boats of all categories, is aimed at getting boaters back on the water in the off season while introducing river racing to this area of the country. Ensured of a good release from the reservoir, the Gila River will have excellent swift water. "The flood really cleared out the river, making it perfect for our race," said Gene Poston, race sponsor and spokesman for Whole Earth Adventures, "The river's wider, faster and free of strainers; it's completely different."

Pre-registration is requested (but not mandatory) to ensure a class for all boaters. Prizes will be awarded for all classes of three or more boaters. Classes will be combined on the day of the race if necessary. Registration will close at 11:00 a.m. on the day of the race with the race starting at Noon. The race is $10.00 if preregistered by Friday, September 10. Registration the day of the race is $15.00. Volunteers are needed to help conduct this event. If you are interested in preregistering, volunteering, or want more information, call Brian Smiley at 598-0017 or Dan Behm and Julie Meeker at 966-2240.

WHOLE EARTH ADVENTURES

CIMARRON RIVER COMPANY

2nd Annual GILA RIVER CLASSIC

All boaters or floaters welcome at the Gila River Classic!

Winkelman, AZ. - Sunday, September 19, 1993. Racers of all kinds will converge on the new and improved Gila River for the 2nd Annual GILA RIVER CLASSIC, a swift water race for kayaks, canoes and inflatables. With pre-registration, race organizers will add additional categories based on enrollment. Prizes will be provided in every category with three or more competitors. Last year prizes from our sponsors included plaques, boating gear, hats, shirts, CD's's, books, gift certificates and much more. To pre-register, call (602)598-0017 on or before September 12.

The entry fee is $10.00 for all boaters pre-registered by September 12th, or $15.00 on the day of the race. We encourage all boaters to pre-register to ensure prize coverage for all categories.

Race day registration will end at 11 am with the race starting promptly at noon. Registration and check-in will be just south of Winkelman Center where the Route 77 bridge crosses the Gila River. There will be signs clearly directing you to the check-in and finish line area.

Winkelman is just under two hours from Phoenix, approximately 30 miles south of Superior, AZ. on Route 177. Winkelman is about an hour and a half from Tucson, 70 miles north on Route 77.

DESERT MOUNTAIN SPORTS

Central Arizona Paddlers Club

Pre-registration & Race Information call: (602)598-0017

96-003-002

Gila River

04

arizona

THE ARIZONA REPUBLIC

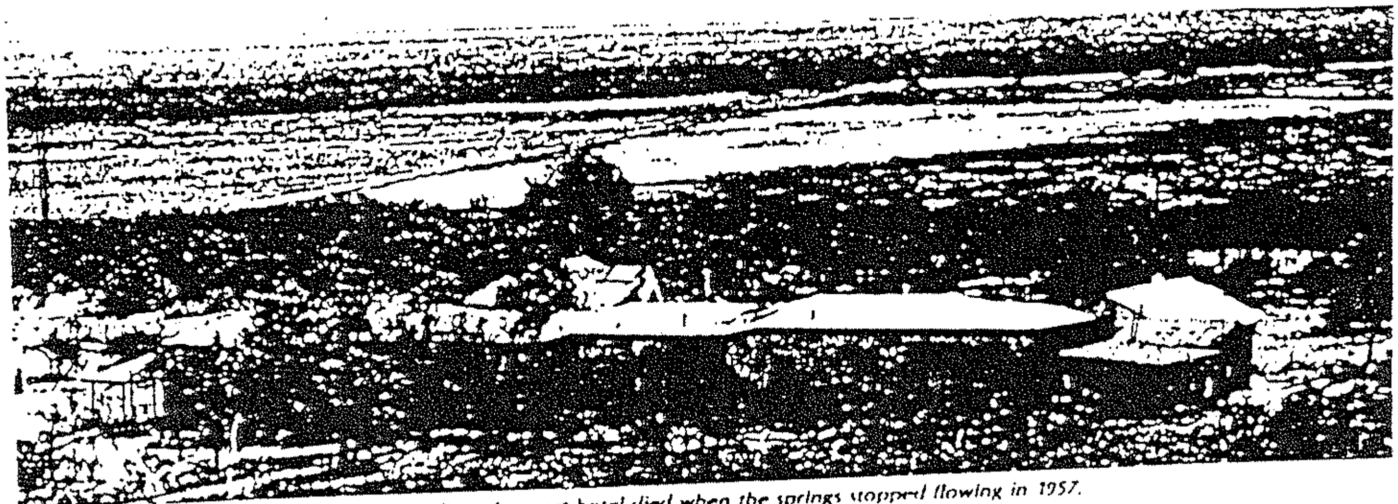
JULY 10, 1977 ■ SUNDAY

Chris Evert

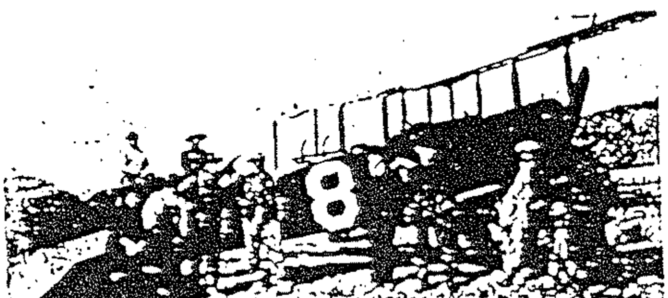
and the summer Racquets

AGUA CALIENTE ISN'T A HOT SPOT

'Let's face it, General Patton ain't around building any more swimming pools and Teddy Roosevelt isn't sleeping at any more places'



Agua Caliente's resort hotel died when the springs stopped flowing in 1957.



Lote Conde, now 67, said his father took this picture in the early 1920s. Conde is second from left, front.

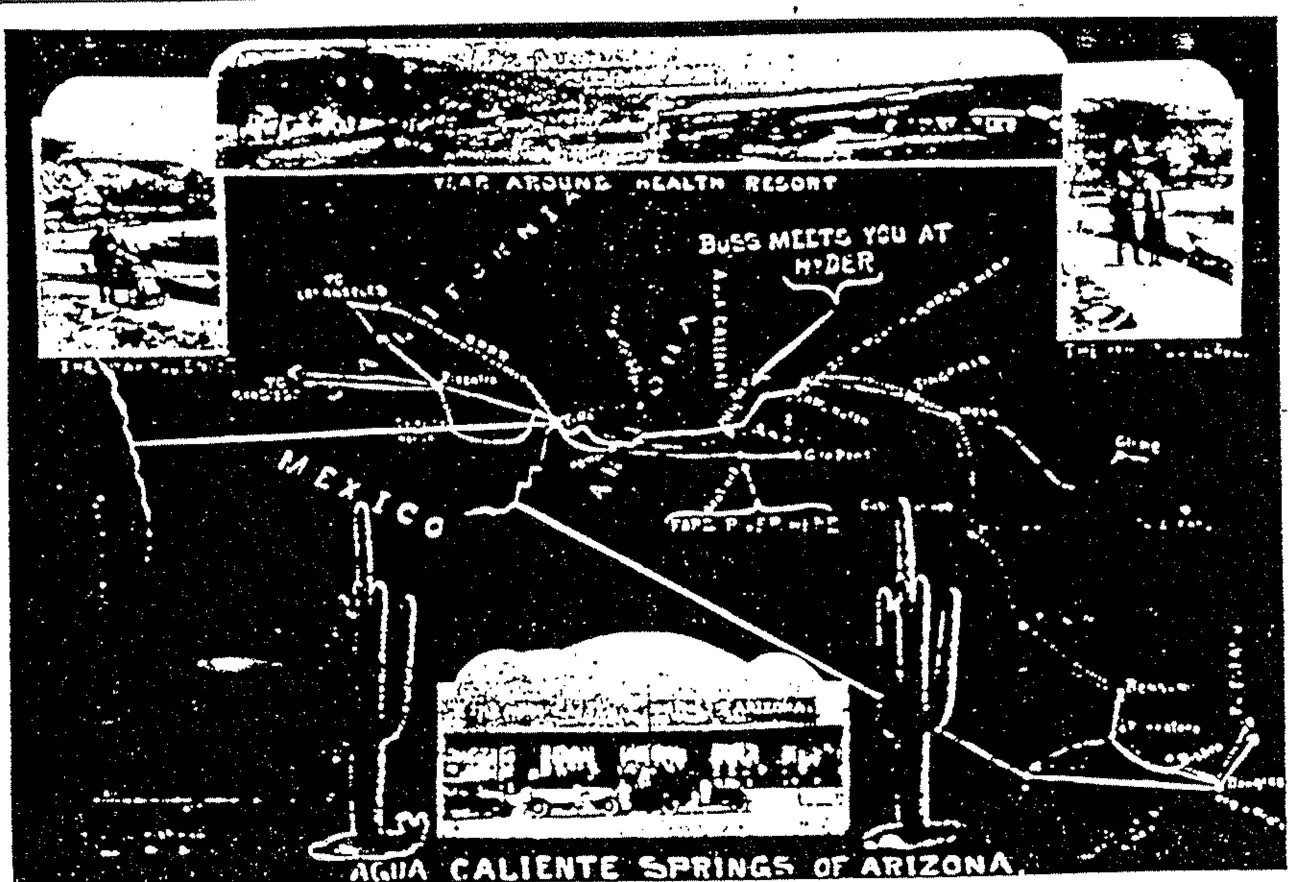
In its heyday the hotel and hot springs attracted s notables as Teddy Roosevelt.

There aren't any signs around Agua Caliente announcing, "Teddy Roosevelt Slept Here." He did. But Slim Nordahl doesn't care. He sleeps there pretty often, in an old bunk bed about two inches higher than the tops of his boots, and he eats things out of cans and listens to the floor rot. He's being paid by a couple of Phoenix lawyers to run a bulldozer, clearing land for agriculture.

The area where the hotel was built at the turn of the century is desolate. Dust blows in sheets where there isn't any irrigation. Water comes out of the ground from shallow wells and sometimes is hot, sometimes medium, sometimes cold. It depends on where the hole is drilled. At the turnoff to the hotel, on a paved county road twelve miles north of Sentinel, a sign reads, "Do not cross when flooded."

On the back of it somebody handwritten, "Paradise, God." It c be a last statement from somet crossing the Gila during a flood.

The hotel was built at the site natural hot spring that used to b out of the ground at 118 degrees cure things doctors are still just ing at. The Modesti family pione development of the area after left Corsica during the Napo by Dan Lee



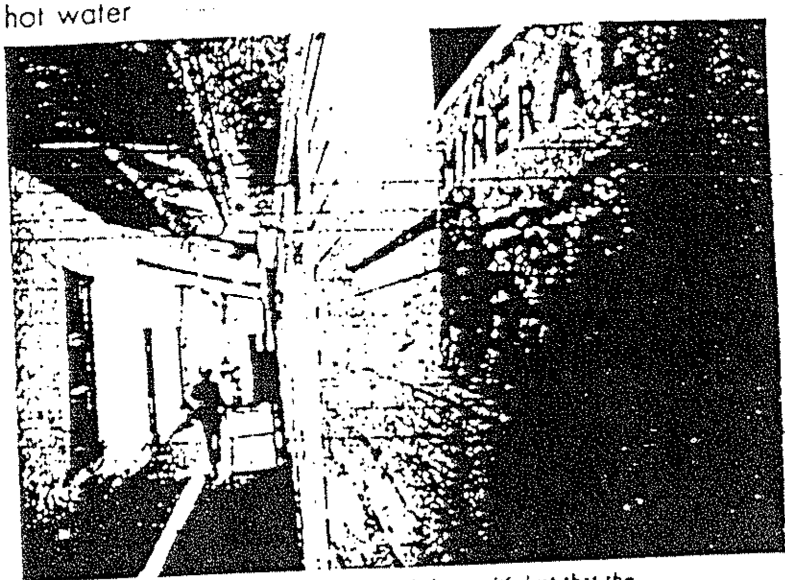
Advertisements for Agua Caliente stressed the curative qualities of the natural hot springs.

Wars. The men didn't want to be drafted. Two attorneys, John and Colt Hughes, acquired the hotel and large chunks of surrounding agricultural land a few years ago.

The Hughes brothers hired a Buckeye farmer, Kenneth Beloat, to oversee their holdings. He lives in a mobile home across from the hotel, with a CB radio, a pickup truck and three dogs. He starts making sun tea as soon as the weather gets warm and he and his friends who drop by drink it out of quart-size glasses.

"There's a fault runs through here and traps the water," Beloat said. "We've got eight hundred acres here we're going to farm. The first well we drilled pumped seven thousand gallons a minute, and the water was so hot we had to drill another one and mix the water before we could irrigate with it."

Beloat had been at Agua Caliente only a month, and was still being filled in on its history by locals. "I understand General (George) Patton built the pool," he said. "He trained troops here to fight (German field marshal) Rommel. The guys who were screwoffs had to haul rocks off the hot water



The mineral baths are still there—it's just that the minerals aren't suspended in water anymore.

'they took a boat across the river to ferry the passengers'

mountain one by one to build the pool.

"You see our sprinkler running out there? We're trying to get this place back to life. Our oleanders came back. We were watering to keep the dust down, and things just started popping up. The palm trees are just sucking up water. They were all dead, or they looked like they were."

Jim and Judy Lake were staying with Beloat for a few days. They are photographers who live on the road, staying wherever they have decided to work. Lake said he thinks the hotel will be fixed up by somebody. "Let's face it," he said, "General Patton ain't around building any more swimming pools and Teddy Roosevelt isn't sleeping at any more places. He found his last one."

The hotel began taking ghosts for tenants in the middle 1950s when the hot springs began to give out. Farmers were moving in and cultivating the area surrounding Agua Caliente, and at least one of them drilled into the stratum that contained the water feeding the springs. In 1956 Phinoclad Modesti advertised nine hot mineral baths, room and board for seven dollars per day per person. The following season the baths went dry, according to Lote Conde, who lives just over the hill from the hotel.

Conde came to Agua Caliente in 1910, and because he was only six months old, was accompanied by his parents. "Old man Modesti was running it, and they had a big grocery store and all," he said. "All the passengers came from Sentinel in those days. Every day they took a boat across the river to ferry across the passengers and the freight. My dad was a farmer here, and I washed dishes and worked in the engine

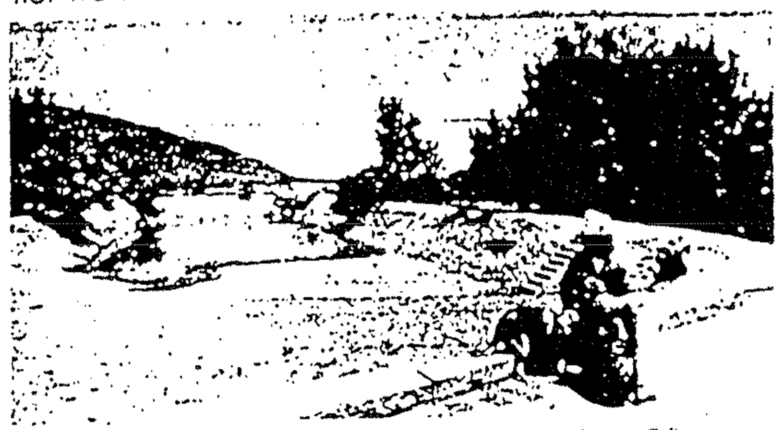
Conde has several head of cattle in his yard.

room at the resort when I was in grade school."

The Gila was a flowing stream then. It hadn't been dammed.

Conde said people came to the resort from Phoenix on a road which followed the north bank of the Gila. the springs were a stopping point on the Yuma to Tucson stage route in the 1870s, before there was construction at the site.

In its best days the resort featured twelve springs with bath houses on them, Conde said. "Each had a big spring bubbling inside, and a table with a heavy blanket so you could sweat like hell," he said. "If you had rheumatism you had to take twenty-one baths before it did you any good. But some would come in wheelchairs,



Kenneth Beloat is now the only permanent resident of Agua Caliente.

'The gamblers here played everything— cards, dice, faro'

stay six months, and walk away. People from back east, from San Diego, everywhere, rich and poor people came there."

He said the railroad went through Hyder in 1926, so that Agua Caliente was only three miles, instead of twelve miles, from a train station. That also meant people didn't have to ford the river to get to the resort. Conde's wife, Delores, said she worked as a waitress and chambermaid at the resort for a dollar a day plus tips. One of the hotel guests she remembers was Arizona's first governor, George W. P. Hunt.

A 1972 newspaper article quoted Jim O'Neal, who came to the area in the 1920s. "It cost nine dollars a week for your bedding, food and firewood," he said. "Mexicans delivered the wood to you every day.

"If you soaked your legs in the hot mud for twenty-one days straight, it cured you. That mud healed me. They dug out little baths and ran hot water to them. You could sit there all day and night if you wanted to. Some people did, but I never did.

"The gamblers here played everything — cards, dice, faro, anything you could think of. It was big business."

Joe "Pee Wee" Amavisca, a rancher, remembers going to Agua Caliente for hot baths when he was a boy. "It used to be like a regular metropolitan area," he said. "It was real green, and there were ducks on the lake. It was beautiful.

"My dad used to Indian farm around there. He'd scratch with an old Ford tractor, use the water from the river, and he'd grow watermelon and squash and everything. That's how the people used to live in this area. They'd barter back and forth depending on what one raised and what he needed.

"I think they could do something with it. It won't be the same as it was when the springs used to come up natural, but the water's there, the same water. Ken tells me the lawyers are thinking about drilling and pulling out water into a basin or something where people can swim or whatever."

Beloat said there is a well close enough to the old swimming pool to bring water to it for a nominal cost, but he said the pool needs a lot of work. "I think a nice fiberglass one set on the inside would be nice," he said.

"I was talking to an old well driller the other day, and he said, 'Well, we could make the springs run again, but it would take about six or eight days of drilling with a rock drill and about a truckload of powder to blow it. But we could blow the old springs back open, blow a hole down to the water where it'd come bubbling out of the ground again.'"

He said the water is so close to the ground in the area that getting water is no problem. But renovating the hotel and making it look good would be a detailed and expensive project. And water pumped to the surface doesn't have the same appeal as natural hot springs. □

in next week's

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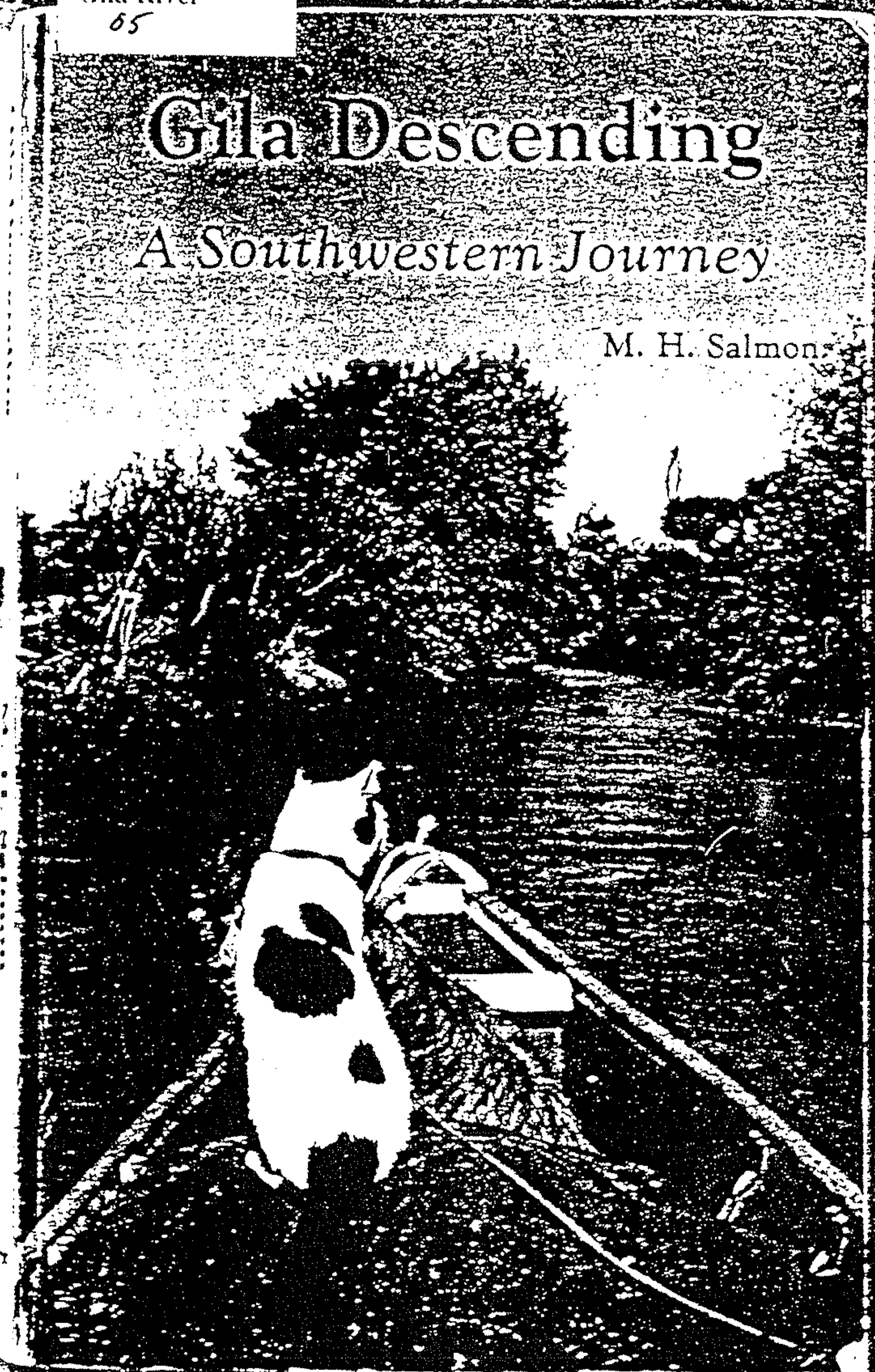
THE FUTURE IS US

an interview with Robert Theobald

by Assistant Editor James E. Cook


Gila Descending
A Southwestern Journey
M. H. Salmon

GILA DESCENDING

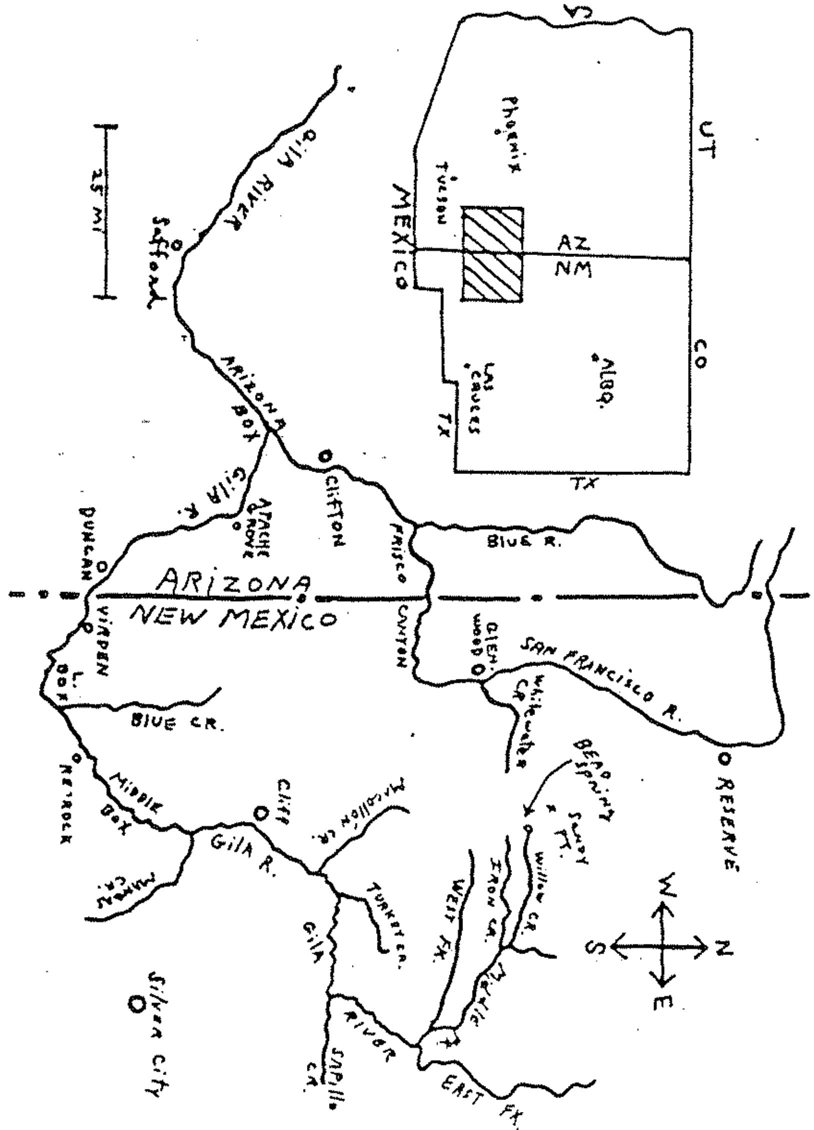
A Southwestern Journey

M. H. Salmon

Illustrations by Fred Barraza

High-Lonesome Books
Black Range Station
San Lorenzo, New Mexico 88057

Printed by
The Print Shop
Silver City, New Mexico



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opposition to such legislation comes from legislators and governors who inhabit the southwestern border states where these "illegals" are supposedly such a problem. The essential problem, of course, is that Mexico has overpopulated its range, which is, for the most part, a desert. Deserts were not designed by nature to hold an abundance of people; unless we wise up to that fact, on both sides of the border, we're all in trouble. Those boys in Washington ought to spend some time in the Southwest. And they ought to lighten up!

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Running water of any sort being on the order of a rare gem in the Southwest, what there is tends to be of great interest to those who would either commercialize it, keep it inviolate, or use it for recreation. Those rare, pristine gems like the Gila (I was now within twenty-five miles of the end of the natural Gila) which have neither been greatly commercialized nor overused for recreation, necessarily stand out as the region's most precious treasures. With mixed emotions—not wishing to inadvertently promote either commercialization or overuse—a canoeist herein reveals another river (stream really) within the region which stands out with a similar appeal.

The San Francisco River forms in the White Mountains of Arizona and heads directly for the nearby New Mexico line. They've got it plugged up right at the border, forming a pond called Luna Lake, but a trickle of it carries on, picking up a rill or two coming off Escudilla Mountain and a few others, like Centerfire Creek, over in New Mexico before it runs through the town of Reserve. From there it streams on into the Gila National Forest once again, picking up Tularosa Creek, Negrito Creek, then a good stream, Whitewater Creek (remember that?) at Glenwood, below which it turns back west towards Arizona. From there, for about thirty miles (about fifteen miles on either side of the border) the "Frisco" runs through as lovely a riparian canyon as you'll find in the Southwest. Nice enough that a portion is under consideration for protection under the Wilderness Act. Needless to say, there are those who would do other things with it besides leave it alone.

The battle over the Frisco Canyon is a classic example of easy access versus wilderness style recreation. Although there is no road per se in the Canyon a well-equipped off-road vehicle can, during much of the year, make a fifty mile run all the way from the Frisco Hot Springs, where the canyon begins, to Clifton, Arizona. During the 1960's ORV use in the canyon began to increase markedly. A diverse group of conservationists began to lobby the Forest Service to exclude vehicles and to consider some kind of wilderness designation for the canyon. Several ORV groups, in particular the Las Cruces Jeep Club, lobbied in kind for their right to use the canyon as a road. Through it all the Gila National Forest, managers of the region, has consistently sided with the ORV users—"Off-road vehicle use in the San Francisco River bottom is not at present presenting unacceptable

resource loss," has been the standard forest service response to the conservationists right up into the 1980's.

On two occasions the Forest Service has commissioned outside researchers to inventory the ecology of the canyon, including assessments of ORV damage to riparian habitat. In 1973 Dr. John Hubbard, endangered species director, New Mexico Department of Game & Fish, and Dr. Bruce Hayward, Western New Mexico University, studied the canyon and filed a report. In 1982, Steve Carothers of the Museum of Northern Arizona did the same. Both reports noted significant damage to riparian vegetation from ORV use and, contrary to the forest service belief that high water each spring wipes out the tire tracks, demonstrated that ruts from ORV's lead to channel cutting during high water which exacerbates the erosion originally begun by the vehicles.

Hubbard in particular is adamant about the value of the Frisco Canyon as a wilderness riparian area.

"I don't know why the Forest Service remains so stubborn on this issue," Hubbard told the *Albuquerque Journal*. "The damage caused there (Frisco Canyon) by ORV's has been documented, but the Forest Service refuses to recognize their own research. This is really a crucial issue. I know of no riparian area in the Southwest that compares to the Frisco Canyon in opportunities for wilderness and solitude."

In the 1970's during RARE II (roadless area review), the Frisco Canyon became a wilderness study area (WSA); however, vehicular use was still allowed. The obvious inconsistency here—how can you study an area as a wilderness without treating it like a wilderness?—escaped the Forest Service. Now, in the 1980's, the Forest Service plans to drop the area as a WSA, thereby solidifying ORV use there for future generations. Of course confirmed wilderness lovers like me will always push for a wilderness designation, wherever we can get it. Knowing we often don't get what we want, it makes sense for conservationists in the Southwest to focus their attentions on the riparian areas. For running water, when undisturbed, provides an ecosystem, a life zone, all its own, a riparian swath of cottonwood, sycamore, Emory Oak, walnut, hackberry and dozens of other streamside plants that can nourish over the length of one stream everything from *Canadian* zone forests down through *Sonoran* desert. It is in the desert regions—as along the Frisco Canyon, or the Gila where I traveled—that the narrow winding trail of the riparian zone shows its best effect, forming a continuous, tenuous oasis that trails through an otherwise arid land and multiplies species of plants, birds, fish and mammals along its route. And so in the Frisco Canyon and elsewhere the battle goes on...

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After picking up the waters of the Blue River and passing through the town of Clifton, the Frisco once again begins a circuitous route through canyonlands. Shortly, it merges with the Gila. With the Gila narrowing

up once more—great rock walls again surrounding us—I approached with great anticipation the confluence of the two rivers within the Gila/Arizona Box.

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Were I to ever (and someday I might) set up a semi-permanent camp for a stay of a year or two, it would be at the confluence of the Gila and San Francisco Rivers. Either there or up above, where Sapillo Creek joins the Gila. Either location would be secluded, scenic and largely self-sustaining for an enterprising outdoors person. Either would be classic Southwest. All within the context of a most pleasant change of seasons. When, standing in the canoe, I looked over the last little spit of land that formed the final separation between the two rivers, saw the green Frisco about to make its juncture with the more silted Gila, that's what I wanted to do...stay...for a year or two.

The campsite provided was precisely as I would have it if I were a creator of natural campsites. There was a small sandy beach on the Gila side where I beached the canoe. This little triangle of sand was backed by a one hundred foot rock wall, and fronting the Frisco was a rock ledge maybe three feet high that overlooked deep, swift water. I could set out sundry odds and ends there like I was using a shelf, and the water below looked prime for fish. It was mid-afternoon and very hot but brush and trees growing out of the base of the bluff gave us the shade we needed.

The crew promptly found the shade. I waded in knee deep, filled my hat with water and put it directly back on my head. I stood around in my little place in the sun for awhile then side-walled the bluff, making my way up the Frisco to where the bluff ended and a shoreline opened up. I meandered upstream in the rock canyon of the San Francisco River. Then wandered on back. Besides cottonwoods and other riparian growth, there were ocotillo cactus and mesquite of the *Lower Sonoran* life zone. At the junction of the Gila and San Francisco Rivers, I thought that perhaps I was at the true heart of the Southwest. And then I saw the desert flower...

A cactus flower of the Claret group, growing incongruously out of a seam in rock and so scarlet it marked your eyes. It caught me. No domestic flower, not a tulip nor a pansy nor a greenhouse rose, can equal the tone, tint or flush of color provided by any number of flowers that grow in the desert. This can be seen to be true by any disinterested eye; it is made the more so by the fact that the desert flower blossoms amid such starkness. The brightness then, can provide a bit of a shock, and for me an unsettling memory...

Desert flowers are not to be picked—rare gems not to be disturbed—but I'll confess that I picked one once, right by the house, by way of a presentation, an offering, in an attempt to truncate the route of a woman headed ineluctably into her next phase. It was that day when that which you had believed would last forever, is ended. A desert flower did not impress. Shared concerns, mutual respect, and unspeakable intimacies quite forsaken, she walked out the door with a look on her face that would flush a covey of quail. Tough. Tougher than me. Tougher than I would ever want to be. My desert flower along the San Francisco River was beautiful but reminiscent. I left it alone. It will be some time before I shall risk such as that again.

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It was the night when the moon would fill its form entirely. I knew it wouldn't show for a while in that steep walled canyon and I knew the fishing would be better before it did, for big cats are more active during the dark of the moon. In the gathering dusk I was late making any supper. I wasn't hungry. I had a pole line in the water on the Frisco side. I had been unable to gather any suitable live bait, had to make do with beef liver. If I couldn't catch a big cat here I wasn't going to catch one this trip. I wasn't optimistic.

Signs of life, my pole line began to drift off *upstream*, and I set the hook. It took a good five minutes with the fish working the current to his advantage and my wrists and forearms could feel it by the time I landed the best fish of the trip so far by honest angling—a twenty inch Channel Cat. He was well tapered and slick with a fine, dark green back easing into a white belly and black speckle-spots on the side. I rebaited the hook with an outsize chunk of liver, propped the rod into solid security and commenced to clean my fish. It didn't take long and he was crisping in the fry pan. Hungry now, I was crouched in the sand with my back to the Frisco

lifting filets with a fork when I looked up and saw Rojo sitting off a little ways with his head and ears cocked high and to one side in a good likeness to the old RCA Victor dog. He could hear something I couldn't. I turned around and what he was hearing was the sound of the drag letting line off the reel; the pole was bent into an alarming geometry; the fish wasn't but a few yards of taking all the monofiliment away!

I grabbed the pole, hopped up on the rock ledge overlooking the San Francisco and, tightening the drag, lay into that fish. I was hooked to the bottom but the bottom kept moving away! I jumped down, waded some shallows downstream towards the fish, then up onto this little gravel bar that split the rivers where I began to run and by all of this gained back a bunch of line. With the fish out in front of me now (he did not want to enter the rapids just below) I watched my line trail an animal's struggling route through the long, green pool, tied to the unknown monster below.

When, using light tackle, you are overmatched by a big fish you know you must keep pressure as close to the breaking point as your skill allows. You can never let the fish rest. He will never tire just swimming around; you must make him work at swimming. The longer he's out there swimming around the greater the chance he'll lose the hook, wear through the line, or wrap the line around some underwater structure. But apply too much pressure, just for an instant, and he's gone. The line breaks, or the rod breaks or the hook straightens. You protect your line and rod by keeping the rod at a sharp angle with the fish and by setting your drag to give just ahead of the breaking point. I knew all this, in theory and in practice, but when that fish surfaced briefly just before dark I knew there would be no landing soon. Not with a whippy spinning rod and six pound test line.

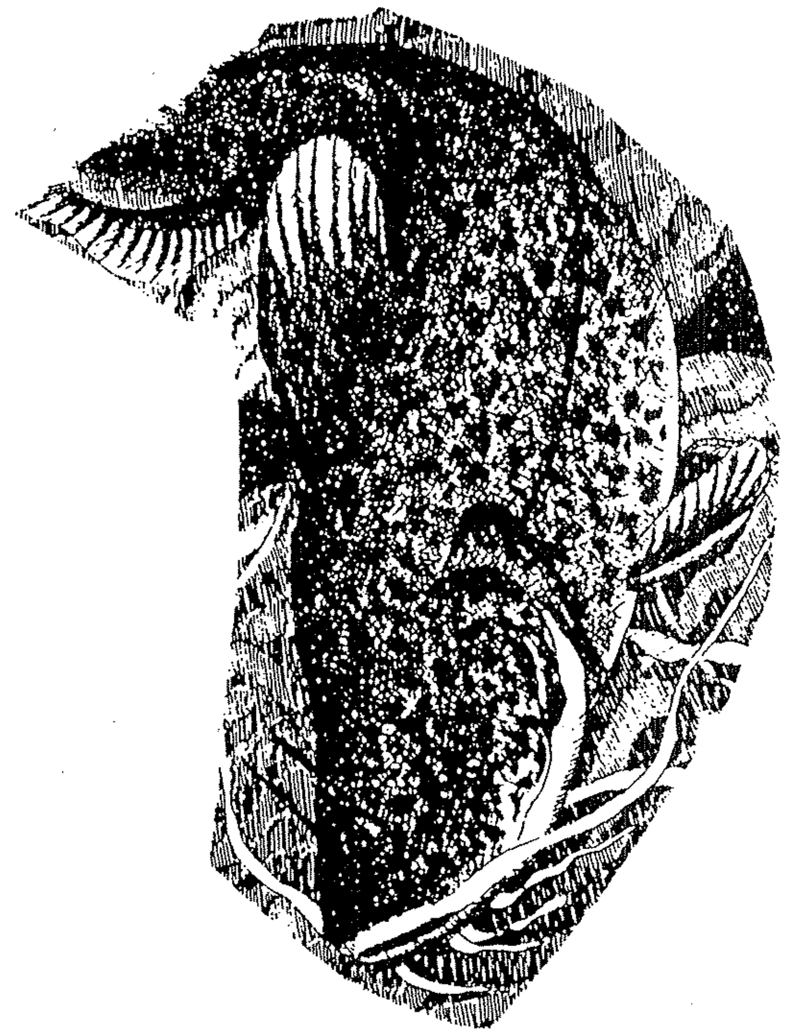
He'd been making these long almost leisurely runs, holding to the bottom between times, pumping the rod with head shakes, and I think he came up to see what he was tied to...one of those big ol' flatheads: a dark, vaguely mottled back, a body as long as your leg, a head pushing half a foot between the eyes and a mouth that could swallow a grapefruit, muskrat, or trophy trout.

After that it wasn't long. The line jumped back out of the water, landing over my shoulder, parted inches above the hook. He'd cut through the leader with his raspy teeth.

It was dark as I walked back upstream to camp. Rojo had followed me down. As we returned a tomcat sat on a rock ledge, watching intently with night eyes. I had nothing for him.

My catfish filets were overdone, and cold, but we all shared a meal. I tied on another hook and returned bait to water. For most of the night I sat along that rock ledge watching the waters; the full moon showed up, and under its peculiar light on rock and water I caught a soft-shelled snapping turtle sixteen inches across the back and another nice Channel Cat. Interesting. However, I didn't keep them. The one I'd wanted was gone.

Yet one can always find solace in a living river. It is never still, never staid; hiding its prizes, providing glimpses, it holds a continual promise of things to come.



One need never fear therein the final offering. There would always be another. Surely there would be another.

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I left my camp along the San Francisco/Gila River with the sun well up later that day. I was in no position to stay a year or two. I could have stayed for several more days. I was tempted. But I knew I'd be back and the touch of it was all I wanted for now. Holding to my own cryptic promises, the crew and I shoved off. We ran maybe fifty yards down the Frisco side before joining the Gila in a pretty good shot of rapids.

The twelve mile run through the rest of the Gila/Arizona Box was the equal of anything I'd seen—a fine canyon float with the remnants of the mining days decaying along the river banks and adjacent hills, Eagle Creek coming in on the north side like a trout stream, a wonderful riparian display and some lively rapids to give it all animation. Right now this region is roadless, managed by the Bureau of Land Management (BLM). But there's a battle going on and the days of the Gila/Arizona Box as I knew it may be numbered...

The struggle for the Gila/Arizona Box, like the battle for the San Francisco Canyon, says a lot about our principal federal land management agencies, the BLM and the U.S. Forest Service. Conservation groups have lobbied for the Gila/Arizona Box being put in the BLM wilderness system. They'd like to protect about 20,000

acres along the river from mining interests and the proposed (wouldn't you know it!) Camel's Back Dam. Predictably, the BLM is saying "no." I say predictably, because neither the BLM nor the Forest Service likes the wilderness concept. Certainly there are individuals within those agencies who are strong wilderness supporters but, *as agencies*, they much prefer the concept of "multiple use" (a.k.a. "multiple abuse") of our public lands. True, these agencies tout the wilderness reaches we now have, but historically both agencies have given in to wilderness designation reluctantly; invariably the agency position on any given wilderness has been either "no," or has been less than what conservationists wanted and ultimately achieved. It's not hard to figure out why. These agencies have become managers rather than stewards of our lands. And wilderness doesn't take much management. A wilderness patrol once in a while. Some trail maintenance. A launch for canoeists. Nothing compared to the intensive management involved in an area that's roaded in with logging or mining or ORV use planned or in progress. Wilderness doesn't give the managers much to do. It requires less budget and fewer employees. Thus our land management agencies have the same vested interest in developing and managing land that the Bureau of Reclamation has in developing and managing free flowing streams. Too often agency decisions are self-serving. They are not based on a true stewardship concept wherein "the resource comes first." The San Francisco Canyon, the Gila Middle Box and the Gila/Arizona Box may yet receive wilderness designations that will protect them from developments which, otherwise, are sure to come in time. If they do receive protection, it will be in spite of rather than because of the Bureau of Land Management or the U.S. Forest Service.

Approaching Bonita Creek the hills began to fall back away from the river, mighty Mt. Graham stood dark and forested in the distance and on the shore a pale, willowy, desert type coyote stopped drinking to stare at us. Though he remained motionless amidships, I've never seen such intensity in a tomcat. Rojo trembled and whimpered on the front seat. Our coyote didn't move till we'd passed by and when he did he simply disappeared, quick as a bird, light as a cloud. With the spring shedding of his winter coat he was pretty scruffy looking, but there's no finer mosaic than one of those pale coyotes pelted out prime in winter. Most of the ones up in Minnesota had been bigger, more wolflike animals, thick-furred and dark-coated. I remember one lovely, lithe, silvergray animal though, who ran before Rojo's daddy and two others for many hours before they bayed him up. At ten below I followed the race on snowshoes, found him backed in under a blowdown with the pack screaming triumph all around. The coyote is North America's premier game animal. There's nothing you can hunt that's faster, smarter, tougher all in one. I had mixed emotions (still do) about killing, skinning and selling the hide off that silvery Minnesota brush wolf. But I did. Seeing his counterpart along the Gila, I remembered him well, floating a desert river.

At Bonita Creek I stopped at the roadhead, seeking

to hitch a ride to a telephone. But there was no one around. Down river then, and the Gila took on an ugly cast for the first time since I'd marked its waters at Bead Spring. A wide flood plain here, no trees, heavily silted water and the work of incipient construction all around. A low diversion dam was a minor obstacle. I lifted right over the top and thereafter let Rojo run the bank for a ways.

Some five miles below Bonita Creek I came to a major diversion dam populated by a bunch of cars and pickups and folks fishing, swimming, enjoying the desert water. Pulling in on the north side, a husky sort of guy in his forties with more of a southern than southwestern accent greeted me, rounded up his son and without my asking helped me get the boat over the dam and out of the river.

"Where you comin' from?"

I told him. He shook his head and smiled. "Well damn! And a cat!"

"I need to find a phone," I said..."call my ride."

"How much it cost your ride come get ya?"

"A tank of gas."

"Hell, I'll run you home for a tank of gas."

"Home's a long ways. You run me home from here I'll pay more than gas."

We loaded the boat and the hound dog and that pesky tomcat in the bed of the pickup. Then Charles Dixon of Arkansas made a short run into Safford, Arizona to quickly arrange this unplanned excursion with his good wife (she must have been).

He wanted to take the back way, the high road, up

Highway 666 and on over to Mule Creek and that was fine with me. He told me that two hundred miles down the Gila River with a dog and a cat was quite something to do. I remembered how, before I'd done it, the forest ranger at the Gila Wilderness station had told me he didn't believe that trip had been traveled before, all in one. I anticipated my accomplishment then, and put the phrases beside my name—"Wilderness Expedition," "Backpacker," Whitewater King!" Having done it, I wasn't so sure. It was already beginning to seem like a piece of cake, no less meaningful for that. Most anyone could have done it, had he or she the interest and the time.

I gazed out across the desert, cholla flats, and no sign of the Gila in sight, the pickup steady and smooth at sixty-five. And it made me sleepy. And in spite of a good conversation on how to catch big catfish in the deep South and the great Southwest, I kept closing my eyes. Every time I did I was back on the river.

Herein is the remarkable story of a 200 mile wilderness journey down the Gila River of New Mexico and Arizona. Traveling partly on foot, mostly by canoe, the author was accompanied by a hound dog and a tomcat. His trip is replete with whitewater thrills, and angling for trout, bass and catfish; ruminations on the wilderness ethic, and the antics of two companions who promote all of humor, exasperation and love. But besides being a modern day excursion into the natural world, *Gila Descending* is a personal odyssey as well; and little by little that story, too, is told.

"*Gila Descending* is a joy to read. M. H. Salmon and his flesty animal co-pilots have enough chutzpah to keep us laughing; enough literary audacity to delight and educate; and enough love of land, water and wilderness to stir the most hardened conscience."

John Nichols

"...a delightful book. No reader could ask for a finer river to read about than the Gila, or a better companion to explore it with than M. H. Salmon. May the Government (ugh!) and God (we hope) long preserve them both."

Edward Abbey

"As you join the author - and his coyote hound and tomcat - on a float trip down the Gila, you will find a unique companion: a hunter with an informed environmental conscience; a fisherman with the sense to know that catfish are as good as trout; a wry observer whose prose owes more to local speech and the elegant essays of Aldo Leopold than to the high-tech fodder in the yuppie monthlies. Above all, he is a passionate and original defender of wilderness *with its hair on.*"

Steve Bodio, Bodio's Review
Gray's Sporting Journal

Cover Photo: M. H Salmon

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ORIGINAL

GILA RIVER

01

RECEIVED 8-30-96

Material Relevant to both Salt and Gila Rivers

Submitted by

Arizona Center for Law in the Public Interest

August 29, 1996

IN THE COURT OF APPEALS
STATE OF ARIZONA
DIVISION ONE

ARIZONA CENTER FOR LAW IN THE PUBLIC INTEREST, a nonprofit corporation; DEFENDERS OF WILDLIFE, a nonprofit corporation; MICHAEL GREGORY; THOMAS WRIGHT; and JAMES VAALER, Plaintiffs-Appellants, v. MILO J. HASSELL, in his capacity as State State Land Commissioner; ARIZONA STATE LAND DEPARTMENT, an agency of the State of Arizona; and STATE OF ARIZONA, Defendants-Appellees, and CALMAT CO. OF ARIZONA, an Arizona corporation; TANNER LAND COMPANY, INC., an Arizona corporation; THOMAS M. AND FRANCES K. VALENTE, husband and wife; FIRST AMERICAN TITLE INSURANCE COMPANY OF ARIZONA, an Arizona corporation; MARICOPA COUNTY, a political subdivision of Arizona; SALT RIVER PROJECT AGRICULTURAL IMPROVEMENT DISTRICT, a political subdivision of Arizona, and SALT RIVER VALLEY WATER USERS ASSOCIATION, an Arizona corporation, Defendants Intervenors-Appellees.	1 CA-CV 89-134 MARICOPA County Superior Court No. CV 87-20506

APPELLANTS' OPENING BRIEF

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B. Navigability Of Arizona Rivers

The navigability of many Arizona rivers is supported by both historical and modern evidence. More than 140 years ago, the navigability of the Gila River was recognized in Article VII of the Treaty of Guadalupe Hidalgo (1848):

> The River Gila . . . divided in the middle between the two republics, the navigation of the Gila . . . below said boundary shall be free and common to the vessels and citizens of both countries; and neither shall, without the consent of the other, construct any work that may impede or interrupt, in whole or in part, the exercise of this right; not even for the purpose of favoring new methods of navigation.

Today, Arizona's rivers and lakes support a wide range of boating activities. The 1989 draft Statewide Comprehensive Outdoor Recreation Plan, published by the Arizona State Parks Board, identifies 42 Arizona stream segments that provide whitewater canoeing, kayaking, or rafting opportunities for persons of varying levels of boating skills.[6] The plan also identifies a number of other river segments that are suitable for quiet-water boating by persons with minimal skills, including the Upper Verde and the Lower Salt. A.84-86. Commerical river running companies now conduct substantial numbers of trips each year on the Salt, Verde, Gila and Virgin Rivers. A.81-84. On the Upper Salt River alone, the United States Forest Service allows more than 30,000 service days of commercial use each year. A.83.

Many of the smaller watercourses in the state are boatable. According to the U.S. Department of Interior, the following are

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6 Arizona State Parks Board, 1989 Statewide Comprehensive Outdoor Recreation Plan, Arizona Rivers, Streams & Wetlands Study at 79-89 (draft), excerpted at A.65-86.

minimum criteria for river depth and width to support the types of boating indicated:

Recreation Craft	Required Depth (ft)	Required Width (ft)
Canoe/Kayak	0.5	4
Drift boat, rowboat-raft	1.0	6

PSJ.4 at 3. According to James Slingluff, an experienced Arizona river runner (A.55), modern canoes generally need only 2-3 inches of water to boat on a river, and only 1-1 1/4 inches if the canoe is totally flat-bottomed. PSJ.5 at 71-72. A wooden or canvas boat generally needs 4-6 inches of water to boat on a river. Id. at 159-60.

In the trial court, plaintiffs offered hundreds of pages of exhibits and deposition testimony supporting the navigability of 18 different Arizona rivers. IA.189-192, 212, 213. This evidence included historical accounts of actual pre- and post-statehood river travel; information on the historic depths, widths and flows in various rivers; and firsthand accounts of actual current use of numerous rivers. A small sample of navigability evidence on several of these rivers is provided below. A more complete summary discussing all 18 rivers is provided in the Appendix to this brief at A.87.

1. Agua Fria River: According to a 1915 federal land survey, the Agua Fria routinely had 4 to 12 inches of water in an 80 foot wide channel beginning at a point 3 1/2 to 4 miles above the confluence with the Gila River. Below that point, to the confluence

with the Gila River, the river depth was approximately 2 feet deep. PSJ.52; PSJ.1 (Attachment 1 to State's Answers - memo of 7/25/86 from Bill Allen to Jay Skardon); PSJ.21 at 81-84. These surveys led the State Land Department's chief hydrologist to conclude in 1986 "that the lower 3 1/2 to 4 miles of the [Agua Fria] channel were navigable at statehood." PSJ.1 (Attachment 1 to State's Answers).

2. Gila River: There are numerous historical accounts of actual river travel on the Gila. The pioneer James O. Pattie canoed the river as part of a fur trapping expedition in the 1850's. PSJ.10 at 184. During the mid- to late 1800's, a number of pioneer groups boated westward on the Gila, in some cases navigating most of the river's length. PSJ.16 at 249-51, PSJ.53, 54, 55, 56. At one point, the Gila was also used by two steamers to transport freight and passengers from Yuma to Gila City, twenty miles upstream. PSJ.9 at 407. Ferryboats were commonly used on the Gila in the late 1800's and early 1900's, including several commerical operations. PSJ.17, 57, 58. A ferry from Sentinel to Agua Caliente Hotsprings carried passengers and freight on a daily basis during this period, according to a local resident who moved to the area in 1910. PSJ.17.

An 1852 account from a government expedition reported that in the Gila below the San Pedro confluence, the average stream of water measured about 40 yards in width with an average depth of 2 feet. PSJ.12 at 20. The 1846 military survey of Lt. Col. Emory states that "[t]he Gila, at certain stages, might be navigated up to the Pimos Village and possibly with small flat boats at all stages of water." PSJ.8 at 95. Historical flow records maintained by the United States Geological Survey show that, in 1912, flows in the Gila River near Clifton equaled or exceeded 190 cubic feet per second on 116 separate days. PSJ.25 at 130. According to an outfitter who currently runs commercial river trips on the Gila, 200 cfs is adequate to support a commercial river trip on the San Francisco near the Gila confluence. PSJ.24 at 74.

3. Salt River: There are several historical accounts of actual navigation on the Salt in pre-statehood days. See, e.g., PSJ.20, 59. One group successfully boated the Salt in June 1885, from the area of today's Roosevelt Lake down to Tempe. The group had made the trip to determine whether logs could be brought downriver to Phoenix from the Sierra Anchas. The Arizona Gazette reported that "the undisputed conclusion is that such work can be successfully carried out." PSJ.20. The Salt River also had several established ferry businesses. PSJ.60, 61. One of the most well known ferry operations was that of Charles T. Hayden, which operated near today's Mill Avenue Bridge. PSJ.60. Historical photos of the Salt, including Hayden's Ferry, are reproduced in the Appendix at A.97-101. According to an 1850's account, the Salt 12 miles upstream from the Gila was 80 to 120 feet wide and from 2 to 3 feet deep. PSJ.19 at 240, 244. See also, PSJ.17 at 90.

A number of companies currently operate commercial river trips on the Salt. A.48, 52, 80-83. One of these companies conducts approximately 100 trips per year, encompassing all seasons. A.48. Another company runs trips in the period from December through May. A.52. The Salt is also currently used for private recreational boating trips. A.55, 80-83; PSJ.5 at 73-87. According to two experienced river runners, the Salt River from the Highway 60 Bridge to the Highway 288 Bridge is suitable for river travel in all seasons. A.48, 55. The National Park Service describes the Salt River as "one of the best whitewater streams in the Southwest." A.62.

4. Tonto Creek: Tonto Creek is currently used for recreational boating. A.53. At least one outfitter has applied for a permit to conduct commercial trips on Tonto Creek. Id. According to this outfitter - an experienced river runner - Tonto Creek is "very suitable for river travel." A.52-53.

5. Verde River: The Army used boats to ferry people and cargo across the Verde at Fort Verde in the late 1800's. PSJ.21 at 34-35; PSJ.22 at 6(A). The State Land Department relied at least in part on this historical use in concluding that the Verde at Camp Verde was navigable at statehood and asserting state ownership of the bed in a 1984 action. PSJ.21 at 34. In 1931, two people boated the Verde from Clarkdale to a point 18 miles above Fort McDowell, stopping to engage in trapping along the way. PSJ.62, 63.

Photographs of recent boating on the Verde are reproduced in the Appendix at A109-114. At least two outfitters currently run commercial river trips on the Verde: One of these operates approximately 40 trips per year. A.48-52. The Verde is also currently used for private river trips, from Perkinsville all the way to Bartlett Reservoir. A.55-56; PSJ.23, 65. One river runner has boated the Verde between Beasley Flats (just below West Clear Creek) and Childs approximately 100 times. PSJ.23.

6. <u>Other examples:</u> Photographs of recent boating on Wet Beaver Creek and Oak Creek appear in the Appendix at A.107, 108, 115. Commercial river trips are currently conducted on the San Francisco and Virgin Rivers. A.52. The Black River, Dry Beaver Creek, Little Colorado River, West Clear Creek and White River have all been boated in recent times and have all been described by experienced river runners as "very suitable for river travel" in various seasons. A.52-53, 55-56; PSJ.5 at 104-07, PSJ.24 at 52, 54.

C. <u>Actual Value Of Riverbed Lands</u>

Riverbed lands in Arizona are worth hundreds of millions, if not billions of dollars. <u>Land Department v. O'Toole</u>, 154 Ariz. 43, 45, 739 P.2d 1360 (App. 1987); A.40. Riverbed and flood plain land sought to be acquired by the Maricopa County Flood Control District alone is valued at $35 million. PSJ.26 at 3. Lands in the Salt riverbed at Phoenix have been valued at more than $21 million. A.47. In a 1985 report, the Rio Salado Development District conservatively estimated the average cost of land in the floodway of the Salt River at Phoenix at $20,000 per acre. A.95. One sand and gravel company paid more than $61,000 per acre for Salt riverbed land in 1985. PSJ.27, 28. Examples of recent appraisals and/or sales prices for other riverbed lands include $1,500 per acre in the Gila, $8,000 per acre in the Agua

ARGUMENT

I. H.B. 2017 VIOLATES THE GIFT CLAUSE OF THE ARIZONA CONSTITUTION BY TOTALLY RELINQUISHING STATE CLAIMS TO MILLIONS OF DOLLARS WORTH OF RIVERBED LAND

A. The State Of Arizona Owns The Beds Of Numerous Arizona Watercourses.

1. **Under the Equal Footing Doctrine, the state owns the beds of all watercourses that were at statehood capable of transporting people or goods for part of the year.**

The test of navigability under the Equal Footing Doctrine is a liberal one: Whether the waterway was at statehood susceptible for use as a highway for transporting people or goods. Utah v. United States, 403 U.S. 9, 11 (1971). A river may be deemed navigable for title purposes despite occasional impediments such as sand or gravel bars, and despite the fact that it is only navigable a few months out of the year. State of Oregon v. Riverfront Protective Association, 672 F.2d 792, 795 (9th Cir. 1982). Actual use for boating, whether commercial or sporting, can demonstrate susceptibility as a highway for public passage. Utah v. United States, 403 U.S. at 11. Although state ownership turns on navigability at the time of statehood, evidence of current recreational use by small craft such as canoes is probative of navigability at statehood. North Dakota v. Andrus, 671 F.2d 271, 277-78 (8th Cir. 1982).

The remoteness of a river and lack of actual use at statehood does not defeat a finding of navigability: The question is whether the river was susceptible of transporting people or goods. United States v. Utah, 283 U.S. 64, 83 (1931). Likewise, a river is deemed navigable if it was susceptible of transporting people or goods by any conveyance - not merely those in use at the time of statehood. State of Alaska v. United States, 662 F. Supp. 455, 465 (D. Alaska 1986). In fact, the floating of logs down a river is a form of navigation for purposes of the doctrine. State of Oregon v. Riverfront Protective Association, 672 F.2d at 795. The fact that dams or diversions render a waterway non-navigable today does not make it non-navigable for equal footing purposes as long as it was passable in its original condition. See United States v. Utah, 283 U.S. at 75-79; State v. Bonnelli Cattle Co., 107 Ariz. 465, 468, 489 P.2d 699 (1971).

The broad judicial construction of "navigability" is well illustrated in North Dakota v. Andrus, 671 F.2d 271 (8th Cir. 1982), reversed on other grounds, Block v. North Dakota, 461 U.S. 273 (1983). There, the court found the Little Missouri River to have been navigable at statehood based on: a) isolated cases of historic use by small craft such as canoes; b) an observation from the Lewis and Clark expedition on the river's width and depth; c) some brief and unsuccessful efforts to float logs downstream; and d) current use annually by hundreds of recreational canoeists. 671 F.2d at 277-78. In another case, a finding of navigability was upheld based on evidence that a river was used for log drives for as little as 2 1/2 months per year even though suffering frequent log jams, flooding and low flows. State of Oregon v. Riverfront Protective Association, 672 F.2d at 295-96. In Illinois v. Corps of Engineers, 17 E.R.C. 2214, 2216 (N.D. Ill. 1981), the court based a finding of navigability on sporadic, historic use by explorers, trappers and fur traders on a shallow and swampy river, and noted that even a single trip by a supply boat could raise an inference of navigability.[7]

2. Numerous Arizona rivers meet the Equal Footing Doctrine's navigability test.

Under the standards set forth above, many Arizona rivers qualify as navigable for purposes of the Equal Footing Doctrine. As discussed in the Statement of Facts, supra, there are numerous prestatehood accounts of actual navigation on Arizona rivers as well as commercial ferry boat operations[8] into the early 1900's. Government surveys in the 1800's reported flow depths and widths in numerous Arizona rivers that would have been more than sufficient to support river travel. Hundreds of commercial river rafting trips are today conducted each year on rivers ranging from the Salt to the Virgin. In addition, dozens of Arizona rivers are currently used for recreational boating for all or part of the year, including the Black River, Dry Beaver Creek, the Little Colorado, Oak Creek, the San Francisco River, Tonto Creek, West Clear Creek, Wet Beaver Creek, and the White River. Courts have held rivers to be navigble for purposes of the Equal

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[7] The court was determining navigability for commerce clause purposes, but such cases can nevertheless be used as persuasive authority in appropriate Equal Footing Doctrine cases. See Alaska v. United States, 754 F.2d 851, 854 (9th Cir. 1985).

[8] Use of ferry boats to cross a river was specifically found to be probative of navigability in City of Centralia v. State, 851 F.2d 278, 282 (9th Cir. 1988).

Footing Doctrine based on comparable - or even less extensive evidence than provided in this case.[9]

3. **The state's title to riverbeds vested automatically at statehood, and is not merely an inchoate claim.**

In the proceedings below, defendants asserted that the state's riverbed interest is only an "inchoate claim" until there is a judicial determination of navigability. Both caselaw and statute make abundantly clear, however, that title to the beds of navigable waters vests automatically in the state upon its admission to the Union. As the United States Supreme Court has repeatedly held, the state "receives absolute title to the beds of navigable waterways within its boundaries upon admission to the Union." State Land Board v. Corvallis Sand and Gravel Co., 429 U.S. 363, 372 (1977) (emphasis added). The state assumes this ownership as an inherent incident of sovereignty. Martin v. Waddell, 41 U.S. (16 Pet.) 367, 409-411 (1842). The unequivocal nature of the state's ownership interest is further confirmed in

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9 In the trial court, defendants did not seriously dispute the truth of the navigability evidence offered by plaintiffs, but instead relied primarily on conclusory assertions of nonnavigability by persons with no demonstrated expertise in river travel or the amount of water needed to support boating. See IA.210 at 17-18; IA.211 at 7-11. Even if these "experts" were qualified to assess boatability, the determination of navigability is a mixed question of law and fact - not one that can be "decided" by witnesses. See Young v. Environmental Air Prods., 136 Ariz. 206, 210, 665 P.2d 88 (App. 1982), modified on other grounds 136 Ariz. 158, 665 P.2d 40 (1983). Defendants also relied heavily on the lack of actual historic boating evidence as to several rivers but as noted above, lack of actual use does not defeat a finding of navigability if the river was susceptible for use in the transport of people or goods. United States v. Utah, 283 U.S. 64, 83 (1931).

96-003-003

GILA RIVER

02

IN THE COURT OF APPEALS
STATE OF ARIZONA
DIVISION ONE

ARIZONA CENTER FOR LAW IN THE PUBLIC INTEREST, a nonprofit corporation; DEFENDERS OF WILDLIFE, a nonprofit corporation; MICHAEL GREGORY; THOMAS WRIGHT; and JAMES VAALER, Plaintiffs-Appellants, v. MILO J. HASSELL, in his capacity as State State Land Commissioner; ARIZONA STATE LAND DEPARTMENT, an agency of the State of Arizona; and STATE OF ARIZONA, Defendants-Appellees, and CALMAT CO. OF ARIZONA, an Arizona corporation; TANNER LAND COMPANY, INC., an Arizona corporation; THOMAS M. AND FRANCES K. VALENTE, husband and wife; FIRST AMERICAN TITLE INSURANCE COMPANY OF ARIZONA, an Arizona corporation; MARICOPA COUNTY, a political subdivision of Arizona; SALT RIVER PROJECT AGRICULTURAL IMPROVEMENT DISTRICT, a political subdivision of Arizona, and SALT RIVER VALLEY WATER USERS ASSOCIATION, an Arizona corporation, Defendants Intervenors-Appellees.	1 CA-CV 89-134 MARICOPA County Superior Court No. CV 87-20506

APPELLANTS' REPLY BRIEF

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allowed limited conveyances of specific riverbed or tideland parcels for purposes consistent with the trust, they have consistently and uniformly held that states may never transfer the whole of the public trust into private hands, any more than they can relinquish their police powers.

ARGUMENT*

I. H.B. 2017 VIOLATES THE GIFT CLAUSE BY TOTALLY RELINQUISHING STATE CLAIMS TO MILLIONS OF DOLLARS WORTH OF RIVERBED LAND

A. The Evidence Is Compelling That Many Arizona Rivers Were Navigable At Statehood.

Although defendants' briefs abound with conclusory assertions that Arizona's riverbed claims are "weak," the simple fact is that they do not and cannot contest the extensive, actual evidence of navigability presented by the plaintiffs in this case. It is undisputed that there are numerous historical accounts of boat travel on Arizona rivers, that pre-statehood depths and widths of many rivers were more than sufficient to support navigation, and that many Arizona rivers are routinely used today for both commercial and recreational boating. Although the defendants dispute the legal inferences to be drawn from these facts (incorrectly, as further discussed below), they do not seriously claim that plaintiffs' historical evidence is wrong, that more water is needed for river travel than plaintiffs claim, or that

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* NOTE: Abbreviations for citations to the record herein are the same as in Plaintiffs' Opening Brief. Pl. Open. Br. at 1 n.2 and 5 n.5.

the current river use documented by the plaintiffs does not really occur. Defendants cannot dispute these facts because they are all extensively documented in the record: By official government reports, by historical accounts cited and relied on by defendants' own witnesses, by affidavits and depositions of five Arizona river runners who collectively have participated in hundreds of river trips in Arizona, and by actual photographs of boating on Arizona watercourses.[1] See, e.g., Pl. Open. Br. at 6-11, Pl. Open. Br. Appendix (A) at 48-64, 87-123.

The only "evidence" offered by the defendants consists of negative inferences and conclusory assertions of a type that courts simply do not rely upon in determing navigability in fact. For example, intervenors rely primarily on: a) the supposed preference of fur trappers for overland routes in the early Southwest; b) the purported failure of one attempt to drive logs down the Salt River; c) occasional mishaps on early boating trips in Arizona; d) the nonuse of the Gila River to transport produce between Phoenix and Yuma; and e) the fact that one party traveling westward on a floatable wagon in 1849 did not attempt to

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1 The state in passing notes that it raised some evidentiary objections below (State Br. at 16 n.3), but because the trial court never ruled on these objections and they have not been specifically presented on appeal, they must be deemed waived. See generally Killingsworth v. West Way Motors, Inc., 87 Ariz. 74, 80-81, 347 P.2d 1098 (1960); Tucson Federal Sav. & Loan v. Aetna Inv. Corp., 74 Ariz. 163, 173-74, 245 P.2d 423 (1952); 4 C.J.S. Appeal & Error §§320, 321.c (1957). In any event the objections were utterly meritless for reasons thoroughly addressed by plaintiffs below. IA. 211 at 3-7, 11-36.

float downstream. But the mere fact that on a particular trip or at a particular time individuals decided not to travel by river does not in any way show that rivers were not susceptible for use as highways. The choice of the mode of travel on a given trip could be influenced by many factors, such as the availability of railroads, the availability and orientation of overland routes, the purpose of the trip, and the season of the year. For this very reason, the United States Supreme Court has expressly held that the lack of actual, historic boating use on a given river does not defeat a finding of navigability. United States v. Utah, 283 U.S. 64, 81-82 (1931) (susceptibility of river to use as a highway may be proved without any evidence of actual use for boating). The isolated examples of boating accidents offered by defendants are grossly exaggerated (as further discussed below), and in any event are hardly determinative of non-navigability. Boating accidents have occurred on every navigable waterway since boats were invented, and courts have uniformly held that occasional impediments and problems in river travel do not defeat a finding of navigability. See, e.g., id. at 86.

Intervenors also fail to refute the evidence of navigability as to the five specific rivers discussed by plaintiffs in their opening brief, as follows:

Agua Fria River - The fact that the state decided to waive its navigability claims on the upper Agua Fria in no way contradicts plaintiffs' point that the lowest 3 1/2 to 4 miles of the river were navigable at statehood. The Land Department's chief hydrologist expressly so found, and the state has never adopted a contrary position. Plaintiffs' Supplemental Appendix (SA), attached hereto, at 1.[2] Intervenors also rely on the conclusory assertion of Elaine Lacy that the Agua Fria River "is non-navigable over its entire length." Int. Br. at 3. Despite intervenors' description of Ms. Lacy as a "expert," the simple fact is that she is completely unqualified to render such a conclusion. She has never boated on a river anywhere, has no knowledge of canoeing, rafting or other forms of river travel, and has no specialized knowledge of navigation or on the amount of water needed to float a boat. PSJ 72 at 8-11, 26-28. Her speciality as a historian - Latin American History - hardly qualifies her to make judgments over the navigability of rivers. Id. at 11, 12, 18-19, 24. In any event, the determination of navigablity for purposes of title is a mixed question of law and fact, rendering conclusory assertions such as Ms. Lacy's completely inadmissible. See Young v. Environmental Air Prods., 136 Ariz. 206, 210 (App. 1982), modified on other grounds 136 Ariz. 158; M. Udall & J. Livermoore, Law of Evidence §26.

Gila River - Intervenors provide exaggerated, misleading accounts of several isolated mishaps on early Gila River trips. For example, although it is true that the Mormon Battalion encountered some difficulties at the beginning of its trip on the Gila, these were due in large measure to the fact that their

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2 The stipulation referred to by intervenors (Int. Br. at 3) makes absolutely clear that the state conceded non-navigability only with respect to stretches of the Agua Fria above the lowest 3 1/2 to 4 miles. SA at 2. See also SA at 6.

boats were overloaded: After the load was lightened, the rafts made headway and eventually traveled 70 miles in 7 days. IA 204, App. 105 at 4-7. Likewise, intervenors cite an 1891 trip down the Gila in which a boat was purportedly "destroyed": But the actual account (copy attached hereto at SA 9) shows that the boat was upset and lost in a flood (a plausible occurrence on any river), that the two men built another boat and continued on, that they otherwise "met with no special incident," and that they ultimately navigated the entire length of the river in Arizona, hunting and trapping on the way.

Intervenors also cite a single trip in 1889 in which a ferry boat was wrecked on a sandbar on the Gila. This one accident is hardly significant when compared with the numerous successful ferry boat operations on the Gila in the late 1800's and early 1900's, including the almost daily ferry boat travel between Sentinel and Agua Caliente Hotsprings. PSJ 17, 57, 58. Intervenors further mislead in suggesting that plaintiffs' summary judgment exhibit 54 somehow supports an inference of non-navigability. Int. Br. at 5. The exhibit (copy attached hereto at SA 10), is an 1879 newspaper account of a successful Phoenix to Yuma river trip by which "the advocates of navigation of the Gila obtained a solid fact." The article also notes that a steamboat had previously transported loads of wood on the river. Id. These and the numerous other accounts cited by plaintiffs clearly refute intervenors' assertion that the Gila was traveled only by "daring" and "intrepid" individuals. See, also, SA at 11.

Finally, intervenors seek to minimize the Treaty of Guadalupe Hidalgo's reference to the Gila's navigability, but that reference shows at the very least that government officials in the mid-1800's perceived the river as having some value for navigation. Contrary to intervenors' assertion the Court in Oklahoma v. Texas, 258 U.S. 574 (1922) did not in any way hold that treaty references to navigability are "inadmissible." The Court in that case simply held that a treaty statement that the Red River was navigable was not conclusive evidence that the entire length of the river was navigable in fact, in the face of other evidence to the contrary. Id at 584-85.

Salt River - Intervenors completely ignore plaintiffs' extensive evidence of historic and current boating on the Salt, and focus almost entirely on one 1885 trip that they claim was unsuccessful. In reality, the newspaper account of the trip (attached hereto at SA 12-13), indicates that only one mishap occurred, and that it did not prevent completion of an "exciting and interesting trip." The trip was taken to determine whether logs could be rafted to the lower Salt, and the "undisputed conclusion" from the trip was "that such work can be successfully carried out." SA at 13.[3]

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[3] Intervenors' effort to draw support from a brief reference to the Salt as a non-navigable stream in a 1908 decree is completely unavailing: There is no evidence that the reference was in any way intended to be an adjudication of navigability for any purpose, or was even based on any actual evidence relevant to the issue. Int. Br. at 7. Defendants also incorrectly assert that the state has conceded the non-navigability of the Salt River, citing a statement to that effect in a totally unrelated court

Verde River - The evidence cited by plaintiffs - e.g., the accounts of historic use, the photographs and affidavits showing extensive current boating, and the state's successful assertion of sovereign ownership over the Verde Riverbed at Camp Verde - are all undisputed by the defendants. Intervenors complain that plaintiffs did not cite the deposition testimony of Herbert Young, but that testimony is hardly probative of non-navigability: At best, it shows that one person who was not involved in river related activities did not happen to see any boating on the river. Likewise, the statement of the state's counsel in defending the settlement of the Valley Concrete case that evidence of navigability at Cottonwood was "weak," was little more than a conclusory assertion made to defend a litigation position (the settlement was being challenged by the Audubon Society, which felt the settlement was inadequate). Earlier in the very same litigation, the State Land Department asserted in answers to interrogatories that flow rates on the Verde at Cottonwood were such as to make it navigable. PSJ 22.[4]

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3 (Continued)
judgment. State Br. at 34; Int. Br. at 23-24. The issue was stipulated in a case having nothing to do with sovereign ownership, and there is no evidence that the state official making this "concession" had any authority whatsoever to do so. The Arizona State Land Department - which is given sole charge of the stewardship and management of state lands - was not a party and has unequivocally taken the position that the navigability of the Salt River has not been determined. SA at 6; A. 46.

4 Contrary to intervenors' rhetoric, the state has never stipulated to the non-navigability of the Verde at Cottonwood: If anything, as plaintiffs have previously argued, the payment of a $90,000 settlement by the Valley Concrete company suggests that

Tonto Creek - Intervenors rely exclusively on the conclusory assertion of a single hydrologist that the creek is not susceptible for use as a highway. As with Ms. Lacy, the hydrologist is completely unqualified to make such a conclusion: There is no evidence that he has any knowledge whatsoever of the river depths and flows necessary to support river travel or that he has any familiarity whatsoever with boating. Moreover, his assertions of non-navigability are flatly refuted by the affidavits and deposition testimony showing that numerous trips have in fact been taken down the Creek (20 by one river runner alone) and that one outfitter is seeking a permit to run commercial trips there. A. 52; PSJ 5 at 171-72; PSJ 25 at 50-51.

Defendants urge judicial deference to the legislature's "finding" that the state's navigability claims are weak. In reality, the legislative finding is at best equivocal: It simply states that "the Land Department has determined that the state's claim, if any, to certain watercourses is weak," and that "its claim to other watercourses may be more viable." H.B. 2017 §1.A (emphasis added).[5] In any event, the determination of naviga-

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4 (Continued)
the state's claims had some merit. In this regard, the statement of Valley Concrete's lawyer that the settlement was not intended to recognize the state's navigability claims is utterly irrelevant: The formal, filed settlement dismisses the state's navigability claims along with all the others in exchange for $90,000, and there is nothing in the document to suggest that the payment was in response to only the damage claims. PSJ 42.

5 Moreover, the legislature elsewhere in the bill directed the Attorney General to study and pursue riverbed ownership claims against the United States based on navigability. H.B. 2017 §5.
(Continued)

bility is a federal question. Declarations by a state legislature as to the non-navigability of a river are not controlling for purposes of the Equal Footing Doctrine. See, e.g., United States v. Utah, 283 U.S. at 75; Newcomb v. City of Newport Beach, 60 P.2d 825, 828 (1936).

B. The Test Of Navigability For Purposes Of The Equal Footing Doctrine Is A Liberal One.

Contrary to intervenors' assertion, the characterization of the federal test of navigability as a "liberal" one is not something merely invented by plaintiffs: It is a description used by courts and commentators alike based on a common sense reading of the caselaw. See, e.g., North Dakota v. Andrus, 671 F.2d 271, 278 (8th Cir. 1982); Frank, Forever Free: Navigability, Inland Waterways, and the Expanding Public Interest, 16 U.C. Davis L. Rev. 579, 603 (1983). Defendants are also completely off base in asserting that the cases relied upon by the plaintiffs deal only with the admissibility of evidence on navigability, as the discussion below further shows.

1. Susceptibility for transport of people or goods is the essence of the federal test.

Despite the overwhelming caselaw holding that a river is navigable if susceptible for transporting people or goods, intervenors continue to insist that the test is met only if the travel

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5 (Continued)
Obviously, the legislature felt that the state did indeed have viable claims based on navigability: Its decision to waive those claims as against private parties was plainly motivated by special interest considerations, and not any serious belief that the claims were not worth pursuing.

is "economically productive" and only if there was actual commercial use at statehood. The federal courts have unequivocally rejected such a narrow test. In Utah v. United States, 403 U.S. 9, 11 (1971), the United States Supreme Court held that the Great Salt Lake was navigable at statehood, based primarily on evidence of noncommercial boating. The Court rejected objections that the use was not commercial in the customary sense, holding that "[t]he lake was used as a highway and that is the gist of the federal test." Other decisions are in complete accord that navigability is demonstrated by the capability of a waterway for use in transporting persons or goods, whatever the purpose or activity involved. See, e.g., United States v. Holt State Bank, 270 U.S. 49 (1926); City of Centralia v. FERC, 851 F.2d 278, 281 (9th Cir. 1988); Alaska v. United States, 754 F.2d 851, 854 (9th Cir. 1985).[6]

The source of defendants' confusion on this issue is their insistence on applying their own peculiar definition of commerce - one that is apparently limited to the shipping of cargo on some sort of a grand scale. The federal courts have never followed such a narrow definition. For example, in The Montello, 87 U.S. (20 Wall.) 430, 442 (1874), the Supreme Court did not - as intervenors imply - limit navigability to "commercially useful"

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6 Intervenors cite several state court decisions on this point (Int. Br. at 16), but these at most can be read as holding waters to be non-navigable where they are not useful for transportation. Int. Br. at 16. Any broader reading of these cases would have to be rejected as inconsistent with the above cited U.S. Supreme Court precedents.

rivers. Rather, the Court equated commerce with transportation of any kind:

> The capability of use by the public for purposes of transportation and commerce affords the true criterion of the navigability of a river, rather than the extent and manner of that use.

Id. at 441-42 (emphasis added). Subsequently the Supreme Court made clear that "commerce has been held to include the transportation of persons and property no less than the purchase, sale and exchange of commodities." *United States v. Hill*, 248 U.S. 420, 423-24 (1919). In making navigability for title determinations, "the court need only inquire if the water body is susceptible to the most basic form of commercial use: the transportation of people or goods." *State of Alaska v. United States*, 662 F. Supp. at 465.

Of course, plaintiffs *have* shown substantial evidence of commercial use for fur trapping, westward travel, and ferry businesses in territorial and statehood days, and extensive present day use by commercial river outfitters. Interventors suggest that ferry travel across a river and river rafting for hire somehow do not constitute commerce. Yet they make no attempt to refute the authority cited by plaintiffs, *City of Centralia v. FERC*, 851 F.2d 278, 282 (9th Cir. 1988), where the court specifically relied on evidence of ferry travel "across" a river as significant evidence of navigability.[7] As for the river

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[7] Moreover, there is absolutely no support for intervenors' notion that only travel up and down a river constitutes navigation. The crux of the navigability test is the "utilization of

outfitters, the special master's report adopted by the United States Supreme Court in United States v. Utah, expressly recognized the "transportation of tourists for hire" as a form of commerce. United States v. Utah, Report of the Special Master at 117. Given that tourism is one of Arizona's leading industries, it is simply absurd for intervenors to suggest that these activities do not constitute commerce. See United States v. Underwood, 344 F. Supp. 486, 487-88, 496 (D. Fla. 1972).

2. **Actual use for boating, including modern day boating, is probative of navigability at statehood.**

Plaintiffs have maintained that actual use for boating, whether commercial or sporting, can demonstrate susceptibility as a highway for public passage, citing Utah v. United States, 403 U.S. at 11. The defendants cite several cases where evidence of actual use was not sufficient to establish navigability, but those cases found non-navigability based on a variety of other factors as well, and because of the extremely limited and restricted nature of the boating the occurred. For example, the river segment held non-navigable in Oklahoma v. Texas, 258 U.S. 574 (1922), was navigable only for sporadic periods of 7 days or less, required frequent, long portages, and was apparently navi-

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7 (Continued)
the waterway as a path between two points." Alaska v. United States, 754 F.2d 851, 854 (9th Cir. 1985). Ferry boats that crossed Arizona rivers, such as Hayden's Ferry and the ferry at Agua Caliente Hotsprings were plainly using waterways as paths between two points. Such use also strongly supports an inference that the river was susceptible for travel lengthwise as well.

gated only once by a government survey boat. Id. at 587-88.[8] Likewise, the lake found to be non-navigable in United States v. Oregon, 295 U.S. 1 (1935), was little more than a swamp, surrounded by 1,000 acres of mud, and containing growths of vegetation that prevented navigation. 295 U.S. at 16, 18, 22. Id. at 22. Similarly Pennsylvania Environmental Council v. Bartlett, 315 F. Supp. 238 (M.D. Pa. 1970), relied on by the state, held a river to be non-navigable because the only apparent evidence of navigability was a single kayak trip. As for George v. Beavark, 402 F.2d 977 (8th Cir. 1968), the Eighth Circuit has specifically rejected the case as authority for determining navigability for Equal Footing Doctrine purposes. North Dakota v. Andrus, 671 F.2d 271, 278 (8th Cir. 1982). The narrow fact situations in these cases and others cited by defendants are simply not analogous to the broad evidence of navigability presented by the plaintiffs in this case. As to virtually every river discussed, there is evidence of actual repeated travel over significant distances without major obstacles, and of boatability for substantial parts of the year. See, e.g., A. 48-64, 87-123; IA 211 at 17-41; PSJ 25.

Intervenors assert that plaintiffs' evidence of current boating on Arizona rivers is not probative of navigability because "modern" canoes and rafts were not in use at statehood.

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8 Contrary to the state's assertion (State Br. at 10), the court did not in any way hold that evidence of actual use was "inadmissable": Indeed, the Court had previously held that such evidence could be "most persuasive." United States v. Utah, 283 U.S. 64, 82 (1931).

But there is absolutely no requirement that the inquiry be confined to modes of travel in use at statehood. State of Alaska v. United States, 662 F. Supp. 455, 463 (D. Alaska 1987). Rather the question is simply "the capacity of the rivers in their ordinary condition to meet the needs of commerce as these may arise." United States v. Utah, 283 U.S. 64, 83 (1931) (emphasis added). Intervenors cite language from The Montello, 87 U.S. (20 Wall.) 430, 442 (1874), to the effect that not every creek on which a boat can be made to float is deemed navigable. The Court made this reference, however, in the context of a much broader statement of the liberal definition of navigability for purposes of the Equal Footing Doctrine:

> It would be a narrow rule to hold that in this country, unless a river was capable of being navigated by steam or sail vessel, it could not be treated as a public highway. . . . If it be capable in its natural state of being used for purposes of commerce, no matter in what mode the commerce may be conducted, it is navigable in fact, and becomes in law a public river or highway. Vessels of any kind that can float upon the water, whether propelled by animal power, by the wind, or by the agency of steam, are or may become the agency by which a vast commerce can be conducted . . .

Id. at 441-42 (emphasis added). Thus, navigability has never been defined solely by reference to any particular mode of transportation at statehood or otherwise.[9]

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[9] Intervenors also seek support from the Ninth Circuit decision in Alaska v. United States, 754 F.2d 851 (9th Cir. 1985), but the court there in no way held that navigability could only be demonstrated with reference to craft in use at statehood. The court simply held that use of a small, remote Alaskan lake for float plane takeoffs and landings was insufficient to demonstrate navigability because the lake was not useful as a highway between two points. 754 F.2d at 854.

Finally, plaintiffs' evidence of navigability is not limited to use by modern canoes and rafts. With respect to most rivers, plaintiffs have provided evidence of actual historic use, historic flows, or both. Plaintiffs have also provided expert testimony and official government reports on the depths, widths and flows needed to support boating of various kinds, including wooden and canvas craft such as those in use at statehood. The current and historic flow data submitted by plaintiffs shows that most river segments discussed have historically been capable of supporting traditional wooden craft as well as the more modern canoes and rafts.[10]

3. Other courts have found navigability based on comparable evidence.

Contrary to defendants' assertions, courts have found rivers to be navigable based on evidence similar to, or even less exten-

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10 For example, the undisputed evidence shows that a rowboat can generally travel in a river approximately 1 foot deep and 6 feet wide, and a canoe with even less depth and width. PSJ 4; PSJ 5 at 71-72, 159-60. Prestatehood accounts by government explorers reported depths and widths substantially above these minimums. For example: a) Gila (1852) - 2 feet deep, 40 yards wide; b) Salt (1850's) - 2 to 3 feet deep, 80 to 120 feet wide; c) Bill Williams (1853-54) - 1 to 2 feet deep, 15 feet wide; d) Little Colorado (1853) - 2 1/2 feet deep, 10 to 20 yards wide. PSJ 12 at 20; PSJ 19 at 240, 244; PSJ 7 at 8, 102, 109. Other examples are cited at A. 87-96. In addition, experts have estimated the flow rates (in cubic feet per second - "cfs") required to travel on various Arizona rivers, and historical records show that such flow rates have typically been available for substantial parts of the year. For example, one experienced river runner has indicated that 250 cfs is adequate to support travel in a wooden canoe on the Salt between the Highway 60 bridge and Horseshoe Bend. The historic normal annual mean flow on this stretch, based on flow records from 1925 through 1975, is 601 cfs. PSJ 70 at 162; PSJ 18 at 314.

sive than that presented in this case. For example, the Supreme Court in Utah v. United States, 403 U.S. 9 (1971), found the Great Salt Lake navigable at statehood based on occasional use of boats to haul livestock between the mainland and an island, pre-statehood use by an excursion boat, other hauling described by the government as being sporadic and for short terms, and evidence that the lake was deep enough to afford passage at statehood. Id. at 11-12. In City of Centralia v. FERC, 851 F.2d 278 (9th Cir. 1988), the Ninth Circuit found a portion of the Nisqually River in Washington (specifically, a section called the "Mudflats") to be navigable based on evidence that it was accessible by boat at mid- to high-tides, that small ferries were used to carry passengers across the river, and that at times logs were floated on this section.[11] In State of Alaska v. United States, 662 F. Supp. 455 (D. Alaska 1987), the Court found the Gulkana River to be navigable, even though typically frozen for half the year, based on: an undocumented historical account of a trip by native Americans in the 1700's or 1800's; modern day use by recreationists in motorboats, inflatable rafts and canoes; and evidence of current depths ranging from 12 inches to 6 feet. Id. at 466-68. And despite the state's mischaracterization of the case, the court in North Dakota v. Andrus did not merely rule on

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11 The court was determining navigability for purposes of federal regulatory jurisdiction under the commerce clause, but the court noted that the test of navigability for title purposes was "nearly identical." 851 F.2d at 281.

the admissability of evidence, but rather expressly affirmed a finding of navigability based on a few historical accounts and evidence of current recreational use. 671 F.2d at 278.

The review of the law and facts above shows that the state's prediction of a legal "quagmire" in determining navigability of Arizona rivers is completely unfounded. The federal courts have developed a consistent body of law that sets forth a very liberal test of navigability for purposes of the Equal Footing Doctrine. The test has been employed to adjudicate the navigability of numerous rivers in a wide variety of settings across the nation.

C. The State's Title To Riverbeds Vested Automatically At Statehood, And Is Not Merely A "Potential" Claim.

Despite the overwhelming evidence that many Arizona rivers were navigable at statehood, defendants continue to insist that the state holds only a potential claim to riverbeds, while the private claimants remain the "true" owners. Plainly, the state's claim to the riverbeds is more than a "potential" one - its title to the beds of navigable waters vested "automatically" at the "instant" of admission to the Union. Arizona v. California, 373 U.S. 546, 597 (1962); Illinois Steel v. Bilot, 425 N.W. 418, 425 (Wisc. 1901). And the law is unambiguous that land grants and titles are to be strictly construed in favor of the sovereign, particularly where the beds of watercourses are involved. See cases cited in Pl. Open. Br. at 22.[12] Likewise, persons

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[12] The state seeks to distinguish the facts in these cases, but does not refute the basic principles they establish: namely the rule of title construction in favor of the sovereign and the strong identification of riverbeds with the sovereign.

96-003-003

GILA RIVER

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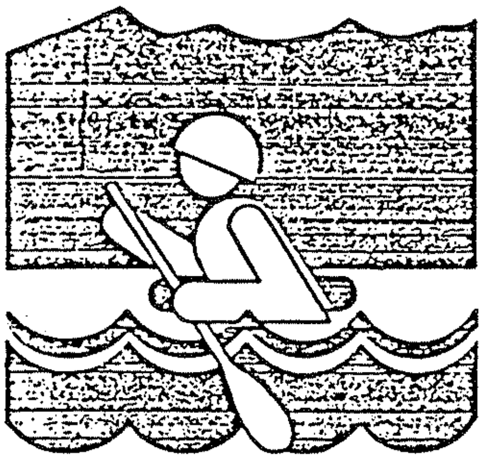
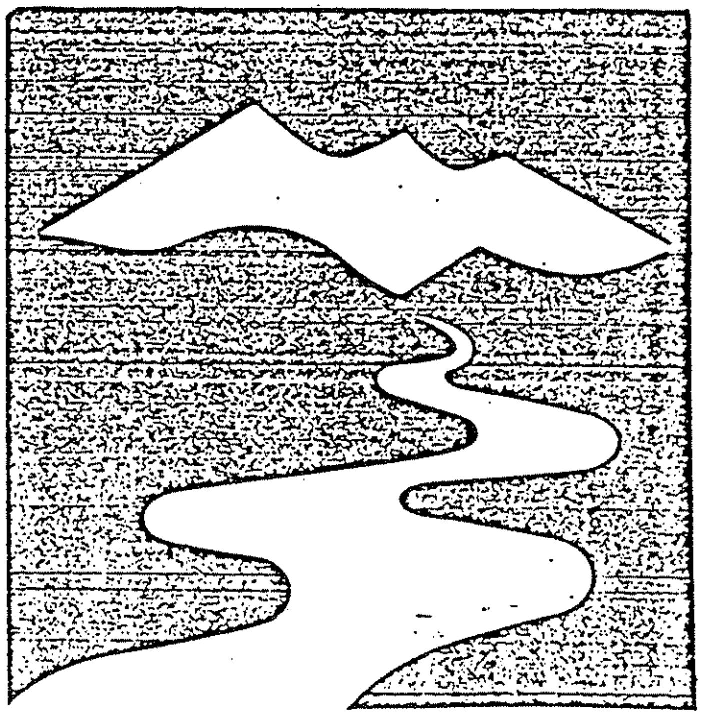


Methods of Assessing Instream Flows for Recreation



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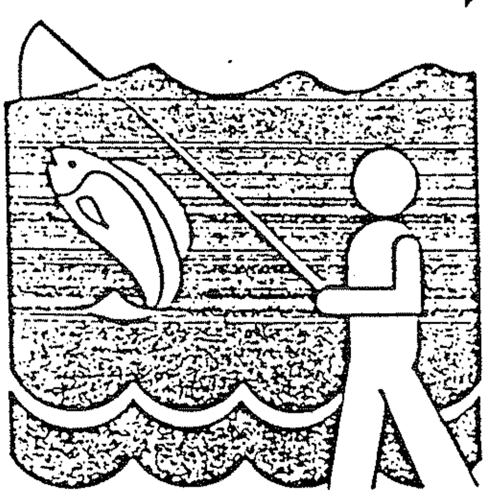

Cooperating Agencies:

Fish and Wildlife Service
Environmental Protection Agency
Heritage Conservation and Recreation Service
Bureau of Reclamation

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FWS/OBS-78/34
June 1978

METHODS OF ASSESSING INSTREAM FLOWS FOR RECREATION

Instream Flow Information Paper No. 6

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This study was financed in
part through the Water
Resources Council under
provisions of the Federal Non-Nuclear
Energy Research and Development Act of 1974

Cooperative Instream Flow Service Group
Western Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior

[1]Detailed to the Cooperative Instream Flow Service Group from the Heritage Conservation and Recreation Service.

TABLE OF CONTENTS

ABSTRACT

The Instream Flow Group (IFG) has conducted research into methods of quantifying instream flow needs for fish, wildlife, and recreation. This paper describes two techniques developed by IFG for performing recreational instream flow studies. The single cross section method is relatively simple and provides a base flow figure which will provide for the boating activities which make use of the of river. The incremental method is more sophisticated and may be used to develop recommendations regarding streamflows required for various types of recreation, or to provide a recreation analysis of any streamflow. Streamflow suitability criteria for recreation are presented for both methods.

INTRODUCTION

It has been long recognized that there are many competing demands for the use of stream water. Diverting stream water for irrigation, water supply, and energy developments can deplete streamflows to the point where opportunities for recreation and the associated environmental values of the stream are seriously impaired. Numerous water planning studies, both basin-wide and project oriented, have emphasized the need to quantify the amount of water required to support recreation, fish and wildlife resources, and to maintain aesthetic conditions.

The tools and techniques for estimating streamflows required for recreation and aesthetics, and for insuring reasonable consideration of recreation and aesthetics in the allocation of stream water, are currently undergoing study. Instream flow requirements and values for recreation, in the past, have often been based only upon the amount required to maintain a fishery. However, several studies have indicated that recreation and aesthetic requirements, at times, may not be the same as for a fishery.

This paper presents the techniques of assessing instream flows for recreation. These techniques were developed by the Cooperative Instream Flow Service Group and closely parallel techniques used to assess instream flows for fisheries. The data collection procedures, the physical and hydraulic simulation of the stream, and the computer models which analyze the data are the same for both fisheries and recreation. The major difference between the two techniques is the response of the individual fish or recreationist to various physical parameters of stream flow. These responses to stream flow by different user groups are the criteria which are basic to the methods introduced here.

The first method is called the single cross section approach. This method is useful primarily for identifying flows below which a recreation activity is not feasible and results in a so called "minimum" flow recommendation.

The second method is called the incremental method. With this method the recreation planner is able to analyze various flows and determine the recreation potential of a stream at different flows.

This paper is being distributed with four objectives in mind. These are:

1. To bring the problem of preserving instream flows to the attention of recreation agencies and the research community in order to encourage more research in this vital and neglected area.

2. To discuss the development of the recreation probability-of-use curves and of recreation criteria in general, which are necessary for quantifying instream water requirements for recreation.

3. To obtain review and comment on the recreation criteria and probability-of-use curves, and to request data which may be used to test or improve the criteria or curves.

4. To describe the two approaches for assessing stream flows and discuss how various recreation planning processes can be served by their application.

Both methods of instream flow analysis discussed in this paper utilize computer modeling techniques. Both approaches also require that streamflow data be collected. The single cross section approach, as its name implies, requires that information be collected at only one location on the stream. The incremental method requires that data be collected at multiple locations on the stream. In addition to cross sectional data, data relating the streamflow parameters to recreation potential are necessary. These data are termed recreation criteria.

Recreation criteria for instream flow methodologies are the recreation activity information bases necessary to describe a relationship between the quantity of water flowing in a stream, and the quantity and quality of a particular recreation activity which takes place in the stream.

SINGLE CROSS SECTION METHOD

This method requires that only a single cross sectional measurement be taken across a stream. The product of such an approach is a determination of the lowest flow acceptable for recreation. The approach is based on the assumption that a single cross section, properly located, can define a minimum flow requirement. Such a cross section is located at an area displaying the least depth across the entire stream. When this area provides minimum depths for boat passage, the flow at this level may be defined as a minimum acceptable flow. It is assumed that when sufficient water to support boating is available in these critical areas, other areas will have sufficient water to support most of the other instream recreation activities. This approach is best applied to those streams in which flows are expected to be higher than the minimum most of the time.

Criteria for this approach are set forth in Table 1. Criteria have been developed for boating activities only, but for various types of boating craft. Only minimum criteria are presented because this approach provides information on "minimum flows." Criteria are measured in terms of stream depth and width. Velocity is not considered because a minimum velocity is not considered necessary for this approach.

Table 1. Required stream width and depth for various recreation craft as determined by single cross section method.

Recreation Craft	Required depth (ft)	Required width (ft)
Canoe-kayak	0.5	4
Drift boat, row boat-raft	1.0	6
Tube	1.0	4
Power boat	3.0	6
Sail boat	3.0	25

The criteria of Table 1 are minimal and would not provide a satisfactory experience if the entire river was at this level. However, the cross section measured for this method is the shallowest in the stream reach. Therefore, these minimum conditions will only be encountered for a short time during a boating trip, and the remainder of the trip will be over water of greater depths and widths. An important assumption is that all water greater than the minimum is equally useful for the activity (i.e., more is better until bank-full stage).

A computer program (IFG-1) has been developed which predicts width and depth across the transect of any stage (water surface elevation). The output shows discharge and the width with depth equal to or greater than a specific depth. Different water surface elevations may be put into the computer model which are translated into flow in cubic feet per second. When a flow provides the minimum width and depth necessary for an activity, discharge may be considered minimum. Such a minimum indicates that significant losses, if not elimination of this activity, will occur if minimum flow is not equaled or exceeded.

THE INCREMENTAL METHOD

This method, more sophisticated than the single cross section method, describes a relationship between the amount of water in a reach of stream and the associated recreation potential. The incremental method can describe the potential for any recreation activity at any streamflow. A major difference between the methods is that the single cross section method can only be used to identify low flow and cannot be used to assess the recreation potential at any other flow; the incremental method can be used to assess the potential at other flows or to calculate the change in receation potential caused by a change in stream flow..

The incremental method involves a modeling procedure whereby the surface area of a stretch of stream is calculated. In addition to the total surface area of the reach of stream, the area which has certain depths and velocities is calculated. The usable surface area for each activity is then calculated by use of depth and velocity requirements.

It is necessary to make three assumptions regarding the relationship between the quantity of water and the recreation uses of the water: (1) water depth and water velocity are the two streamflow components which are most important in determining whether or not a certain recreation activity may be safely and pleasurably engaged in[1]; (2) there are

[1]Other parameters such as water quality and temperature are also very important in determining the amount of instream recreation use but in many cases are not significantly influenced by flow. Width is also important but is considered outside of the computer model (i.e., width is not a part of the calculation of usable surface area).

GILA RIVER
#4

AFFIDAVIT

STATE OF ARIZONA)
ss
County of Maricopa)

My name is Jerry Van Gasse, President of Arizona Whitewater Expeditions (AWE), an Arizona proprietorship with offices in Tempe. AWE is a commercial river running company, offering rafting and kayaking trips to members of the public on the Salt, Gila, Verde, San Francisco, and Virgin Rivers. I have a total of nine years experience as a professional river guide, and have participated in more than two-hundred trips on rivers in Arizona and other states. The U.S, Forest Service and the Bureau of Land Management have issued official permits to AWE to conduct commercial river trips on the Verde and Gila Rivers. In addition, AWE has applied for a permit to conduct commercial trips on Tonto Creek.

We run approximately twenty trips each year on the Salt River in the period from December through May. On the Verde River, we lead approximately six trips per year during the period January through March. We conducted five trips on the San Francisco/Gila Rivers beginning just this year during the period of February through April. The trip starts at Clifton on the San Francisco and ends at the confluence of the Gila and Bonita Creek. We also have a commercial permit for river trips on the Virgin River, and have floated this stream in the period of March through May. Based on my experience, all of these rivers are very suitable for river travel during the

Dated this 14th day of July, 1987.

Jerry Van Gasse

Jerry Van Gasse

Subscribed and sworn to before me this 14th day of July, 1987

Melinda Vetterlein

Notary Public

My commission expires:

OFFICIAL SEAL
MELINDA VETTERLEIN
NOTARY PUBLIC - STATE OF ARIZONA
MARICOPA COUNTY
My Comm. Expires April 19, 1989

96-003-003

GILA RIVER

05

AFFIDAVIT

STATE OF ARIZONA)
) ss.
County of Maricopa)

Janet E. Cantley, being first duly sworn on her oath, states:

1. I currently reside at 335 W. Pebble Beach, Tempe, Arizona 85282.

2. I am Curator of Photographs at the Tempe Historical Museum at 3500 S. Rural Road, Tempe, Arizona 85282.

3. Duties of the Curator of Photographs include maintenance, conservation, and reproduction of the historical photographs of the collection.

4. According to museum records, the photograph labelled "Photo #1" was reproduced from the negative of an original photograph loaned by the Tempe Daily News. The photograph depicts the Tempe State Bridge in 1914. A copy of this photograph is attached to this affidavit as "Photo #1."

5. According to museum records, the photograph labelled "Photo #2" was reproduced from the negative of an original photograph loaned by the Salt River Project. The photograph depicts the Hayden's Ferry c. 1887. A copy of this photograph is attached to this affidavit as "Photo #2."

Law Sch[illegible] [illegible]nic
Arizona S[illegible] University
Tempe, AZ 85287
(602) 965-6968

6. According to museum records, the photograph labelled "Photo #3" was reproduced from the negative of an original photograph loaned by Helen Harter. The photograph depicts a Salt River Swimming Hole in 1923. A copy of this photograph is attached to this affidavit as "Photo #3."

7. Photographs labelled "Photo #1", "Photo #2", and "Photo #3" are reproduced from negatives maintained in the photograph collection of the Tempe Historical Museum.

Janet E. Cantley

Janet E. Cantley

SUBSCRIBED AND SWORN to this 2nd day of May, 1988.

Bonita A. Cotter

Notary Public

My commission expires:
My Commission Expires Sept. 21, 1991

Law School
Arizona State University
Tempe, AZ 85287
(602) 965-6968

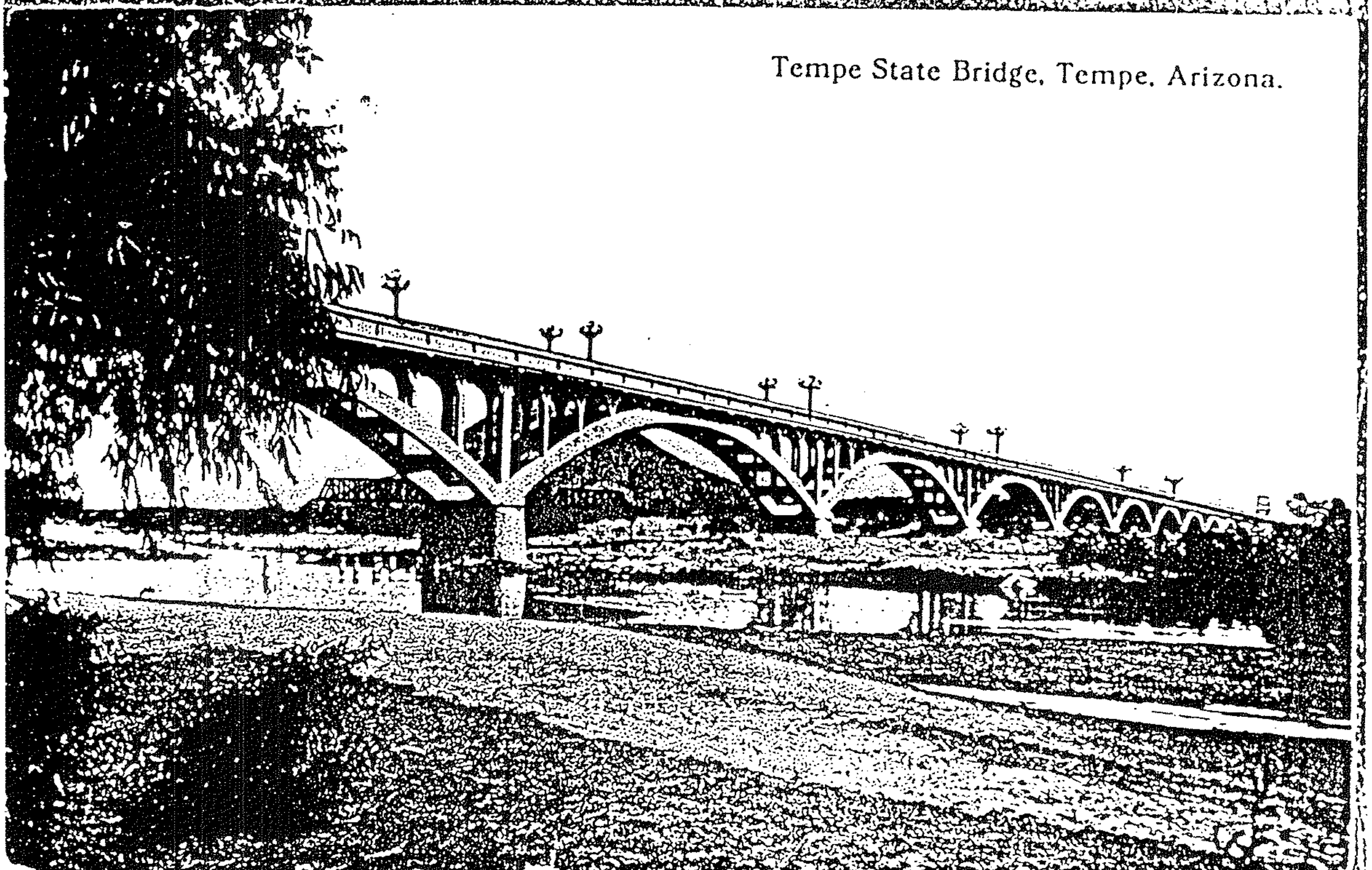

PHOTO #1

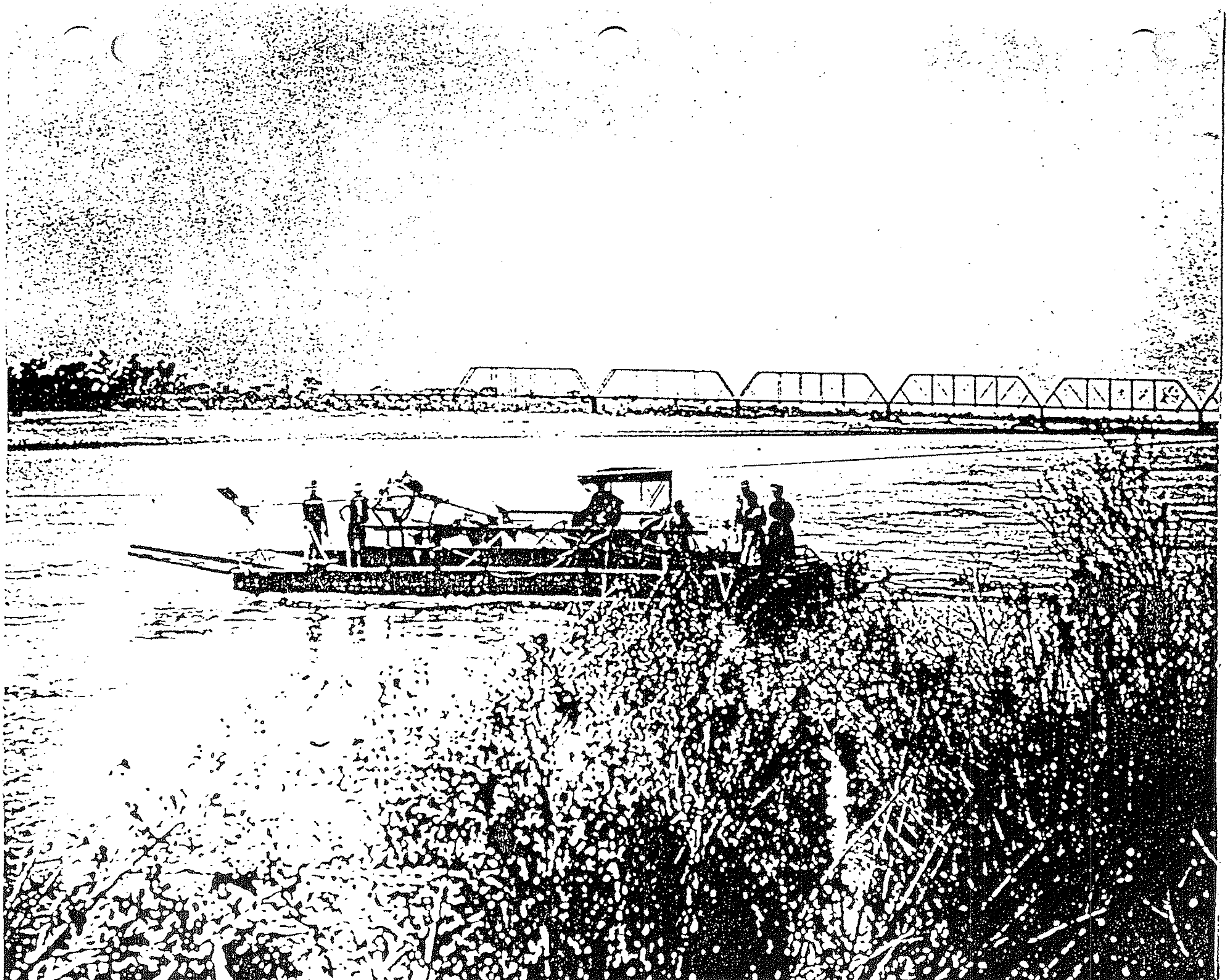

PHOTO #2

PHOTO #3

Terms for the Loan of an Object from the Tempe Historical Society, 3500 S. Rural Road, Tempe, Arizona 85282.

The Borrower agrees to credit the Tempe Historical Society and the Tempe Historical Museum for the loan of the object(s) in all publicity and exhibitions, handouts, and publications; to return the object(s) in the condition in which they were loaned; to return them to the Museum on or before the expiration date of this agreement, to reimburse the Museum for any loss or damage incurred to the loaned object(s). The borrower is responsible for being familiar with the Museum's policies and procedures as they relate to loans.

The Borrower may not photograph, make a replica of, repair or otherwise alter the loaned object(s) unless permission is herein expressly given: ____________
____

96-003-063

Gila River
06

AFFIDAVIT

STATE OF ARIZONA)
) ss
County of Pima)

My name is James Anthony Slingluff. I have twenty-two years of canoeing experience. I have canoed extensively in Arizona since 1984.

I have canoed each of the following sections of Arizona rivers on multiple occasions (exceptions noted) and believe each to be very suitable for river travel in the seasons indicated at the boating skill level noted.

1. Salt River:

A. Highway 60 bridge to Horseshoe Bend; all seasons; intermediate boating skills.

B. Horseshoe Bend to Highway 288 bridge; all seasons; beginning boating skills.

C. Stewart Mountain Dam to Granite Reef Dam; subject to dam releases (ordinarily in summer); beginning boating skills.

2. Verde River:

A. Perkinsville to TAPCO power plant (Clarkdale); all seasons; beginning boating skills (except for two particular rapids).

B. Dead Horse Park to Thousand Trails Campground; Fall/Winter/Spring; beginning boating skills.

C. Beasely Flat to Childs; Fall/Winter/Spring; intermediate boating skills.

D. Childs to Horseshoe Lake; Fall/Winter/Spring; beginning boating skills.

3. Little Colorado River, Grand Falls to Black Falls; snowmelt, monsoons; beginning boating skills.

4. Wet Beaver Creek:

A. Ranger Station to Montezuma Castle, one trip; snowmelt, monsoons; advanced boating skills.

B. Montezuma Castle to confluence with Verde; snowmelt, monsoons; beginning boating skills.

5. Dry Beaver Creek, Highway 179 to Interstate 17, one trip; snowmelt, monsoons; intermediate boating skills.

6. Oak Creek:

A. YMCA Camp to Page Spring, one trip; snowmelt, monsoons; intermediate boating skills.

B. Page Spring to Cornville; Fall/Winter/Spring; beginning boating skills.

C. Cornville to confluence with Verde; all seasons; beginning boating skills.

I have encountered other recreationists (boaters, hikers, and/or fishermen) on all the aforementioned sections of the Salt, Verde, Little Colorado, Wet Beaver, Dry Beaver and Oak Creek.

Further affiant saith not.

Dated this 15 day of July, 1987.

James Anthony Slingluff

James Anthony Slingluff

Subscribed and sworn to before me this 15th day of July, 1987.

Leta R. Chapman

Notary Public

My commission expires: My Commission Expires February 5, 1989

96-003-003

Gila River

07

AFFIDAVIT

STATE OF ARIZONA)
) ss
County of Coconino)

My name is George Marsik, President of Worldwide Explorations, Inc., an Arizona corporation with offices in Flagstaff. Worldwide Explorations is a commercial river running company, offering rafting and kayaking trips to members of the public on the Salt and Verde Rivers. I have been with Worldwide Explorations for five years, and have a total of eleven years experience as a professional river guide. I have participated in literally hundreds of river trips on a variety of rivers both in Arizona and in other states. The United States Forest Service has issued official permits to Worldwide Explorations to conduct commercial river trips on the Salt and Verde Rivers.

We conduct approximately forty river trips each year on the stretch of the Verde running from Camp Verde to Sheep Bridge. The river ordinarily has sufficient water for such trips during the months of October through April. In my opinion, this stretch of the river would be useable for such trips year around were it not for water diversions for agricultural irrigation.

The Verde River has been designated by Congress and President Reagan for protection under the National Wild and Scenic Rivers Act. Because of this legislation, the Verde River from Beasley Flat to Sheep Bridge has been guaranteed the protection that this unique resource deserves. The outstanding attributes of the Verde River are unique in the world. It probably has the finest riparian habitat in the state of Arizona and the Southwest. Numerous biological studies have detailed the richness and diversity of life along its banks.

The segment of the Verde River that was designated Wild and Scenic is not the only section on the river that provides critical habitat for threatened and endangered species. Because of its topography, climate and area of drainage, the Verde River as a whole provides and maintains much critical habitat that is essential for protecting and sustaining many species that are threatened and endangered. Loss of any segments of this critical habitat would diminish the ecosystem's ability to provide sufficient quantity of territory to allow for diversity.

On the Salt River, Worldwide Explorations conducts approximately 100 trips per year between the Highway 60 bridge and the Highway 288 bridge. We conduct trips within this stretch year around.

Preservation of the river bottom and riparian wildlife habitat is critical to maintaining the recreational and aesthetic values of these rivers. I have observed sand and rock mining operations in the bed of the Verde River that have destroyed acres of riparian habitat, diverted river flows, and severely impaired the scenic beauty of the river channel. In my opinion, further private development in and along the beds of the Salt and the Verde Rivers will substantially impair our operations and the use and enjoyment of these areas by the public.

Affiant saith nothing further.

Dated this _____ day of ___________, 1987.

George A. Marsik
George Marsik

Subscribed and sworn to before me this 14th day of July, 1987.

Ingrid A. Lamphere
Notary Public

My commission expires: 9-1-90

4

96 - 003 - 004

GILA RIVER

01

ORIGINAL

RECEIVED 8-30-96

JOHN S. SCHAPER
Attorney at Law
P. O. Box 26860
Phoenix, AZ 85068-6860

Telephone and Fax (602) 371-1952

August 30, 1996

Christina Waddell, Executive Director
Arizona Navigable Stream Adjudication Commission
1700 West Washington
Phoenix, AZ 85007

Re: Gila River

Dear Ms. Waddell:

On behalf of the Buckeye Irrigation Company and the Buckeye Water Conservation and Drainage District, I enclose the original and six copies of a Memorandum dealing with the effect of irrigation diversions prior to 1912 on the flow of the Gila River at the Salt River confluence to be filed in the above matter.

It is my understanding that the Commission will deal with questions concerning the navigability of the Gila River in two stages, and that the enclosed material may not be of concern in the initial proceedings. However, it has also been my understanding that any evidence relating to the Gila was to be submitted no later than September 3, 1996. Therefore, the enclosed material is provided to you for filing at this time.

Very truly yours,

John S. Schaper

JSS:w
Enc.
c: Jackie Meck

96 - 003 - 004

ORIGINAL

GILA RIVER

02

RECEIVED 8-30-96

MEMORANDUM

EFFECT OF IRRIGATION DIVERSIONS PRIOR TO 1912 ON FLOWS OF GILA RIVER AT SALT RIVER CONFLUENCE

Introduction

A.R.S. § 37-1128, as amended in 1994, requires that the navigability of any watercourse in Arizona as of February 14, 1912, be determined by taking into account dams and diversions of water, and other cultural uses, as part of the natural and ordinary condition of the watercourse. That provision is consistent with Article 17, § 2, *Arizona Constitution*, which confirmed all appropriative rights to the diversion and use of water acquired prior to statehood under various Territorial and Federal laws, including the Mining Law of 1866 and the Desert Land Act of 1877. It is also consistent with the position taken by the Buckeye Irrigation Company in the memorandum attached as Item 1, which was submitted to ANSAC on January 13, 1994, in Docket No. 94-1, before the enactment of the current statute. Therefore, any consideration of the navigability of the Gila River, or any segment, must begin with an understanding of the extent to which the flow of the river was altered and depleted by appropriation before 1912.

The following information has been taken from records and other materials maintained in the office of the Buckeye Irrigation Company, and is either public information or was prepared by consultants and attorneys for the Buckeye Irrigation Company in connection with litigation concerning the depletion of flows in the Gila River at the headgate of the Buckeye Canal.

The Buckeye Diversion

The diversion dam for the Buckeye Canal is located in the bed of the Gila River immediately west of the confluence of the Gila and the Agua Fria River. Flows in the Gila at that point provide water for agricultural irrigation of land on the north side of the Gila River located south of the Buckeye Canal.

The first diversions of water from the Gila River in the Buckeye Valley were made in 1886. Water rights for lands irrigated under the Buckeye Canal, and for other canals upstream on the Salt River below Joint Head Dam, were adjudicated by a decree entered in the Maricopa County Superior Court in 1917 in Cause No. 7589. (The "Benson-Allison" decree.) Rights were established by that decree for over 19,500 acres of land with priority dates of 1911 or earlier, and with water duties permitting the diversion of a constant flow in excess of 235 c.f.s. (Item 1, Exhibit B) Water reaching the Buckeye diversion included flows in the Agua Fria River, although that stream was normally dry and has been estimated to have contributed no more than one per cent of the available flow of the Gila.

There are almost no recorded measurements of the flows in either the Salt or Gila at the confluence of those rivers during any period prior to 1912. A few records exist of measurements in canals diverting water from the Salt River below Joint Head Dam prior to 1912. There are no continuous records of actual diversions into the Buckeye Canal prior to 1913, and no continuous diversion records were kept by the Buckeye Irrigation Company before 1918. Both the Salt and Gila were and are braided streams above the Buckeye diversion, and the base flow was contained in several different channels. The entire base flow of the river was diverted into the Buckeye Canal for many years prior to 1912 when it was possible to accomplish the diversion. (Damage to the diversion works from flooding and other factors frequently interrupted the diversion of water.)

The Gila River at the Salt River Confluence

In 1942, S. T. Harding, a prominent engineer and water rights expert employed by the Buckeye Irrigation Company, conducted a study which included estimates of flows in the Gila River at the Salt confluence for the period from 1896 to 1910 - the 15 years prior to the construction of Roosevelt Dam. He reviewed available records of diversions on both the Salt River and Gila River, as well as limited information in various publications. His conclusion was that there was little or no base flow in the river between Gila Crossing and the Salt confluence during most of the summer months, and that upstream diversions by prior appropriators took the entire flow of the river at different diversion points, and kept many segments of the river dry. (A copy of Harding's table of estimated flow is attached as Item 2. An excerpt from Lee's study published in 1904, W.S.P 104, Underground Water of Gila Valley, is attached as Item 3.)

The conclusion that the Gila River was an intermittent or ephemeral stream at the Salt River confluence prior to 1912 is consistent with the fact that appropriative rights to divert more than 1000 c.f.s. above Gila Crossing existed at that time, and were confirmed in 1935 by the decree in Globe Equity No. 59, United States District Court for Arizona. (Attached as Items 4 and 5 are tables appearing on pp. 103 and 109 of the 1993 report of the Department of Water Resources on rights established by the Globe Equity Decree.) That conclusion is also consistent with the determination of the 1960 report of the Special Master in *Arizona v. California*, 373 U.S. 546 (1963), that the Gila River was overappropriated.

The Salt River at the Gila River Confluence

The entire normal flow of the Salt River was appropriated before 1910 by diversions at Joint Head Dam or at Granite Reef Dam. In the Kent Decree of 1910 (*Hurley v. Abbott*, No. 4564, Territorial Court for the Third District, Maricopa County), it was recognized that lands west of Joint Head Dam might be entitled to divert water rising in the Salt River below that dam, but that a determination of the appropriative rights of those lands was beyond the scope of the adjudication made by that decree.

The Kent Decree established appropriative rights for over 151,000 acres of land within what is now the Salt River Project, and recognized rights for the use of waters to be stored behind Roosevelt Dam, which was completed in 1910 with a storage capacity of approximately 1,300,000 acre feet. (Item 1, Exhibit A)

Because of the appropriative rights recognized by the Kent Decree, the base flow in the Salt River immediately upstream from the Gila confluence existed only because of seepage, agricultural return flows and rising groundwater. Two court decrees recognized rights to divert and use that water.

In 1903, *United States v. Haggard*, No. 19, Territorial Court of the Third District, Maricopa County, established rights for the irrigation of 3034 acres of land on the north and south side of the Salt River from diversions below Joint Head Dam, including certain Indian lands, with a water duty of 40 inches per 160 acres, constant flow, or approximately 19 c.f.s. The Benson-Allison Decree confirmed the Haggard Decree and established additional rights for the irrigation of lands under the St. Johns Canal, the New State Canal, and other small diversions. (Item 1, Exhibit B)

Harding estimated that the summer flow rising in the Salt River below Joint Head Dam during the period from 1896 to 1910, and reaching the Buckeye diversion, would have ranged from 92 c.f.s. to 155 c.f.s., with an average of 124 c.f.s. The effects of storage at Roosevelt Dam were estimated to have caused a subsequent reduction in that flow to approximately 80 c.f.s. Measurements made in June of 1899 established that the flow of the Salt River, after the diversion of 7.8 c.f.s. at the St. Johns Canal in the vicinity of what is now 91st Avenue, was 23.9 c.f.s., and that the Salt and Gila gained approximately 80 c.f.s. between that point and the Buckeye Canal heading eight miles to the west of the St. Johns Canal. The entire flow of the Gila was then diverted into the Buckeye Canal, leaving 1 c.f.s in the river.

Harding found no records of Gila River flow for any period prior to statehood for the segment between the Buckeye diversion and Gillespie Dam, but estimated that the gain in that reach of the river from return flows and rising groundwater would have been between 30 c.f.s. and 65 c.f.s., taking into account the diversions by the Arlington Canal.

Summary

All available data indicate that both the Salt River below Joint Head Dam, and the Gila River from the Salt confluence to Gillespie Dam, were sustained primarily by seepage, rising groundwater, and agricultural return flows prior to 1912, and that normal base flows in both rivers were appropriated for irrigation at any location where the flow of the river and the topography of the surrounding area would permit gravity flow diversions. Because of repeated appropriations, the rivers did not flow in sufficient volume or for distances which would have sustained commercial navigation in those segments.

96-003-004

Gila River
03

JOHN S. SCHAPER
State Bar No. 001148
P. O. Box 33127
Phoenix, AZ 85067-3127
(602) 371-1952

Attorney for Buckeye Irrigation Company and
Buckeye Water Conservation and Drainage District

BEFORE THE ARIZONA NAVIGABLE STREAM ADJUDICATION COMMISSION

IN THE MATTER OF NAVIGABILITY OF THE SALT RIVER (From Granite Reef Dam to the Gila Confluence.)	Docket No. 94-1 MEMORANDUM CONCERNING NAVIGABILITY AND MOTION FOR SUMMARY DETERMINATION OF NON-NAVIGABILITY

The Buckeye Irrigation Company and the Buckeye Water Conservation and Drainage District submit the memorandum attached hereto and incorporated heren by reference, for consideration by the Commission in determining the navigability of the Salt River from Granite Reef Dam to the confluence of the Salt River and Gila River, and other watercourses in Arizona, and move that the Commission summarily determine as a matter of law that the Salt River was not a navigable watercourse on February 14, 1912.

This submission of this motion and memorandum does not constitute a waiver of objections previously made to the jurisdiction of the Commission to determine the navigability of the Salt River, or any other watercourse in the State of Arizona.

DATED this 13th day of January, 1994.

John S. Schaper

John S. Schaper
Attorney for
Buckeye Irrigation Company and
Buckeye Water Conservation
and Drainage District

MEMORANDUM

The Navigability Definition

The Commission's task requires application of A.R.S. Sec. 37-1101(6), which defines a "navigable watercourse" as one which was in existence on February 14, 1912, and was used or susceptible of being used in its ordinary and natural condition as a highway for commerce over which trade and travel could have been conducted in the customary modes. "Watercourse" means a natural "body of water." A.R.S. Sec. 37-1101(11).

The statute adopts what is sometimes called the "Federal" test of navigability, which was articulated by the United States Supreme Court in The Daniel Ball, 77 U.S. 557 (1870). The statute also requires a showing that a river was used for both commercial trade and travel before it can be found to have been navigable. The general standard is essentially the same as that adopted by the Congress for the exercise of jurisdiction for commerce purposes over navigable streams under the Rivers and Harbors Act. 33 U.S.C. Sec. 401 et seq; 33 CFR 329.1 et seq. The significance of that statute is discussed subsequently.

The Daniel Ball definition is distinct from other inapplicable concepts such as "waters of the United States," which establishes Federal jurisdiction for purposes of the Clean Water Act. 33 U.S.C. Sec. 1344; Cf. 33 C.F.R. Sec. 328.3(a). Similarly, definitions of "waters of the state" which are subject to control by the Arizona Department of Environmental Quality under A.R.S. Sec. 49-201 et seq., and "public waters" which may be under the jurisdiction of the Arizona Department of Water Resources under A.R.S. Sec. 45-141 et seq. are irrelevant for purposes of determining navigability.

The Commission should bear in mind that the Daniel Ball test was recognized and understood at both the Federal and Territorial level when the Arizona Territory was being settled after 1870 and prior to 1912. An examination of the laws dealing with rivers in Arizona enacted during that era by the United States Congress and the Territorial Legislature, and the Arizona Constitution drafted in 1910, requires the Commission to conclude that the Salt River was never considered by any legislative, administrative, or judicial body at that time to be navigable under the Daniel Ball test, and the Commission cannot now make a contrary determination.

Appropriation and Navigability

It is undiputed that in 1912 the flow of the Salt River was almost entirely depleted between Granite Reef Dam and the Gila confluence because of impoundments at Roosevelt Lake, and diversions at Granite Reef Dam, at Joint Head Dam, and at canal headings between Joint Head and the Gila confluence. (See: CH2M Hill Final Report at 82)[1] The use of the waters of the river was essential to the maintenance of life in an arid environment. The depletion of the natural flow of the river was sanctioned by both the Federal and Territorial governments, and neither

----

1. Curiously, the CH2M Hill Report makes absolutely no mention of diversions of water from the Salt River by irrigation projects downstream from Joint Head Dam both north and south of the river, including lands in the St. Johns Irrigation District, the New State District, the Peninsula-Horowitz area, and Indian lands. Water rights for those lands were adjudicated in 1917 in Benson v. Allison, No. 7589 in the Maricopa County Superior Court.

considered the river to be navigable under the Daniel Ball test. On the contrary, the laws of that era governing the use of the river, and property rights established under those laws, presumed that the river was a not a navigable highway for commerce and travel.

Territorial Legislation

In 1864, the Territorial Legislature declared all rivers, creeks and streams of running water in Arizona to be public, and applicable to mining and irrigation. Art. 22, Bill of Rights, Howell's Code. Common law riparian rights in streams were also rejected by the Territorial Legislature. Rev.Stat. 1877, Sec. 3198.

The Territorial Supreme Court approved the right to appropriate water in a series of cases in 1888, and subsequently recognized the right of a prior appropriator to divert and use the waters of any stream for beneficial purposes, regardless of the sufficiency of the flow to meet the needs of others. See: Hill v. Lenormand, 2 Ariz. 354, 16 P. 266 (1888); Dyke v. Caldwell, 2 Ariz. 394, 18 P. 276 (1888); Clough v. Wing, 2 Ariz. 371, 17 P. 453 (1888); Hunning v. Porter, 6 Ariz. 171, 54 P. 584 (1898).

The Territorial Legislature also adopted laws which granted the right to condemn lands for canal and ditch purposes. Oury v. Goodwin, 3 Ariz. 255, 26 P. 376 (1891), upheld the validity and need for such laws, concluding that the diversion and use of water for agricultural irrigation was in the public interest and justified the grant of condemnation powers to private persons. (Public bodies and private persons still have the power to condemn riverbed property to impound, divert, obtain, and transport water for beneficial use. A.R.S. Sec. 12-1111(4), (12), and (16).)

By 1910, extensive appropriations of water had been made by diversions from the Salt, Gila, Agua Fria, Verde, San Pedro, Little Colorado, Hassayampa, and other rivers and their tributaries in Arizona. The importance of those diversions prompted the drafters of the Arizona Constitution to then include Article XVII which expressly recognized and confirmed all existing rights to the appropriation and beneficial use of "any of the waters" in the state, and repudiated the concept of riparian water rights.

The Constitutional confirmation of existing appropriation rights to divert and consume water cannot be reconciled with the idea that a watercourse could be used for commercial purposes or travel. Article XVII of the Arizona Constitution is entirely repugnant to the argument that a stream which was wholly controlled and diverted for beneficial use could have been "navigable in fact" in 1912.

In summary, the diversion of rivers for consumptive agricultural, mining, and domestic use was critical to the settlement of the Arizona Territory, and was established as a matter of paramount public importance by the Territorial Legislature, and by those who wrote the Arizona Constitution. There is no recognition in any Territorial or State enactment of any protected right of navigation involving a river within Arizona. On the contrary, all applicable local laws regulating the use of rivers and streams which existed prior to 1912 cannot be reconciled with the idea that any Arizona watercourse was navigable under the Daniel Ball test. Moreover, every Federal law applicable to the use of water in the Arizona Territory is consistent with and confirms the non-navigability of the Salt River in 1912.

Federal Legislation

Under treaties with Mexico, the United States of America acquired title to all lands in the Arizona Territory which had not been confirmed to persons who had obtained titles from Spain or Mexico. The United States also obtained plenary control of all waters in the Territory, including the right to delegate the regulation of the use of non-navigable water to the Territorial Legislature. See: Boquillas Land and Cattle Company v. St. David Assn., 11 Ariz. 128, 89 P. 504 (1907).

The Congress encouraged private persons to settle the largely vacant public domain, recognizing their rights to construct and maintain facilities for the diversion of stream flows to obtain water for beneficial use, and confirming water rights acquired under local laws. Specific statutes were passed in 1866, 1870 and 1877 dealing with those water rights. See: 30 U.S.C. Sec. 51; 43 U.S.C. Secs. 321 et seq. and 661. The right to locate diversion facilities in the bed of any stream in accordance with local laws was expressly confirmed and approved by those statutes. See: Gila Water Co. v. Green, 27 Ariz. 318, 232 P. 1016 (1925), which involved what is now Gillepie Dam on the Gila River.

The Desert Land Act of 1877, 43 U.S.C. Sec. 321 et seq., is of particular interest because it granted settlers in arid states the right to acquire as much as 640 acres of land for a total of $1.25 per acre if the land could be irrigated from a non-navigable watercourse within three years of the date of entry.

The Desert Land Act was specifically applicable to Arizona, and permitted entry upon, and issuance of a patent for lands which would not, without irrigation, produce some agricultural crop. The statute had a significant impact. The 1890 census found 1,075 persons were irrigating 65,821 acres in Arizona in 1889. By 1910, 320,051 acres in the Arizona Territory were irrigated - 300,067 by gravity flow diversions from streams. See: Kinney on Irrigation and Water Rights, 2d Ed., Secs. 253, 256, pp. 413, 416-420.

Much of the new Arizona acreage irrigated between 1877 and 1910 by settlers under the Desert Land Act was in the Salt River Valley. Table 10 of the Kent Decree of 1910, which determined all rights to the appropriation of the Salt River above Joint Head Dam, established that 121,365 acres were brought into cultivation by the diversions from the Salt River during that period. Similarly, from 1883 through 1911, 25,938 acres were brought under irrigation by the diversion of water from the Salt River downstream from Joint Head Dam, and by the Buckeye Canal immediately below the confluence of the Salt and Gila. See: Exhibits A and B attached.

Patents for those lands issued under the Desert Land Act were necessarily based upon the premise that the water applied to the lands came from a non-navigable stream. Otherwise, the land could not have been settled, irrigated, and patented under that Federal law. The titles to those lands depended upon the use of non-navigable waters from the Salt River.[2]

At the same time, the Congress was also aware of and concerned about the protection of navigable waters throughout the United States. An 1890 law prohibited any unathorized obstruction to the navigable capacity of any waters over which the United States had jurisdiction. 26 Stat. 454, Sec. 10. That law was refined in in 1899 by the Rivers and Harbors Act requirement that any obstruction could be placed in a navigable stream only with approval of the Corps of Engineers and the Secretary of the Army. 33 U.S.C. Sec. 403. There is no evidence that the United States ever exercised a right to control the Salt River under the 1899 law - a point ignored in the CH2M Hill Report discussion of Federal criteria for navigability. (p. 97)[3]

It is also significant that the construction of Roosevelt Dam by the Department of the Interior under the National Reclamation Act of 1902, 43 U.S.C. Sec. 372 et seq., was justified as an additional means for the storage and diversion of

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2. The Desert Land Act was undoubtedly used to obtain title to irrigated land in the Salt River Valley. See: Arnold v. Christy, 4 Ariz. 19, 33 P. 619 (1893), which involved the validity of a contract to sell unpatented land by a person who had made an entry under the Act on a section near Glendale, Arizona, which was irrigated from the Arizona Canal.

3. The Corps of Engineers does exercise juridiction over the Salt River, and other watercourses in Arizona, under Section 404 of the Federal Clean Water Act. 33 U.S.C. Sec. 1344(b) However, that statute does not apply the Daniel Ball standard of navigability, and involves much broader jurisdiction than is exercised under the Rivers and Harbors Act.

water to promote the settlement of otherwise unusable lands. The Federal government could not have lawfully built Roosevelt Dam under the Reclamation Act unless the water stored in the dam was available for diversion and irrigation use in the Salt River Valley. If anyone then believed that the Salt River was navigable, a project designed to impound and divert its entire flow would have been completely inconsistent with any Constitutional right and duty to use and protect the river for navigation, would have done violence to the Desert Land Act, and would have ignored the purpose of the Rivers and Harbors Act.[4]

In 1910, Justice Kent made it clear that there could never be a question about the legality of appropriative rights to waters of the Salt River or to the titles to lands established under Territorial statutes or the Desert Land Act, or about the legality of the impoundment of the river by Roosevelt Dam, or about the non-regulation of the Salt River by the Corps of Engineers. He concluded that the Salt River was non-navigable. The United States was a party to the litigation in which that conclusion was reached. That conclusion was and is inescapable and unassailable.

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4. The water of a navigable stream may be appropriated under local law if navigability is not impaired by the depletion of the flow. But, navigability is a paramount concern, and the Constitutional obligation of the Federal government to protect commerce on navigable streams cannot be surrendered to a local government. United States v. Rio Grande Dam & Irr. Co. 174 U.S. 690 (1899).

Conclusion

Arizona was settled and has grown because the right to appropriate and use its rivers was sanctioned and encouraged by every governmental organization having control of those resources.

If the Salt River had been navigable prior to 1912, the United States Congress, the Bureau of Reclamation, the General Land Office, and the Corps of Engineers would have protected the navigability of the river for commerical purposes. The United States did not do so. On the contrary, the Federal government encouraged thousands of settlers to invest their lives and fortunes in the use of the river for the development of irrigation systems which were allowed only on non-navigable streams. The United States permitted those water rights which it had promoted to be confirmed in the Arizona Constitution. It was a party to the 1910 ruling of Edward Kent, the most respected Arizona jurist of that period, that the Salt was not navigable.

The Arizona Navigable Stream Adjudication Commission cannot assume that the Federal government abdicated its responsibilities to regulate the Salt River as a navigable stream before 1912. Nor can the Commission now rewrite the legal history of Arizona. The Commission must conclude, as everyone concluded at the time, that the Salt River was not a navigable watercourse in 1912.

Respectfully submitted,

John S. Schaper

John S. Schaper

EXHIBIT A

Table 10 From The Kent Decree

Showing Acreage Irrigated From the Salt River

Prior to 1910

TABLE No. 10.

"A table of acres and miners' inches for Class A land, showing the total acreage year by year and water for the same at 48 miners' inches per quarter section or one miners' inch for every three and one-third acres.

YEARS	Total acreage and miners' inches	Total on North Side	Total on South Side	Broadway Canal	San Francisco Canal	Tempe Canal	Utah Canal	Mesa Canal	Consolidated Canal	Highland Canal
Indian	2,333	2,333								
	700	700								
1869	5,543	5,543								
	1,663	1,663								
1870	7,363	6,998	365	365						
	2,209	2,099	110	110						
1871	11,528	10,293	1,235	365		820	50			
	3,459	3,088	371	110		246	15			
1872	18,228	12,163	6,065	365		5,650	50			
	5,469	3,649	1,820	110		1,695	15			
1873	20,623	12,623	8,000	365	1,625	5,960	50			
	6,187	3,787	2,400	110	487	1,788	15			
1874	21,028	13,028	8,000	365	1,625	5,960	50			
	6,308	3,908	2,400	110	487	1,788	15			
1875	21,908	13,088	8,820	365	1,945	6,460	50			
	6,572	3,926	2,646	110	583	1,938	15			
1876	24,568	14,788	9,780	365	1,945	7,420	50			
	7,370	4,436	2,934	110	583	2,226	15			
1877	29,718	16,548	13,170	365	1,945	9,270	1,590			
	8,915	4.964	3,951	110	583	2,781	477			
1878	39,053	20,453	18,600	365	2,710	10,300	2,900	2,325		
	11,716	6,136	5,580	110	813	3,090	870	697		
1879	45,238	23 888	21,350	365	2,805	11,115	2,955	4,110		
	13,571	7,166	6,405	110	842	3,334	886	1,233		
1880	55,663	31,913	23,750	365	2,885	11,175	2,995	6,330		
	16,699	9,574	7,125	110	866	3,352	898	1,899		
1881	62,338	36,878	25,460	365	2,885	12,265	2,995	6,950		
	18,701	11.063	7,638	110	866	3,679	898	2,085		
1882	70,938	44,623	26,315	365	2,885	12,265	3,315	7,485		
	21,282	13,387	7,895	110	866	3,679	995	2.245		
1883	74,133	45,878	28,255	405	3,625	12,705	3,315	8,205		
	22,240	13,763	8,477	122	1,087	3,812	995	2,461		
1884	77,298	47,368	29,930	405	3,625	13,740	3,635	8,525		
	23,189	14,210	8,979	122	1,087	4,122	1,091	2,557		
1885	79,698	47,938	31,760	405	3 625	14,540	4,385	8,805		
	23,909	14,381	9,528	122	1,087	4,362	1,316	2,641		
1886	83,603	50,438	33,165	405	3,625	15,300	4,750	9,085		
	25,081	15,131	9,950	122	1,087	4,590	1,425	2,726		
1887	89,483	52,513	36,970	405	3,720	17,585	5,390	9,870		
	26,845	15,754	11,091	122	1,116	5,275	1,617	2,961		
1888	99,588	56,793	42,795	405	3,720	19,525	8,955	10,190		
	29,877	17,038	12,839	122	1,116	5,857	2,687	3,057		
1889	107,118	62,053	45,065	405	3,720	20,005	9,275	11,660		
	32,136	18,616	13,520	122	1,116	6,002	2,782	3,498		
1890	111,483	64,393	47,090	405	3.720	21,295	9,530	12,140		
	33,445	19,318	14,127	122	1,116	6,388	2,859	3,642		

TABLE No. 10—(Continued)

YEARS	Total acreage and miners' inches	Total on North Side	Total on South Side	Broadway Canal	San Francisco Canal	Tempe Canal	Utah Canal	Mesa Canal	Consolidated Canal	Highland Canal
1891	114,008	65,283	48,725	405	3,720	22,440	9,530	12,630	....	....
	34,203	19,585	14,618	122	1,116	6,732	2,859	3,789	....	....
1892	121,098	68,468	52,630	405	3,720	22,740	9,960	14,285	1,280	240
	36,329	20,540	15,789	122	1,116	6,822	2,988	4,285	384	72
1893	123,813	69,598	54,215	405	3,720	22,740	10,645	14,545	1,920	240
	37,144	20,879	16,265	122	1,116	6,822	3,193	4,364	576	72
1894	124,843	70,493	54,350	405	3,720	22,740	10,765	14,560	1,920	240
	37,453	21,148	16,305	122	1,116	6,822	3,229	4,368	576	72
1895	126,773	72,183	54,590	405	3,720	22,980	10,765	14,560	1,920	240
	38,032	21,655	16,377	122	1,116	6,894	3,229	4,368	576	72
1896	127,743	72,653	55,090	445	3,720	23,360	10,765	14,640	1,920	240
	38,323	21,796	16,527	134	1,116	7,008	3,229	4,392	576	72
1897	129,098	73,463	55,635	445	3,720	23,520	10,765	14,745	2,200	240
	38,730	22,039	16,691	134	1,116	7,056	3,229	4,424	660	72
1898	129,678	73,678	56,000	445	3,720	23,520	10,800	15,075	2,200	240
	38,903	22,103	16,800	134	1,116	7,056	3,240	4,522	660	72
1899	129,878	73,878	56,000	445	3,720	23,520	10,800	15,075	2,200	240
	38,963	22,163	16,800	134	1,116	7,056	3,240	4,522	660	72
1900	130,583	74,248	56,335	445	3,720	23,520	10,865	15,345	2,200	240
	39,175	22,274	16,901	134	1,116	7.056	3,260	4,603	660	72
1901	131,273	74,778	56,495	445	3,720	23,520	10,865	15,345	2,200	400
	39,382	22,433	16,949	134	1,116	7,056	3,260	4,603	660	120
1902	131,653	75,158	56,495	445	3,720	23,520	10,865	15,345	2,200	400
	39,496	22,547	16,949	134	1,116	7,056	3,260	4,603	660	120
1903	132,133	75,438	56,695	445	3,920	23,520	10,865	15,345	2,200	400
	39,640	22,631	17,009	134	1,176	7,056	3,260	4,603	660	120
1904	132,838	76,033	56,805	445	4,030	23,520	10,865	15,345	2,200	400
	39,852	22,810	17,042	134	1,209	7.056	3,240	4,603	660	120
1905	134,213	76,333	57,880	465	4,030	23,520	11,135	16,105	2,200	425
	40,264	22,900	17,364	140	1,209	7,056	3,340	4,832	660	127
1906	135,228	77,108	58,120	465	4,030	23,740	11,135	16,125	2,200	425
	40,568	23,132	17,436	140	1,209	7,122	3,340	4,838	660	127
1907	139,823	80,773	59,050	465	4,030	24,380	11,135	16,305	2,310	425
	41,947	24,232	17,715	140	1,209	7,314	3,340	4,892	693	127
1908	146,748	87,508	59,240	465	4,030	24,380	11,135	16,475	2,330	425
	44,024	26,252	17,772	140	1,209	7,314	3,340	4,943	699	127
1909	151,083	91,813	59,270	465	4,030	24,380	11,165	16,475	2,330	425
	45,325	27,544	17,781	140	1,209	7,314	3.349	4,943	699	127

EXHIBIT B

Table from Supplemental Decree of December 3, 1918, in

Benson v. Allison

Showing Lands Irrigated Prior to 1918

TABLE OF ACREAGE SHOWING THE YEAR OF FIRST CULTIVATION, THE ACREAGE FOR THAT YEAR, AND THE TOTAL ACREAGE YEAR BY YEAR UP TO AND INCLUDING THE YEAR 1915.

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Year	Total Acreage	Mc Callom	Penn.	Horo-witz	Indien	New State	St Johns	Buckeye
1883	[illegible]		120					
	120		120					
1885	233						233	
	353		120				233	
1887	902							902
	1255		120				233	902
1888	4831						115	4716
	6086		120				348	5618
1889	1000							1000
	7086		120				348	6618
1890	640							640
	7726		120				348	7258
1891	4							4
	7730		120				348	7262
1892	1128						145	983
	8858		120				493	8245
1893	1080		100		480		120	380
	9938		220		480		613	8625
1894	1230		96	304	75			755
	11168		316	304	555		613	9380
1895	1738		298	80	75			1285
	12906		614	384	630		613	10665
1896	2055		40	160	75		320	1450
	14951		654	544	705		933	12115
1897	1210				75			1135
	16161		654	544	780		933	13250
1898	1418			110	75		150	1083
	17579		654	654	855		1083	14333
1899	1155						120	960
	18734		654	654	930		1203	15293
1900	1097.5				75		60	962.5
	19831.5		654	654	1005		1263	16255.5
1901	1209		67		75	40		1027
	21040.5		721	654	1080	40	1263	17282.5
1902	725	505	100			70		50
	21765.5	505	821	654	1080	110	1263	17332.5
1903	335					335		
	22100.5	505	821	654	1080	445	1263	17332.5
1904	70					70		
	22170.5	505	821	654	1080	515	1263	17332.5
1905	514		134			220		160
	22684.5	505	955	654	1080	735	1263	17492.5
1906	307							307
	22991.5	505	955	654	1080	735	1263	17799.5
1907	200							200
	23191.5	505	955	654	1080	735	1263	17999.5
1908	605					545		60
	23796.5	505	955	654	1080	1280	1263	18059.5
1909	912	485				37	80	310
	24708.5	990	955	654	1080	1317	1343	18369.5

Year	Total Acreage	Mc Callom	Penn.	Horo-witz	Indian	New State	St. Johns	Buckeye.
1910	890 25598.5	990	955	654	1080	45 1362	50 1393	795 19164.5
1911	340 25938.5	990	955	654	1080	80 1442	40 1433	220 19384.5
1912	308 26246.5	130 1120	955	654	1080	1442	1433	178 19562.5
1913	100 26346.5	1120	955	654	1080	60 1502	1433	40 19662.5
1914	160 26506.5	1120	955	654	1080	1502	40 1473	120 19722.5
1915	235 26741.5	1120	955	654	1080	1502	120 1593	115
1916	26741.5	1120	955	654	1080	1502	1593	19837.5
1917	209 26950.5	1120	955	654	1080	209 1711	1593	19837.5

ESTIMATED MONTHLY BASE EFFLUENT FLOW FROM
GILA RIVER AT JUNCTION WITH SALT FOR 1896 - 1910.

Sec. Ft.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
96	45	46	41	31	24	10	6	6	11	19	28	37	25
97	54	55	50	40	30	17	12	12	18	27	36	45	33
98	45	46	41	31	24	10	6	6	11	19	28	37	25
99	39	40	35	26	18	8	4	4	8	16	23	33	20
00	34	34	30	23	16	6	2	2	5	13	20	29	18
01	39	40	35	26	18	18	4	4	8	16	23	33	22
02	29	27	25	20	14	4	0	0	3	11	17	25	15
03	38	39	34	25	17	7	3	3	7	15	22	32	20
04	29	27	25	20	14	4	0	0	3	11	17	25	15
05	62	65	58	50	35	24	19	19	25	34	43	54	41
06	59	62	55	47	32	21	16	16	22	31	40	51	38
07	60	63	56	48	33	22	17	17	23	32	41	52	39
08	58	61	54	46	31	20	15	15	21	30	40	50	37
09	60	63	56	48	33	22	17	17	23	32	41	52	39
10	58	61	54	46	31	20	15	15	21	30	40	50	37
an	47	49	43	35	25	14	9	9	14	22	31	40	28

Gila River
04

96-003-004

96-003-004

Gila River

05

Water-Supply and Irrigation Paper No. 104

UNDERGROUND WATERS OF GILA VALLEY, ARIZONA

by

Willis T. Lee

Published - Washington Government Printing Office, 1904

GILA CROSSING

A much more important area of return water is the western third of the reservation, extending from the railroad to the mouth of Salt River. Within this distance of about 20 miles six irrigation ditches have been constructed by the Indians, each of which in turn diverts all the water in the river except in time of flood.

In the course of his investigations for the development of water near Gila Crossing, Mr. Meskimons measured the discharge at various places on June 1, 1903, with the following results:

Discharge measurements of seepage water near Gila Crossing, Arizona

	Inches
Webb ditch -	200
Thomas ditch - - - - - - - - - - - - - - - - - - -	600
Hoover ditch - - - - - - - - - - - - - - - - - - -	300
Cooperative ditch - - - - - - - - - - - - - - - -	150
Head ditch -	150
Walker ditch - - - - - - - - - - - - - - - - - - -	50
Water unappropriated in river - - - - - - - - -	600
Total available amount - - - - - - - - - - -	2,050

This water is entirely derived by seepage from the underflow, no account being taken of flood water.

96-003-004

Gila River
06

GLOBE EQUITY NO. 59 CONSENT DECREE
ABRIDGED SCHEDULE OF RIGHTS AND PRIORITIES[1]

RIGHT HOLDER	PRIORITY DATE	POINT OF DIVERSION	DIVERSION RATE (CFS)
USA (GRIC)	Immemorial	Ashurst-Hayden, Florence-Casa Grande Project, Sacaton Diversion	437.5
USA (SCAT)	1846	Various ditches and pumps on, or above, the Reservation	12.5
USA (SCIDD)	1868	Ashurst-Hayden	11.96
USA (SCIDD)	1869	Ashurst-Hayden	10.73
USA (SCIDD)	1872	Ashurst-Hayden	7.52
Montezuma Canal Company	1872	Montezuma Canal	0.38
USA (SCIDD)	1873	Ashurst-Hayden	2.0
Montezuma Canal Company	1873	Montezuma Canal	0.62
USA (SCIDD)	1874	Ashurst-Hayden	0.21
Montezuma Canal Company	1874	Montezuma Canal	1.75
San Jose Canal Company	1874	San Jose Canal	1.25
Tidwell Canal Company	1874	Tidwell Canal	0.50
Union Canal Company	1874	Union Canal	3.13
Sunflower Canal Company	1875	Sunflower Canal	0.31
Sunset Canal Company	1874	Sunset Canal	6.34
USA (SCIDD)	1875	Ashurst-Hayden	3.86

96-003-004

Gila River
07

RELATIVE DIVERSION RIGHTS BASED ON A DIVERSION RIGHT OF ONE CUBIC FOOT PER SECOND FOR EACH EIGHTY ACRES
Revised to January 1, 1992

Year of Prior.	Duncan Valley	Safford Valley	Total Upper Valleys	San Carlos Indian Reservation	Ind.*	Winkelman Valley Ind.*	Agr.	U.S.A.	Total
Immem. Rights								437.5	437.5
1846				12.5					450.0
1868								449.5	462.0
1869								460.2	472.7
1872		.4	.4					467.7	480.6
1873		1.0	1.0					469.7	483.2
1874	6.3	7.9	14.2					469.9	496.6
1875		16.5	22.8					473.8	509.1
1876		24.3	30.6					479.5	522.6
1877		35.4	41.7			.1	.3	481.5	536.1
1878		43.9	50.2		.8			481.8	545.7
1879		51.2	57.5		2.0			484.5	556.9
1880		62.2	68.5		3.6	.3	2.2	484.9	572.0
1881	12.1	72.7	84.8						588.3
1882	13.2	85.6	98.8						602.3
1883		104.8	118.0						621.5
1884	13.7	126.1	139.8		5.7	1.3	2.4	485.3	647.0
1885	19.3	142.0	161.3		6.4			486.6	670.5
1886	22.2	160.8	183.0					486.9	692.5
1887	22.9	171.0	193.9		7.2		2.9		704.7
1888	30.5	179.3	209.8						720.6
1889	31.8	191.4	223.2					489.5	736.6
1890		202.8	234.6		7.3			491.3	749.9
1891	32.3	215.6	247.9					503.5	775.4
1892	33.5	221.2	254.7					508.5	787.2
1893	34.5	228.0	262.5					512.5	799.0
1894	37.7	230.3	268.0					514.9	806.9
1895	42.0	235.5	277.5		7.8			524.2	826.2
1896	45.6	246.0	291.6					528.1	844.2
1897	59.8	249.7	309.5						862.1
1898	69.9	253.0	322.9					528.5	875.9
1899		260.3	330.2					528.6	883.3
1900	75.3	270.7	346.0						899.1
1901	76.0	277.7	353.7					529.1	907.3
1902	78.1	283.2	361.3						914.9
1903	79.2	288.4	367.6						921.2
1904	81.3	318.6	399.9					529.7	954.1
1905	82.4	321.5	403.9						958.1
1906	83.5	326.0	409.5		8.0				963.9
1907	85.1	350.4	435.5						989.9
1908	89.1	354.4	443.5		9.9		4.0	535.0	1006.2
1909	90.4	358.5	448.9		22.22			538.4	1027.32
1910	91.2	365.7	456.9					540.1	1037.02
1911	92.1	366.7	458.8					542.1	1040.92
1912	92.2	372.5	464.7					543.8	1048.52
1913	92.3	380.6	472.9					558.9	1071.82
1914	92.9	383.7	476.6					569.3	1085.92
1915	93.4	390.4	483.8						1093.12
1916	93.5	392.2	485.7				4.9	775.0	1301.62
1917	98.5	397.4	495.9						1311.82
1918	99.7	399.1	498.8						1314.72
1919	100.0	404.3	504.3						1320.32
1920	100.1	406.2	506.3				5.2		1322.52
1921	100.2		506.4						1322.62
1924								1256.5	1804.12
1926	100.3		506.5				5.5		1804.52
1929	100.7		506.9						1804.92
Total	100.8	406.4	507.2	12.5	22.22	1.3	5.5	1256.5	1805.22

* Industrial and Municipal use

Gila Exhibit 001 **Volume II**

5

96-003-005

Gila River

Gila River

Navigability Study

Draft Final Report

October, 1994
Revised September, 1996

Prepared by

Arizona State Land Department
Arizona Geological Survey
SWCA Environmental Consultants

Preface

This report was prepared by the Arizona State Land Department Drainage and Engineering Section. The report summarizes factual information relating to the navigability of the Gila River as of the time of statehood. This report provides information on the portion of the Gila River located between Solomon and the confluence with the Colorado River. Information presented in this report is intended to provide data for the Arizona Navigable Stream Adjudication Commission (ANSAC) from which ANSAC will make a recommendation to the Arizona Legislature regarding the navigability of the Gila River. This report does not make a recommendation or draw any conclusions regarding title navigability of the Gila River.

The report consists of several related parts. First, archaeological information for the Gila River relating to river uses is presented to set the long-term context of river conditions and river uses. Second, historical information from the periods prior to and including the time of statehood are discussed with respect to river, modes of trasportation, and river conditions. Third, limited oral history information for the river is also presented. Fourth, historical and modern hydrologic and hydraulic data are summarized to illustrate past and potential flow conditions in the river. Fifth, a review of geologic influences on stream flow and river conditions is presented. Sixth, land use and land ownership information are described and presented in a geographic information systems format.

The Gila River Stream Navigability Study was performed by the Arizona State Land Department Drainage and Engineering Section, in cooperation with SWCA Environmental Consultants, Inc., and the Arizona Geological Survey. Project staff included Clyde Anderson, Arizona State Land Department, Project Manager; Dawn Greenwald and Dennis Gilpin, SWCA, historians/archaeologists; Gary Huckleberry, Arizona Geological Survey, geomorphologist, Cameron Hanye, Arizona State Land Department, GIS specialist; Greg Keller, Arizona State Land Department, land planner; Terry Arce and Roz Sedillo, Arizona State Land Department, land title specialists; and numerous Arizona State Land Department staff in various research capacities. Data summarized in this study were obtained from numerous agencies, libraries, and collections named in the appendices of this report. Use of this document is governed by the Arizona State Land Department and the Arizona Navigable Stream Adjudication Commission.

PRELIMINARY

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CHAPTER I
Introduction

Purpose of Study

House Bill 2594, codified as A.R.S. §37-1101 to -1156, was enacted by the Arizona State Legislature and signed by the Governor on July 7, 1992. This Bill provided for the establishment of an administrative procedure to gather information and determine the extent of the State of Arizona's ownership of the beds of watercourses within Arizona. To this end, the Bill established the Arizona Navigable Stream Adjudication Commission (ANSAC) through July 1, 2000, consisting of five members appointed by the Governor. At the same time, the Bill charged the Arizona State Land Department with the task of performing studies to identify, catalogue, gather and evaluate existing available information to aid ANSAC in making its determinations.

The purpose of this study is to identify, catalogue, gather and evaluate existing available information relating to the Gila River. This report presents archaeological, historical, hydrologic, hydraulic, geomorphologic and land use information identified and gathered during the study and consists of resources such as books, maps, artifacts, magazines, photographs, land records, survey notes, flood insurance studies, floodplain maps, stream gage records, geologic maps, soil maps, vegetation maps, contour and topographic maps, etc. A listing of the resources is included in the appendix.

Project Background

In 1984, Valley Concrete and Materials Company was performing sand and gravel mining operations on the Verde River in the vicinity of Deadhorse Ranch State Park. In its efforts to curtail Valley's mining operations the State Attorney General's office invoked the State's implicit ownership of the beds of navigable watercourses under the Equal Footing Doctrine. Under that Doctrine, all states entered the Union with the same rights and privileges as the original 13 states - on an "equal footing". One of those rights was the ownership of the beds of navigable watercourses and tidal waters under the Public Trust Doctrine which dates back to the Roman European and, more recently, the British crown which held those lands and others in trust for use by the public for fishing, recreation, commerce and general navigation. The State eventually settled out of court with Valley Concrete and the question of the State's interest in navigable watercourses was in the public eye to stay.

In 1986 the State Legislature attempted to resolve the question of ownership by passing Senate Bill 1308. That Bill was vetoed by Governor Babbitt.

In 1987 the State Legislature again attempted to resolve the question of ownership by enacting House Bill 2017[1] which declared the Colorado River navigable (by previous actions), indicated that the Gila, Salt and Verde Rivers might be navigable, and that all other watercourses in the State were non-navigable. That Act was approved April 27, 1987 by Governor Mecham. The Act further permitted the release of Gila, Salt and Verde River lands to the public by means of filing a quit claim for a nominal fee. Within three months the Center for Law in the Public Interest was in court, challenging the Act as an unconstitutional gift of public lands and claiming there was no rational basis for declaring watercourses navigable or non-navigable. Eventually the Arizona Court of Appeals agreed with the Center and in 1991 invalidated the Act as unconstitutional.[2]

The question of title ownership remained clouded, however, and in July 1992 the State Legislature enacted House Bill 2594.[3] That Act established the Arizona Navigable Stream Adjudication Commission, ANSAC, and created an administrative process for gathering available information and making a determination relating to navigability or non-navigability. In addition, the State Land Department was charged with the task of gathering information to aid ANSAC in its review and determinations.

Definition of Navigability

Navigability is defined within Title 37, Chapter 7, Arizona Revised Statutes to guide the Commission in its determinations. Specifically, A.R.S. §37-1101(6) states: "'Navigable' or 'navigable watercourse' means a watercourse, or a portion or reach of a watercourse, that was in existence on February 14, 1912, and that was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in the customary modes of trade and travel on water."

Scope of Study

1. Study Limit

This study includes the Gila River, which is located generally in the southern half of Arizona as it runs from its confluence with the Colorado River northeast of Yuma, Township 8 South, Range 23 West, G.S.R.B.M., to the Gila Box northeast of Safford,

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[1] HB 2017, State of Arizona, 38th Legislature, First Regular Session, introduced January 12, 1987.

[2] Appeal from the Superior Court of Maricopa County, Case No. CV 87-20506, in the Court of Appeals, State of Arizona, Division One, filed September 10, 1991.

[3] HB 2594, State of Arizona, 40th Legislature, Second Regular Session, introduced February 27, 1992.

Township 7 South, Rand 27 East, G.S.R.B.M. (See General Location Map, Appendix A)

For the purposes of this study, areas which lie within the 100-year floodplain as defined by the latest Flood Insurance Rate Map (F.I.R.M.) community panels published by the Federal Emergency Management Agency (F.E.M.A.) prior to July 1, 1993. These specified limits lie outside of the "ordinary high water mark" and were chosen to insure that parcels lying partially or wholly within the "ordinary high water mark" would be identified. It will thus be possible to notify the owners or lessees of parcels which will be affected by the Commission's determination of navigability or non-navigability. The study area includes lands owned or leased by private individuals or companies, and city, county, state and federal agencies. Also, the Gila crosses portions of three separate Indian Reservations, in existence since before Statehood.

2. Project Team

The Project Team for this study includes the following individuals. Without their efforts this study would not have been possible.

Clyde Anderson, Drainage and Engineering Section
Terry Arce, Title and Contracts Section
Cameron Hanye, Drainage and Engineering Section
W. Dempsey Helms, Drainage and Engineering Section
Greg Keller, Urban Planning Section
James Latham, Drainage and Engineering Section
V. Ottozawa-Chatupron, Drainage and Engineering Section
Rozanna Sedillo, Title and Contracts Section
Donna Smith, Drainage and Engineering Section
Dennis Gilpin, Archaeologist, SWCA Associates
Gary Huckleberry, Geomorphologist, AZ Geological Society

Also, additional staff from various sections provided support for this study at critical times.

3. Project Tasks

a. Historical Literature Search

A.R.S. § 37-1124 required a literature search be performed to identify historical reference materials. This literature search was performed by Mr. Clyde Anderson, Mr. W. Dempsey Helms, Mr. James Latham and Mr. V. Ottozawa-Chatupron of the Arizona State Land Department (ASLD) Drainage and Engineering Section. This search was based on visits to various persons, museums and libraries in the state.

The ASLD library assembled for this project served as a beginning point and a source to identify other materials. The literature search included an interview with Ms. Mary Lu Moore, historian, assigned to the Civil Division, Arizona Attorney General's office. Also, searches were conducted at the Arizona State Capitol Library, Phoenix Public Library, Yuma Public Library, Arizona State University Library, University of Arizona Library, Safford Public Library, and other public libraries in towns located near the Gila River. Historical societies and museums were also visited. These included Yuma Crossing Quartermaster Depot Historic Site, Yuma Art Center, Quechan Indian Museum, Arizona Historical Society Museum Colorado River Division, Wellton-Mohawk Fine Arts & Historical Museum, Gila Bend Museum, Buckeye Valley Historical & Archaeological Museum, Casa Grande Valley Historical Society Museum, Gila River Arts & Crafts Center and Heritage Park, Graham County Historical Society Museum, Arizona State Capitol Museum, Heard Museum, Phoenix Museum of History, Tempe Historical Museum, Arizona Republic/Phoenix Gazette newspaper morgues, McCormick Railroad Exhibit, and Arizona State University - Museum of Geology. This literature search identified maps, books, newspaper articles, journals, magazines and overall histories which provided historical information related to historical uses of the river for navigation and types of business which were located near the river.

This historical literature search was based on areas identified on base maps provided by the ASLD Drainage and Engineering Section.

b. Archaeological Literature Search

A.R.S. § 37-1124 and Part Two, Paragraph 2.1.1 of the Request For Proposal required a literature search be performed to identify historical and archaeological reference materials. This literature search was performed by Mr. Dennis Gilpin of SWCA Environmental Consultants. This search was based on visits to various persons, museums and libraries in the state.

The ASLD library assembled for this project served as a beginning point and as a source to identify other materials. The literature search included an interview with Ms. Mary Lu Moore, historian, assigned to the Civil Division, Arizona Attorney General's office. Also, searches were conducted at the Arizona State Capitol Library, Phoenix Public Library, Yuma Public Library, Arizona State University Library, University of Arizona Library, Safford Public Library, and other public libraries in towns located near the Gila River. Historical societies and museums were also visited. These included Yuma Crossing Quartermaster Depot Historic Site, Yuma Art Center, Quechan Indian Museum, Arizona Historical Society Museum Colorado River Division, Wellton-Mohawk Fine Arts & Historical Museum, Gila Bend Museum, Buckeye Valley Historical & Archaeological Museum, Casa Grande Valley Historical Society Museum, Gila River Arts & Crafts Center and Heritage Park, Graham County Historical Society Museum, Arizona State Capitol Museum, Heard Museum, Phoenix Museum of History, Tempe Historical Museum, Arizona Republic/Phoenix Gazette newspaper morgues, McCormick Railroad Exhibit, and Arizona State University - Museum of Geology. Visits to these locations suggested additional sources, which were added to the list. This literature search identified maps, books, newspaper articles, journals, magazines, advertisements, and directories which provided historical and archaeological information related to historical uses of the river for navigation and types of business which were located near the river, such as warehouses, transportation and shipping.

This archaeological literature search was based on areas identified on base maps provided by the ASLD Drainage and Engineering Section. A catalogue of the literature and artifacts identified during this search was prepared and submitted to the Project Manager. The catalogue identifies the river reach, the location of the resource and the title of the resource.

c. Hydrologic & Hydraulic Literature Search

A.R.S. § 37-1124 required a literature search be performed to identify hydrologic and hydraulic reference materials. This literature search was performed by Mr. Clyde Anderson and Ms. Donna Smith of the Arizona State Land Department (ASLD) Drainage and Engineering Section. This search was based on visits to various persons, city, county, state and federal agencies.

The ASLD library assembled for this project served as a beginning point and a source to identify other materials. This research identified and catalogued aerial photographs, maps, books, technical journals, newspaper articles, magazine articles, stream gage records, survey data, and flood insurance studies which provided information related to stream flow, flood events, changes in the river's course and character. Searches were conducted at various locations, including Arizona Department of Water Resources, Arizona Game and Fish Department, Arizona Department of Transportation, Corps of Engineers, City of Phoenix Floodplain Management Section, Flood Control Districts (Yuma County, Maricopa County, Pinal County, Gila County, Graham County), State Capitol Library, Phoenix Public Library, Yuma Public Library, Arizona State University Library, Arizona State University Engineering Library, University of Arizona Library, University of Arizona Engineering Library, and Bureau of Land Management.

This hydrologic and hydraulic literature search was based on areas identified on base maps provided by the ASLD Drainage and Engineering Section.

d. Geomorphological Literature Search

A.R.S. § 37-1124 required a literature search be performed to identify geomorphologic reference materials. This literature search was performed by Mr. Gary Huckleberry of Arizona Geological Survey. This search was based on visits to various persons, city, county, state and federal agencies.

The ASLD library assembled for this project served as a beginning point and as a source by which to identify other materials. This research identified and catalogued aerial photographs, maps, books, technical journals, newspaper articles, magazine articles, stream gage records, soils maps, geologic maps, geologic event records, survey data and flood insurance studies which provided information related to stream flow, flood events, and changes in the river's course and character. Searches were conducted at various locations. These included but were not limited to Arizona Department of Water Resources, Arizona Game and Fish Department, Arizona Department of Transportation, Corps of Engineers, City of Phoenix Floodplain Management Section, Flood Control Districts (Yuma County, Maricopa County, Pinal County, Gila County, Graham County), State Capitol Library, Phoenix Public Library, Yuma Public Library, Arizona State University Library, Arizona State University Engineering Library, University of Arizona Library, University of Arizona Engineering Library, and Bureau of Land Management.

This geomorphological literature search was based on areas identified on base maps provided by the ASLD Drainage and Engineering Section.

e. Historical Literature Review

A.R.S. § 37-1124 required that historical reference materials be reviewed to identify and evaluate evidence of historic uses of the study reach. This review and evaluation was performed by Mr. Clyde Anderson, Mr. W. Dempsey Helms, Mr. James Latham and Mr. V. Ottozawa-Chatupron of the Arizona State Land Department (ASLD) Drainage and Engineering Section.

This review evaluated evidence contained in the documents identified during the literature search, and sought to identify attempted uses of the river or the surrounding communities for activities such as the transportation of persons or goods or other commercial activity upon or across the study reach; recreational activity (such as boating) which has occurred upon the study reach; human or social developments which occurred upon or along the banks of the study reach; irrigation systems related to the study reach; and other activities that occurred which may provide evidence of the navigability of the river at the time of Statehood. Oral histories of senior citizens over the age of 75 were identified and interviewed to incorporate their memories of river flow and tales of river use passed on to them by their parents, grandparents, and other friends and acquaintances. This literature review and evaluation was based on materials and persons identified during the literature search, and included field trips to population centers along the river.

f. Archaeological Literature Review

A.R.S. § 37-1124 required that archaeological reference materials be reviewed to identify and evaluate evidence of historic uses of the study reach. This review and evaluation was performed by Ms. Dawn M. Greenwald and Mr. Dennis Gilpin of SWCA, Inc.

This review evaluated evidence contained in the documents identified during the literature search, and sought to identify uses of the river or the surrounding communities for activities such as the transportation of persons or goods or other commercial activity upon or across the study reach; recreational activity (such as boating) which has occurred upon the study reach; human or social developments which occurred upon or along the banks of the study reach; irrigation systems related to the study reach; and other activities that occurred which provided evidence of the navigability of the river at the time of Statehood. Wherever possible, senior citizens over the age of 75 were identified and interviewed to incorporate their memories of river flow and tales of river use passed on to them by their parents, grandparents, and other friends and acquaintances.

This archaeological literature review and evaluation was based on materials and persons identified during the archaeological literature search, and included field trips to population centers along the river.

A catalogue of the literature and artifacts utilized during this review was prepared and included in the report. The catalogue identified the river reach in the resource to the highest degree possible, the location of the resource, and the title of the resource. A report was prepared which identified historical uses of specific river reaches.

g. Hydrologic & Hydraulic Literature Review

A.R.S. § 37-1124 required that hydrologic and hydraulic reference materials be reviewed to identify and evaluate evidence of normal stream flow events, changes in alignment, and other characteristics of the study reach. This review and evaluation was performed by Mr. Clyde Anderson of the Arizona State Land Department (ASLD) Drainage and Engineering Section (see Chapter 7, "Geomorphology").

This review evaluated existing available evidence contained in the documents identified during the literature search pertaining to the discharge of the river. Items reviewed during this evaluation included stream gage records; FIS studies and FIRM maps associated performed by FEMA; USGS topographic maps; BLM records; hydrologic or hydraulic studies performed by the Corps of Engineers; County Flood Control Districts; Arizona Department Of Transportation; Arizona Department of Water Rights; Arizona Department of Environmental Quality; Salt River Project; city and county engineering departments; other public agencies and private consultants; geomorphological studies and reports; city, county and state topographic maps; and accounts of unusual hydrologic, hydraulic, geomorphologic events which occurred along the river. Based on the existing available information, the stream discharge, slope, velocity, normal flow, depth, width, and roughness for the annual, 2-year, and

5-year runoff events were identified. Based on the existing available information, the location of the river and the ordinary high-water mark at the time of Statehood were identified. This literature review and evaluation were based on these materials identified during the hydrologic and hydraulic literature search.

h. Geomorphological Literature Review

A.R.S. § 37-1124 required that geomorphologic reference materials be reviewed to identify and evaluate evidence of normal stream flow events, changes in alignment, and other characteristics of the study reach. This review and evaluation was performed by Mr. Gary Huckleberry of the Arizona Geological Survey.

This review evaluated existing available evidence contained in the documents identified during the geomorphological literature search pertaining to the discharge of the river. Items reviewed during this evaluation included stream gage records; FIS studies and FIRM maps associated performed by FEMA; USGS topographic maps; BLM records; hydrologic or hydraulic studies performed by the Corps of Engineers; County Flood Control Districts; Arizona Department Of Transportation; Arizona Department of Water Rights; Arizona Department of Environmental Quality; Salt River Project; city and county engineering departments; other public agencies and private consultants; geomorphological studies and reports; city, county and state topographic maps; and accounts of unusual hydrologic, hydraulic, geomorphologic events which occurred along the river. Based on the existing available information, the stream discharge, slope, velocity, normal flow, depth, width, and roughness for the annual, 2-year, and 5-year runoff events were identified. Based on the existing available information, the location of the river and the ordinary high-water mark at the time of Statehood were identified. Geologic materials were reviewed to identify changes in the alignment of the river. The current and historic soil condition within and along the river were reviewed to identify degradation and aggradation, which may have occurred before or since the time of before Statehood. This geomorphological literature review and evaluation was based on materials identified during the geomorphological literature search.

i. Ownership Identification

A.R.S. § 37-1124(D) required that the current title ownership of the underlying land be identified. Ownership was determined by Ms. Terry Arce and Ms. Rozanna Sedillo of the Arizona State Land Department (ASLD) Title and Contracts Section. This research was based on those areas identified on base maps provided by the ASLD Drainage and Engineering Section. State land ownership and current lessees were identified by reviewing ASLD records (CLASS). City, county, state and private ownership and lessees were identified by reviewing County Assessor and County Recorder maps and records. Federal ownership and lessees were identified by reviewing Bureau of Land Management maps and records. Parcels and parcel numbers were identified on, or referenced to, the base maps. Information collected and recorded includes the name of the current owner (lessee if public land), the recorded acreage legal description, and a general sketch of the parcel boundary. This review required contacts with the various county seats. Sources of information, in addition to those provided by the Drainage and Engineering Section, were catalogued and provided to the Project Manager. The information contained in the report was stored in an INFO database. A report was prepared which includes the information collected and was keyed to the base map.

j. Land Use Information

A.R.S. § 37-1124 (D) required that the use of underlying lands be identified from existing available information. Land use was identified by Mr. Greg Keller of the Arizona State Land Department (ASLD) Urban Planning Section.

A cursory overview of land use and condition was performed by reviewing the most recent aerial photographs from Flood Control Districts, USGS, BLM, ADOT, ADWR, ADEQ and/or ASLD files. City, county and/or ASLD planning records were reviewed to confirm current and proposed land use. Site reconnaissance (field) visits were performed to review those areas where aerial photographs and public records were either non-existent or out-of-date.

Environmentally oriented site reconnaissance visits were performed simultaneously with land use site visits. This reconnaissance was to identify apparent environmental concerns, and public trust values associated with the site, such as well sites, drainage facilities, parks, waste treatment facilities and landfills, riparian systems, wildlife, vegetation, recreational uses, etc.

This office and site review was based on a listing of preliminary aerial photographic resources, and areas identified on base maps provided by the ASLD Drainage and Engineering Section. A report was prepared and submitted to the Project Manager based on the review and keyed to the base map. The report will identify the river reach, land use patterns, apparent environmental concerns and associated public trust values. An index of the public trust values was prepared and presented in matrix form, based on discussions with ASLD personnel (Natural Resources, Urban Planning, Appraisals, etc.).

k. Geographic Information Systems

Mr. Cameron Hanye of the Arizona State Land Department (ASLD), Drainage and Engineering Section performed a search to identify existing available Geographic Information System (GIS) coverage which was utilized and/or modified for use in base maps for this study. The Arizona Land Resource Information System (ALRIS) library located within ASLD served as a beginning point and a source to identify other materials. This search identified and catalogued land ownership, township-range-section, cities, counties, hydrology, slope, USGS quadrangle, soils, vegetation, and other existing available GIS coverage. Searches were conducted at city, county, state and federal agencies such as the Arizona Department of Water Resources, the Arizona Department of Transportation, Floodplain Managers and Flood Control Districts, Assessors, Recorders, the Arizona Department of Environmental Quality, the Arizona Game and Fish Department, the Arizona Parks Department, the Bureau of Land Management, and the Bureau of Reclamation. Information gathered during the performance of other tasks was entered into new GIS covers as needed.

All materials utilized during this search and a catalogue which identifies the materials, the type of resource, the title of the resource, the location of the resource and the river reach was submitted to the State Land Department upon completion of the study. Maps and exhibits have been prepared to present the information contained in the GIS files, and have been stored in ALRIS directories. A hardcopy version of land use and ownership maps are on file at the Drainage and Engineering Section, ASLD. A summary report was prepared which briefly identifies the sources of information, the types of information acquired, and how the information was utilized and presented.

CHAPTER II

Methodology

Procedures

1. **Initial Contact**

Initial contact was made by means of a telephone call to identify the address and an initial contact/addressee. A letter and questionnaire (see Appendix B) were then sent to public agencies to identify existing available resources. The letter briefly explained the intent of the Streambed Program and the State Land Department's charge to gather information. The letter requested the addressee to review the questionnaire which was attached to the letter, and to return it to the State Land Department.

Nearly 80 agencies were contacted by mail (see mailing list in Appendix C). Forty-three responses were received either in the form of the questionnaire or a letter, some including information or photos. Agencies which did not respond to the initial mailing were contacted by telephone and their responses were taken in that manner. Agencies which were contacted include: libraries, museums, historical societies, county engineers, county assessors and recorders, county planning departments, state agencies and federal agencies. Ms. Mary Lu Moore of the Arizona State Attorney General's Office was contacted and was of great assistance in identifying potential resources.

2. **Follow-up Contact**

Follow-up contact consisted of either a follow-up telephone conversation to confirm the response, or a site visit to identify and gather materials pertaining to the study. Visits to libraries and museums provided access to books, maps, photographs, oral histories, journals, and streamflow records. A bibliography of these materials is located in the Appendix. Recent aerial photographs of the river were obtained to assist in identifying features.

3. **Agency identification**

Through the means of a 'brainstorming' session, numerous agencies were identified that might be repositories for pertinent information. Agencies identified were: Federal, State, County and City agencies including libraries, engineers, historical societies, etc.

4. **Initial telephone call**

The initial contact with an agency consisted of a telephone conversation, either with the head of the agency, or whomever happened to answer the telephone. During that conversation, an 'initial contact' was identified and the address of the agency was confirmed. The respondent was informed that a letter request would be in the mail within a few days, and that the Department would appreciate a timely response to their request.

5. <u>Follow-up with a letter request</u>

After identifying the 'initial point of contact', a formal letter was submitted to the contacted agency requesting their assistance in identifying and gathering pertinent information. In order to facilitate the agency's response, a self-addressed, postmarked envelope was included with the request for information. A copy of a survey questionnaire was also included with the letter, and the contacted agency was asked to search within their agency to identify pertinent information.

6. <u>Follow-up phone call or personal visit</u>

When the agency responded with either the questionnaire or a letter (a number of agencies responded with both the questionnaire and resource materials), either a follow-up telephone call was placed to review the response, or a personal visit was arranged.

7. <u>Second letter request</u>

After the follow-up telephone call or personal visit, a second set of request letters was mailed to the agencies. In the case of those agencies which had not responded to the initial request, a second request was mailed. In the case of agencies which had responded to the initial request, a second request was made to the agency to take a second look and attempt to identify any material which may have been overlooked at the time of the original request.

8. <u>Combination and comparison of results if more than one visitor or telephone interview occurred.</u>

Documentation

Resources have been identified by title, author, publisher information, date, location, nature of resource whenever possible. Photocopies of documents have been obtained for closer scrutiny and to facilitate documentation. In cases where a hardcopy version of the original or transcribed materials was not available for photocopying, hand written notes were taken. If the material was available on microfiché, either copies were made from the microfiché, or the microfiché was duplicated. Resource materials not included within this report are available for review at the State Land Department.

CHAPTER III

Archaeology

ARCHAEOLOGICAL OVERVIEW OF THE GILA RIVER VALLEY

Dawn M. Greenwald and Dennis Gilpin

The Gila River has a long record of prehistoric use and occupation. The river spans southern Arizona from the New Mexico border to the Colorado River, and prehistoric occupation along its banks reflects a multitude of cultural influences. For management purposes, discussion of archaeology along the river has been organized by river segments. The lower Gila includes the segment from the Colorado River to just west of the Gila's confluence with the Agua Fria River (Figure 1); the middle Gila is the segment from just west of the Agua Fria River to just east of the town of Florence (Figure 2); and the upper Gila flows from east of Florence to the New Mexico border (Figure 3). The middle Gila is the segment best known archaeologically, although the other segments contain more cultural diversity. Only a few historic archaeological projects have been conducted along the river, and these are summarized in the final section. The prehistoric archaeology sections were written by Dawn Greenwald, and the historic archaeology section was authored by Dennis Gilpin.

ARCHAEOLOGICAL PROJECTS

Lower Gila

Early explorers and travelers, such as William H. Emory and Newton Chittenden, documented a few archaeological sites along the Gila River prior to systematic inquiries. In 1846, Emory (1848:89-91) described and illustrated the glyphs at the site of Painted Rocks (Figure 1). Chittenden visited the Fortified Hill site in 1888 or 1889, and later published an article about the site, including a map (Chittendon 1905; McGuire and Schiffer 1982). Others who commented on archaeological manifestations in these early years were Bancroft (1883), Lumholtz (1912), McGee (1895, 1896), and Huntington (1912, 1914).

The first archaeological surveys that were conducted were broad overviews of the region. They usually were biased toward larger sites, such as villages, and concentrated on reporting manifestations of the Hohokam, the prehistoric culture that was centered in the Salt and Gila Basins. Gila Pueblo (Gladwin and Gladwin 1929, 1930), a privately owned archaeological research foundation, conducted reconnaissance surveys to determine the boundaries of the red-on-buff culture

(Hohokam) and determined that southwestern Arizona was peripheral to it. The Gila Bend area was surveyed by Simmons (n.d.) for cerros de trincheras, hills terraced with dry-laid stone walls, and in the 1960s Wasley (1965) and Vivian (1965) surveyed most of the lower Gila in sections (Table 1).

The Painted Rocks Reservoir area was surveyed by Schroeder, Ezell, and others, with sites excavated in the same area between 1958 and 1961 (Wasley and Johnson 1965), including Fortified Hill, Citrus, and Rock Ball Court (Figure 1), all typical Hohokam village sites. Canals near Gila Bend were sectioned by Woodbury (1961), who also tested another canal that served the Gatlin site. Based on these investigations, Woodbury estimated that there were over 10 miles of prehistoric canals in the Gila Bend area. In the 1970s, the Museum of Northern Arizona conducted numerous archaeological studies for the Liberty to Gila Bend transmission line. Six archaeological sites were located within the centerline right-of-way, which was 45 miles long; five additional sites were found during survey of 2 linear miles of access roads. All these sites except one, a prehistoric and historic canal system, were surficial and small. The Bureau of Land Management (BLM) sponsored

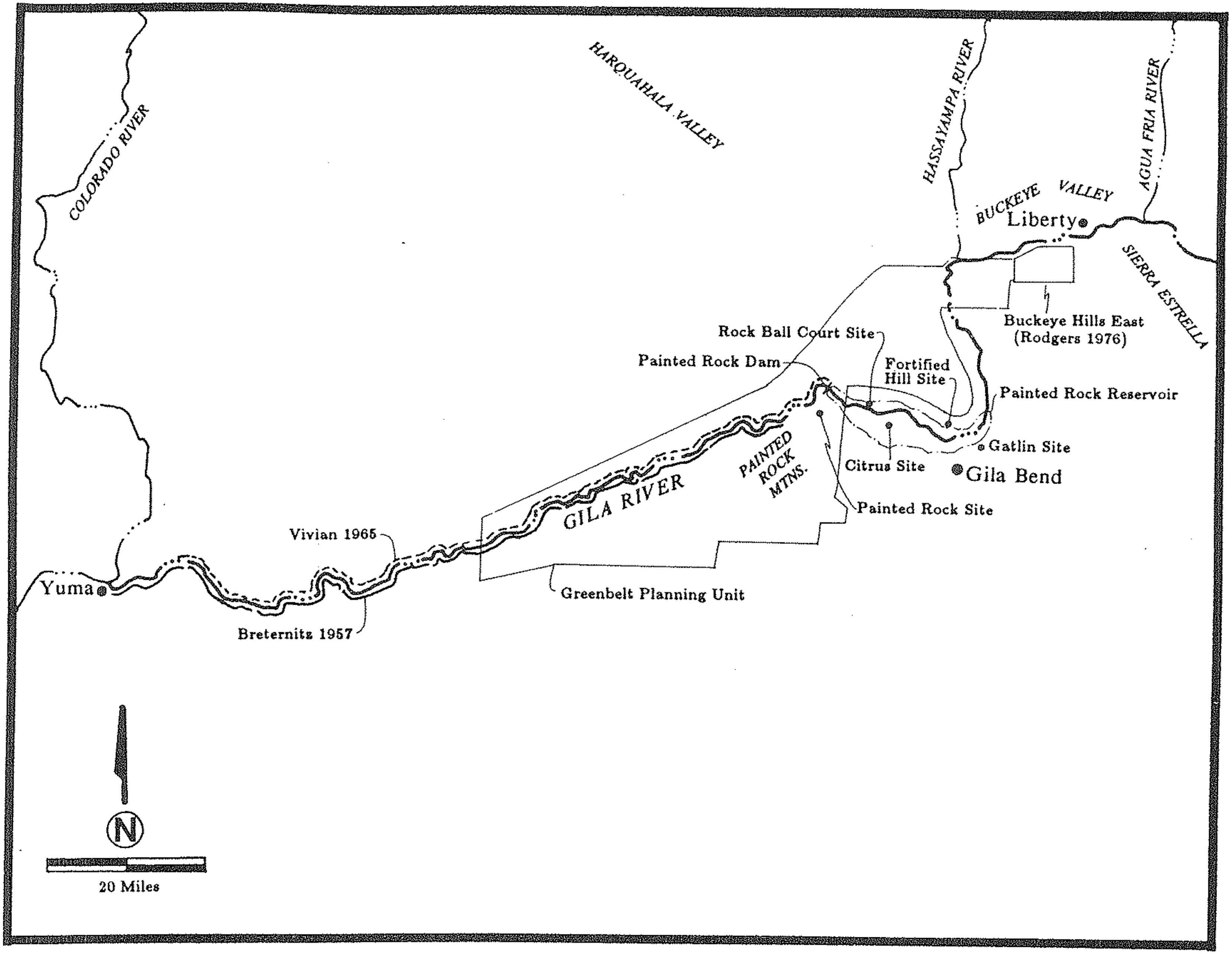

Figure 1. Major archaeological sites and project areas along the lower Gila River.

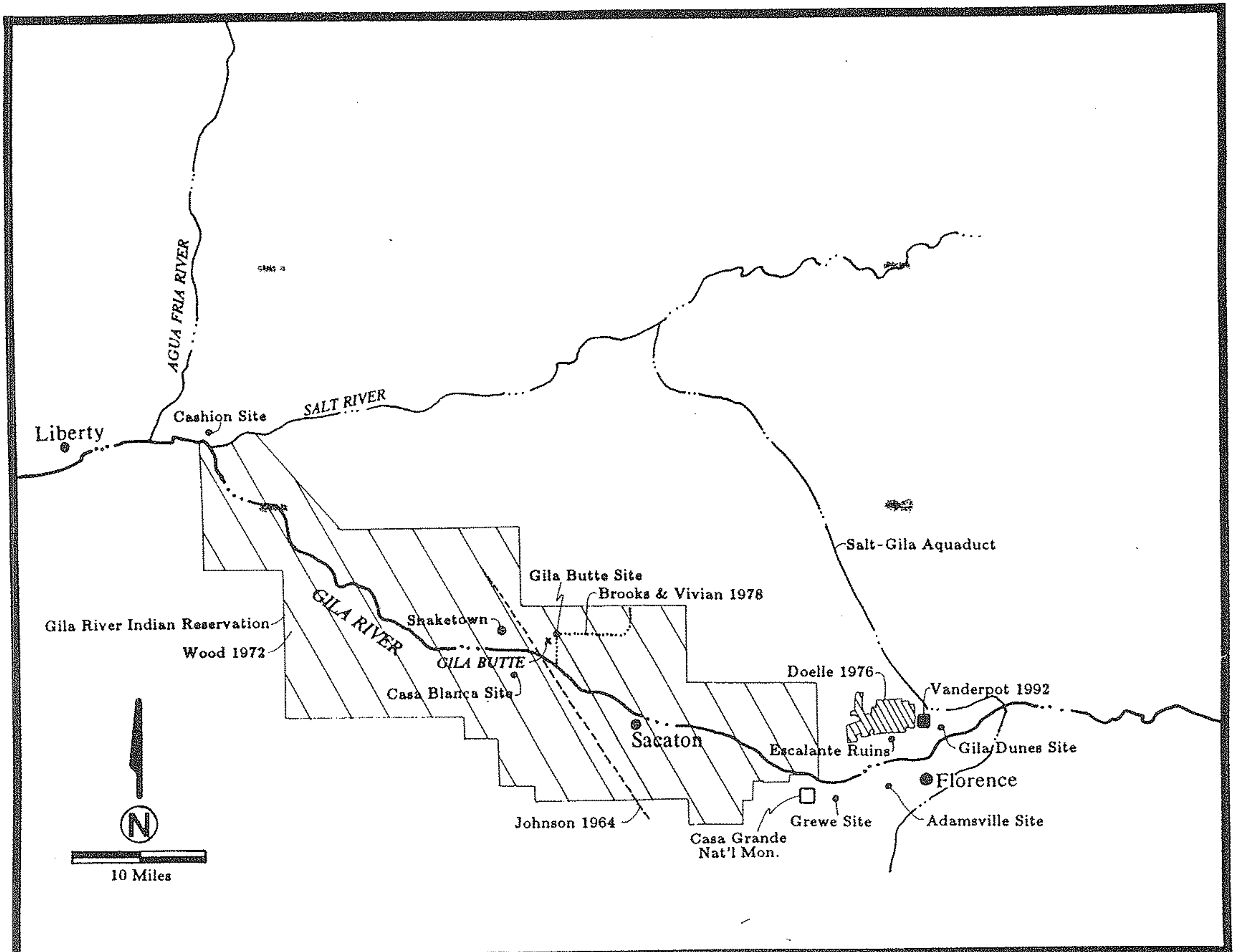

Figure 2. Major archaeological sites and project arc .s along the middle Gila River.

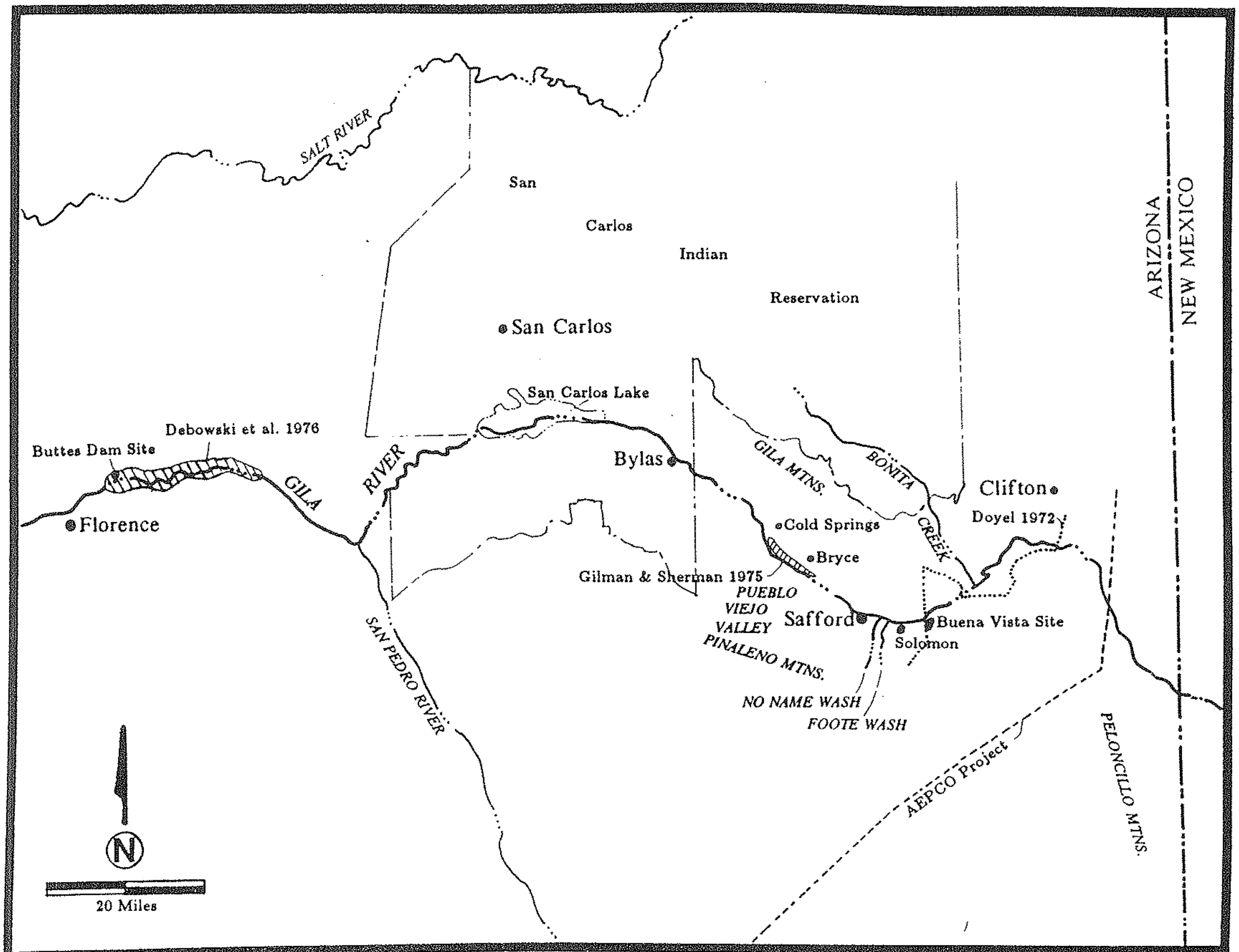

Figure 3. Major archaeological sites and project areas along the upper Gila River.

Table 1. Major Archaeological Projects Along the Gila River

Sponsor	Type of Project	Area Extent	Number of Sites	Reference
National Park Service	Survey	Gila River from Gillespie Dam to confluence with the Salt River (approx. 40 miles)	?	Walsey 1965
National Park Service	Survey	Blaisdell to Painted Rock Dam (120 miles)	85	Vivian 1965
National Park Service	Painted Rocks Reservoir Survey	Painted Rocks Reservoir	28	Schroeder and Ezell, cited in Wasley & Johnson 1965
National Park Service	Painted Rocks Reservoir Excavation	Excavation & Survey	26 (survey) 18 (excavation)	Wasley & Johnson 1965
Rockefeller Foundation of New York	Excavation	Excavation	canals	Woodberry 1961
Arizona Public Service Company	Liberty-to-Gila Bend Transmission Line Survey	45 linear miles	43	Brook et al. 1977
Arizona Public Service Company	Liberty-to-Gila Bend Transmission Line Survey	184.5 linear miles	18	Brook & Davidson 1975; Simmons 1976; Stein 1977
Archaeological Institute of America	Reconnaissance	Southwest U.S. & Mexico	?	Bandelier 1884, 1892
Smithsonian Institution	Reconnaissance	Gila River & its tributaries	?	Fewkes 1909
Various	Mapping canals	Buckeye Valley & Casa Grande	canals	Midvale 1965, 1974
Mrs. W.B. Thompson American Museum of Natural History	Thompson Expedition (Excavation)	"Lower Gila Region"	?	Schmidt 1927
Gila Pueblo	Excavation	Casa Grande and Adamsville sites	2	Gladwin 1928
Gila Pueblo	Reconnaissance	Gila River from Florence to Estrella Mountains	178	Gladwin and Gladwin 1929
Gila Pueblo	Reconnaissance	Gila River between Gila Bend and Yuma	15	Gladwin and Gladwin 1930
Gila Pueblo	Reconnaissance	?	?	Gladwin and Gladwin 1935
Gila Pueblo	Excavation	Snaketown site	1	Gladwin et al. 1937
Van Bergen/ Los Angeles Museum	Excavation	Grewe site	1	Hayden 1931; Woodward 1931

Southwestern Monuments Association	Excavation (testing)	Casa Grande National Monument	1	Ambler 1961; Hastings 1934

Table 1. Major Archaeological Projects Along the Gila River, continued

Sponsor	Type of Project	Areal Extent	Number of Sites	Reference
Maricopa County Parks and Recreation Department	Survey	Estrella Mountain Regional Park	12	Johnson 1963
Arizona State Highway Department	Excavation (testing)	Excavation	8	Johnson 1964
Arizona State Highway Department	Excavation	Snaketown site	1	Haury 1965, 1976
Bureau of Reclamation	Central Arizona Project Survey (Salt-Gila Aqueduct)	58 miles long (Apache Junction to near Picacho, Arizona)	75	Dittert, Fish, and Simonis 1969; Grady et al. 1973; Stein 1979
Bureau of Reclamation	Central Arizona Project Excavations	Excavation	45	Teague and Crown 1983, 1984
Continental Oil Company	Excavation	Excavation	6	Doyel 1974
Continental Oil Company	Survey	7860 acres	9	Doelle 1976b
National Park Service	Roosevelt Water Conservation District Floodway Project Survey and Testing	approximately 1181 acres	29 (survey) 14 (excavation)	Brooks and Vivian 1976; Greenleaf and Vivian 1971; Rice 1977, 1979; Rice et al. 1979; Wilcox 1979
Bureau of American Ethnology	Reconnaissance	Pueblo Viejo area	>15	Fewkes 1904; Hough 1907
University of California	Reconnaissance	Southeast Arizona	?	Sauer and Brand 1930
National Park Service	Excavation	Buttes Dam Site	1	Wasley and Benham 1968
National Park Service	Excavation	Excavation	2	Johnson and Wasley 1966
National Park Service	Survey	Gila River channel between Safford and the Buttes Dam Site (approximately 110 miles)	>39	Tuohy 1960
Bureau of Reclamation	Buttes Reservoir Survey	approximately 9700 acres	272	Debowski et al. 1976
Tucson Gas and Electric Company	San Juan to Vail Transmission Line Survey	approximately 120 miles long	3	Doyel 1972

Graham-Curtis Canal Company	Survey	North side of Gila River between Bryce and Cold Springs	4	Gilman and Sherman 1975
Coronado Resource Conservation and Development Project	Survey	Foote Wash and No Name Wash	21	Kinkade 1975

Table 1. Major Archaeological Projects Along the Gila River, continued

Sponsor	Type of Project	Areal Extent	Number of Sites	Reference
Arizona Electric Power Cooperative	Survey	approximately 123 km long	89	Simpson and Westfall 1978
Arizona Electric Power Cooperative	Excavation	Excavation	11	Westfall et al. 1979
Gila River Indian Community	Reconnaissance	Gila River Indian Reservation (95,000 acres)	366	Ayres 1975; Wood 1972
U.S. Army Corps of Engineers	Survey and Testing	150 acres near Florence	16 (survey) 1 (testing)	Vanderpot 1992
Bureau of Land Management	Survey	Buckeye Hills East (12,800 acres)	20	Rodgers 1976

a large survey (12,800 acres) near Buckeye Hills within their Greenbelt Planning Unit for administrative purposes. Sites were predominantly Hohokam and consisted of a variety of types (Rodgers 1976).

Overviews of the lower Gila River area have been produced by the BLM. Doelle (1975a) prepared an overview of BLM's Greenbelt Planning Unit, and McGuire and Schiffer (1982) published an overview for the BLM of the prehistory of southwest Arizona, concentrating on the area of the Sonoran Desert south of the Gila River.

Middle Gila

Many early explorers, visitors, missionaries, and American government representatives noted archaeological ruins along the middle Gila. The early chroniclers were particularly impressed by Casa Grande, a large Classic period Hohokam site that contains a Great House, a large, multistoried adobe structure. Some of these early commentaries came from Father Kino, a Jesuit missionary who first visited the area in 1694; Manje and Bernal, Spanish soldiers; and Emory, Johnson, and Bartlett, American government personnel. Bandelier (1884, 1892) also wrote about Casa Grande while conducting ethnographic, archaeological, and archival research for the Archaeological Institute of America in the southwest United States and Mexico. In two separate accounts he interpreted the structure differently, once as a residence and then as a fortress. Bandelier made other observations along the Gila, noting that major ruins on the south bank of the river were located between 3 and 6 miles apart within a 2-mile-wide strip and that there were large concentrations of sites between Sacaton and Florence (Bandelier 1892:447, 458). The Hemenway Expedition, led by Cushing in 1886, visited several sites, including Casa Grande, and in 1891 the Smithsonian Institution sponsored Fewkes's work of documenting the extent of vandalism at Casa Grande. Cosmos Mindeleff (1896, 1897) produced records of the site before and after stabilization/restoration occurred at the site, providing detailed descriptions of the architecture. He believed that Casa Grande was built and occupied by ancestors of the Pima. Fewkes continued the work of repairing and protecting the site from the elements from 1906 to 1908 so that it could serve as an "exhibition ruin" for the American public (Wilcox 1977:36).

Following his Casa Grande work, Fewkes (1909) conducted a reconnaissance survey along the Gila and its tributaries to describe major ruins and their condition. During his survey he noted extensive canal systems associated with the sites. In 1927, Cummings studied prehistoric canals around Casa Grande on both sides of the river, and Frank Midvale (1965, 1974) mapped canal systems from approximately 10 miles west and 15 miles east of Casa Grande, as well as canals around eastern Buckeye Valley (Figure 4).

In 1925, Schmidt (1927) led the Thompson Expedition excavations at sites along the Gila and Salt rivers. The goal of the expedition was to establish chronological relationships among sites. Gladwin (1928) conducted test excavations to establish a ceramic and cultural sequence at the Casa Grande and Adamsville sites.

The Gila Pueblo survey began in 1928 (Gladwin and Gladwin 1929), with the area along the Gila River covered from Florence west to the Sierra Estrella Mountains. The survey was specifically oriented to defining the range of the red-on-buff pottery that is the trademark of the Hohokam prehistoric culture. Between 1934 and 1935 Gila Pueblo excavated the large Hohokam village site of Snaketown (Gladwin et al. 1937). This work was a milestone in Hohokam archaeology, providing expanded and systematized knowledge on Hohokam material culture. Architecture, ball courts, and canals were investigated, and the chronological sequence that was developed was the basis for the

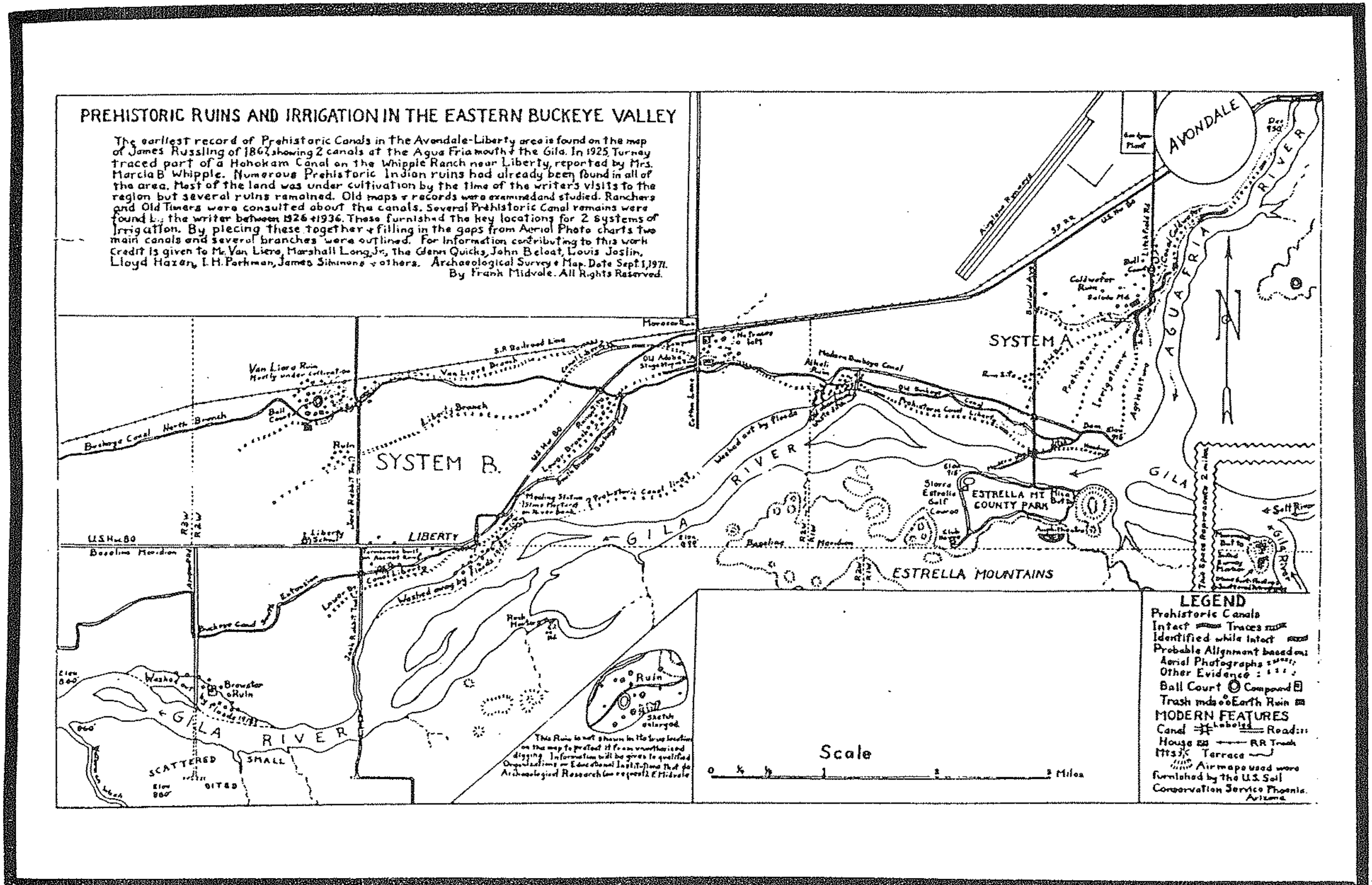

Figure 4. Midvale's map (1974) of the eastern Buckeye Valley.

Figure 4:Midvale map

chronology used today (Table 2). Other sites that were excavated during the early 1930s include the Grewe site, about 1 mile east of Casa Grande National Monument (Hayden 1931; Woodward 1931), and Casa Grande (Ambler 1961; Hastings 1934).

Table 2. Chronology for the Prehistory of the Gila River Valley, Hohokam

Southwestern	Post-Classic	Polvorón	A.D. 1350-1450
Southwestern	Classic	Civano	A.D. 1250-1350
Southwestern		Soho	A.D. 1100-1250
Southwestern	Sedentary	Sacaton	A.D. 900-1100
Southwestern	Colonial	Santa Cruz	A.D. 750-900
Southwestern		Gila Butte	A.D. 650-750
Southwestern	Pioneer	Snaketown	A.D. 550-650
Southwestern		Sweetwater	A.D. 450-550
Southwestern		Estrella	A.D. 350-450
Southwestern		Vahki	A.D. 250-350
Archaic			8000 B.C - A.D. 1
Paleoindian			10,000 - 8000 B.C.

The 1960s saw an increase in archaeological work along the middle Gila. In 1963, the Maricopa County Parks and Recreation Department sponsored a survey of five regional parks, including the Sierra Estrella Mountains (Johnson 1963), where 12 sites were recorded. Construction of Interstate 10 promoted archaeological work near Gila Butte on the Gila River Indian Reservation (Johnson 1964). Eight sites were investigated, including numerous burials. Between 1964 and 1965 the site of Snaketown was re-examined by Haury (1965, 1976). A total of 181 houses were excavated and 29 mounds were tested to collect information on chronology, possible Mesoamerican influences, and the history of irrigation agriculture. Beginning in 1969, a series of projects were undertaken in conjunction with the Central Arizona Project (CAP), a large, multiple-year project sponsored by the Bureau of Reclamation to construct an aqueduct that would supply water from the Colorado River to central and southern Arizona (Table 1). Surveys were conducted along the Granite Reef, Salt-Gila, and Tucson portions of the aqueduct, and these were followed by testing and data recovery efforts in the 1970s and 1980s.

An intensive site survey of the Gila River Indian Reservation conducted in 1970 (Wood 1972) located over 300 prehistoric Hohokam and historic Pima sites. The purpose of the survey was for better management of reservation land.

Beginning in 1971, a number of survey and excavation projects were conducted by Continental Oil Company to mitigate the impacts of a drilling project on the north side of the Gila River near Florence. A preliminary survey and salvage excavations were undertaken in 1971 and 1972 (Ayres 1971; Windmiller 1972), with excavations in 1973 at Escalante Ruin, a large Hohokam site reported in detail in Doyel's 1974 dissertation. In 1974, 7860 acres were surveyed north of Escalante Ruin as part of the same project, locating nine sites. A statistical sample of the surveyed area was also subjected to further investigation, with the emphasis on reconstructing patterns of prehistoric upland exploitation (Doelle 1976b). At about the same time, the Roosevelt Water Conservation District Floodway Project to widen and extend the existing floodway to the Gila River was initiated; in 1971, survey and test excavations (Brooks and Vivian 1976; Greenleaf and Vivian 1971) included work at the Gila Butte Site. The Arizona State Museum (ASM) continued the work in 1974 (Brooks and Vivian 1976), and a 1977 management report (Rice 1977) assessed the project's impact on 29 sites and site complexes in the Gila Butte-Santan area (Berry and Marmaduke 1982:90). The report was followed by testing of 22 sites (Rice 1979; Rice et al. 1979; Wilcox 1979).

Upper Gila

Less archaeological work has been done along the upper Gila River than along the middle Gila. Early explorations and expeditions, including those sponsored by the Bureau of American Ethnology, were in the form of descriptions and brief reconnaissance surveys. Lieutenant Emory described ruins along the Gila River and provided the first description of the Buena Vista site, near Safford (Emory 1848). Bandelier (1892), Russell, Fewkes (1904), and Hough (1907) conducted surveys that passed through the area. During their survey, Fewkes and Hough visited the Buena Vista and Solomonville sites in the Safford region, noting that agriculture had almost destroyed the site of Solomonville. Gila Pueblo's survey of the area (Gladwin and Gladwin 1935) focused on identifying the range of Hohokam red-on-buff pottery. In 1929, Sauer and Brand (1930) conducted a survey that covered the Gila River from approximately San Carlos to the Arizona/New Mexico border. Their goal was to locate the maximum number of archaeological sites in the time allotted and to collect a representative sample of artifacts. The number of sites located is not reported in the text. Tatman (Brown 1973) conducted brief excavations at the Buena Vista site, although they were never completed.

In 1963, Vivian surveyed the proposed Buttes Reservoir area for the National Park Service (NPS), locating five sites. In 1966, ASM excavated one of the sites, the Buttes Dam site, a large Hohokam village on a terrace on the north side of the river (Wasley and Benham 1968). Two other sites were excavated for the NPS on the San Carlos Indian Reservation in 1963 (Johnson and Wasley 1966), but they represented a local variation of a mixture of cultural manifestations (Bronitsky and Merritt 1986). The original survey for the project (Gila River Channel Rectification Project) recorded 18 sites (Tuohy 1960) in 1959, 10 on the north bank and 8 on the south bank of the Gila River, near Bylas.

In the 1970s, a number of surveys and other archaeological work were undertaken in conjunction with utility and water control projects. In 1972, a survey was conducted for Tucson Gas and Electric from Clifton to Tucson (Doyel 1972). In 1974 a survey was done for the Graham-Curtis Canal Company for the proposed construction of five flood control dams and their associated features (Gilman and Sherman 1975). This survey area was approximately 10 miles northwest of Safford, with four prehistoric sites recorded between the floodplain and the second terrace of the river. Dam site areas near Safford also were surveyed for the Coronado Resource Conservation and Development Project in 1975 (Kinkade 1975). Twenty-one sites were found along Foote Wash and No Name Wash, which empty into the Gila River Valley. Most of the sites represented small temporary camps. A series of surveys were conducted for Arizona Electric Power Cooperative (AEPCO) in 1977 from their Greelee Substation to their Cochise Power Plant south of Willcox. A total of 103 sites were recorded (Simpson and Westfall 1978), and 11 sites subsequently were excavated (Westfall et al. 1979). Survey of the proposed Buttes Reservoir area in the 1970s located 250 prehistoric sites or site components, most of which were associated with Hohokam occupation (Debowski et al. 1976).

Other, smaller projects also took place during this time period. In 1973, survey and limited excavations in the Pueblo Viejo area, near Safford, examined the origins of

Salado cultural influence seen there (Bown 1973). Two Salado sites also were excavated by students from Eastern Arizona College in 1975 and 1976 (Bronitsky and Merritt 1986:65).

Overviews for the area around the upper Gila River have been produced to date for the Bureau of Land Management (BLM). Separate overviews were compiled for the Middle Gila Planning Unit (Debowski and Fritz 1974), Winkelman and Black Hills Planning Units (Teague 1974), Geronimo Planning Unit (Doelle 1975b), and for Southeast Arizona in general (Bronitsky and Merritt 1986). The earlier overviews do not always include maps, providing only descriptions of planning units in the text.

PREHISTORIC CULTURAL HISTORY

Lower Gila

Evidence of Paleoindian occupation (approximately 10,000 to 8000 B.C.) of the lower Gila occurs only in the western portion. Between Yuma and Painted Rock Mountains, Breternitz (1957:1) noted a trail site that may have been associated with the Malpais phase (Rogers 1939:6-8). The trail is located on desert pavement and is a cultural feature typical of the San Dieguito Industry, a long-lived and widespread stone artifact industry in the southwest desert, that may date to pre-9000 B.C., although there is controversy regarding the temporal placement of this phase.

Archaic period (8000 B.C.- A.D. 1) sites have not been identified along the lower Gila River, although areas to the north and south of the river have Archaic period occupations. Ventana Cave (Haury 1950), approximately 45 miles to the south, had stratified Archaic deposits, and the Harquahala Valley (Bostwick et al. 1988), approximately 35 miles to the north, contained a number of Archaic sites. Sites that consist only of stone artifacts have been found by Breternitz (1957) and Vivian (1965), and these may represent either occupations by Archaic period hunters and gatherers or use by later ceramic-using groups as temporary camps.

The introduction of ceramics into the prehistoric Southwest was a transition away from the Archaic period lifestyle of mobile hunting and gathering to a more sedentary way of life that was accompanied by farming, food storage, and a settlement shift toward major rivers and streams (Wilcox 1979). Following the Archaic period, two ceramic traditions were prevalent along the lower Gila, the Patayan and the Hohokam cultures. Patayan sites are less well known than Hohokam sites, generally because they are smaller and fewer in number. In addition, little or no archaeological work, recording or excavation, has been done on Patayan sites, so that little information is available. During the pre-Classic periods (A.D. 300-1100), Patayan influence generally extended west of Gila Bend; during the Classic period (A.D. 1100-1450) it spread east to the Buckeye Hills area. Lower Colorado Buff Ware ceramics are dominant on

Patayan sites and were the type found most often during Breternitz's 1955 survey. He recorded 11 sites that contained pottery; most of them were campsites located on sand dunes, in the mesquite flats of the river floodplain, or away from the river (Breternitz 1957:2). Rogers (n.d., cited in Stone 1986:68) described Patayan sites as temporary camping and resource exploitation remains near desert trails that linked reaches of the Colorado and Gila rivers. In the Buckeye Hills area, Patayan occupation is inferred by the presence of Lower Colorado Buff Ware that generally was recovered from upland areas. Use of the area appears to have been associated with seasonal exploitation and is represented by artifact scatters and rock rings as temporary sleeping circles. Along the lower terrace, these remains are usually mixed with Hohokam artifacts (Rodgers 1976:70).

The Hohokam culture occupied the easternmost section of the lower Gila, from the area around Gila Bend to its eastern boundary with the middle Gila River. The Hohokam along the Gila were sedentary agriculturalists who produced a distinctive red-on-buff pottery and expanded their sphere of influence to many parts of the Southwest, evident by architectural and other material traits. Hohokam culture history has been divided into phases within periods (Table 2), separated by changes in ceramic and other material traits, and includes the Pioneer, Colonial, Sedentary, Classic, and post-Classic periods. The Hohokam occupied the lower Gila beginning in the Pioneer period, but ceramics from this period are always mixed with those from later occupations (Doelle 1975a:7). During the Colonial period (A.D. 650-900), however, habitation sites are definable and settlement pattern can be reconstructed. Large permanent habitation sites are concentrated around the Painted Rocks Reservoir and Gila Bend area and are represented by the Rock Ball Court and the Gatlin sites. The Rock Ball Court site (Figure 1) is situated on a terrace overlooking the Gila River from the north. Five structures were excavated at the site, as well as a ball court, two cremations, a pit oven, trash mounds, and borrow pits. The structures and ball court showed some variation from typical Hohokam characteristics. Three of the structures were pithouses, described as houses built completely within pits (Wasley and Johnson 1965:6-17), but they were unusually large, deep, and irregularly shaped (Wasley and Johnson 1965:17). Two of the structures were oval rock-lined surface structures, not typical Hohokam types, that may have been used for storage. In addition, the ball court (26.0 x 14.5 m) was shallower than usual and was surrounded by a caliche apron. These unusual patterns were thought to represent a local development of Hohokam-style architecture. The pithouses had an average floor area of 16.5 m^2, and the surface structures had areas of 29.8 m^2 and 15.0 m^2 each. Based on the Painted Rocks Reservoir excavations, Wasley and Johnson (1965:80) determined that by the Colonial period in the Gila Bend area, Hohokam villages were located on the first and second terraces above the river. Although no canals were found associated with this time period, site locations suggest their use for farming.

The Sedentary period (A.D. 900-1100) was the most elaborate stage of Hohokam culture in the Painted Rocks Reservoir project area (Wasley and Johnson 1965:18).

Sites dating to this period include the Gatlin and Citrus sites (Figure 1). The Sedentary component of the Gatlin site that was excavated incorporates a platform mound, 22 trash mounds, 2 ball courts, a crematorium, a pithouse, and an irrigation canal. The platform mound had a flat top and sloping sides with rounded corners and was irregularly subrectangular (Wasley and Johnson 1965:18). It was built and added on to in successive stages; at its final and largest stage, it was about 12 ft above the surface of the plaza and measured 95 x 70 ft. The trash mounds were an average of 15 m in diameter and 1 m in height. Both ball courts consisted of shallow depressions with semicircular ridges of earth bordering the court along both long sides. One of the ball courts measured 33.0 × 11.2 m; the pithouse had a floor area of 11.7 m^2. The canal had a U-shaped profile, with a channel width of approximately 3 m and a depth of 1.3-1.8 m, and its head was located about 5 miles northeast of the site (Wasley and Johnson 1965:24).

The Citrus site was another Hohokam village located about 15 miles west of the Gatlin site. The northern section of the site had been destroyed by agricultural activities. This site included not only 2 ball courts and 11 structures (pithouses), but a caliche-floored plaza as well. Most of the houses were situated around the edges of the plaza, which was approximately rectangular and measured 35 × 20 m (Wasley and Johnson 1965:37). Three other Sedentary period sites were excavated, revealing the presence of more ball courts, trash mounds, and pithouses. Platform mounds and ball courts imply social organization and complexity among the residents of these sites and that they participated within the same type of sociopolitical structure that was in place to the east, in the heart of Hohokam country. Irrigation agriculture was practiced, and canals were maintained.

After A.D. 1100, following the transition from the Sedentary to the Classic period, there was a settlement pattern shift in the Painted Rocks Reservoir area. Villages changed location from the first and second terraces above the river to the floodplain or first terrace. Five Hohokam Classic period sites were excavated within the Painted Rocks Reservoir (Wasley and Johnson 1965:69), and one, the Fortified Hill site, was described. The Fortified Hill site is located on a butte with a sheer cliff on the north side; it comprises approximately 40 masonry structures within fortification walls. This defensive type of site is more characteristic of areas to the south of the Gila, where fortified sites were common. Only one structure from the Classic period sites was excavated. It was a rectangular surface masonry structure, typical for this time period, with a large floor area (74.4 m^2). Sites contained both inhumation and cremation burial features. The combination of such features is usual during the Classic period, although the appearance of inhumations in the Hohokam area is usually attributed to Salado cultural influences, other traits of which are not apparent in the Gila Bend area.

No post-Classic remains have been reported along the lower Gila. Because so little archaeological work has been done, no conclusions regarding this time period are possible.

Middle Gila

Some archaeological remains of the Paleoindian and Archaic traditions have been recorded along this segment of the Gila River. Evidence of the Paleoindian tradition has been found in the form of a few isolated projectile points in the area around Florence (Agenbroad 1967:116; Huckell 1982) and north of Coolidge (Agenbroad 1967:114). Archaic evidence also occurs as isolated projectile points, as well as a camp site near Florence (Vanderpot 1992:11). The Gila Dunes site was used during the Archaic period as a camp for the seasonal exploitation of resources that were found along and adjacent to the river (Fish n.d.;Vanderpot 1992).

Prehistoric cultural history along the middle Gila is dominated by the Hohokam, with a chronological sequence following that in Table 2. The transition from the Archaic to the Hohokam tradition is generally not well documented along the Gila River. This may be due to inundation of sites by the river so that they are not visible from the surface; transition period sites have been discovered along floodplains of minor tributaries and washes south of the Gila, representing early attempts at floodwater farming prior to the introduction of irrigation agriculture. Hallmarks of the Hohokam culture include canal irrigation, cremations, ball courts, platform mounds, polished redwares and brownware pottery, and other artifacts. Primary sites that have been investigated along the middle Gila include large villages, such as Casa Grande and Snaketown. From intensive study of these large sites, information such as site-specific data and settlement structure through time has been compiled. Haury's (1978) detailed descriptions of excavations at Snaketown have contributed to our knowledge of pre-Classic site architecture and artifact types. Investigations along the Salt-Gila Aqueduct for the Central Arizona Project (Teague and Crown 1984) added to information on Classic period sites. Wilcox (1979) later conducted an analysis of settlement patterns along the middle Gila based on data from university site files, published reports, and his personal observations. His analysis produced a site-size classification based on acreage and changes in site location relative to the river and other sites (Table 3). According to Wilcox's classification, sites were organized as Class A (0.025-35 acres), Class B (50-165 acres), Class C (180-550 acres), or Class D (over 1000 acres). Only the Cashion site, located near the confluence of the Salt and Gila rivers, was categorized as Class D. The discussion that follows draws most heavily on these studies in assimilating current archaeological knowledge of the area.

Table 3. Selected Data on Sites along the Middle Gila River

Temporal Period	House Floor Area[1] (m^2)	Average Distance[2] Between Sites (km)	Average Distance[2] of Sites from River (km)
Early Pioneer	51	NA	1.8
Late Pioneer	23	4.4	2.1
Colonial	20	3.3	2.2
Sedentary	20-25	NA	2.4
Classic	17.1	2.3	2.1

[1]Pre-Classic statistics are taken from Haury 1978, and the Classic period statistics are derived from Teague and Crown 1983.
[2]Statistics are taken from Wilcox 1979.
NA = not available

The Pioneer period, the earliest in the Hohokam sequence, is represented by the Gila Butte and Snaketown sites (Figure 2). During this period, sites were dispersed in no particular pattern along the river at the edge of the floodplain and on the second terrace (Wilcox 1979:101). They consisted of small autonomous villages, each with its own canal system. Early Pioneer period sites were found on the north of the river, while later Pioneer villages were located on both sides of the river. The average distance from the river was 2.1 km, and there was an average distance of 4.4 km between sites (Table 3).

The earliest houses, during the Vahki phase of the Pioneer period (Table 2) were large (average floor area = 51 m^2) and square, becoming progressively smaller (average floor area = 23 m^2) and sometimes rectangular during later Pioneer period phases. The earlier, larger houses are inferred to have been used by large extended families (Haury 1978:68).

Average distance between sites narrowed to 3.3 km during the Gila Butte phase of the Colonial period due to an increase in the number of sites as well as an increase in site size. Ball courts appear on sites located along canal systems. The later Colonial period, or Santa Cruz phase, was a relatively stable time with few new sites and modest increases in village size. Casa Grande, Gila Butte, and the Grewe sites were founded during this period. Settlement pattern along the river continued to be dispersed, with sites averaging a slightly greater distance (2.2 km) from the river than the previous period. Houses had a smaller floor area (average = 10-15 m^2) and developed rounded corners at the end of the Colonial period.

Sedentary period sites in general increased in size; Snaketown doubled in size (Wilcox 1979:105). Few new sites emerged during this time, and the new sites were smaller than previously established villages, possibly representing a hierarchical settlement pattern similar to a chiefdom-level society (Rafferty 1982:83). Agriculture intensified near the villages, and the average distance from the river increased to 2.4 km. Dry farming techniques were employed in the bajada, or lower mountain slope, zone in the form of linear and grid borders, check dams, and rock piles. Rock piles were placed around a plant to conserve moisture and trap nutrients.

Houses were variable in both size (20-25 m^2 in floor area) and shape, occurring as either square or rectangular with rounded corners, or elliptical. Sometimes houses were grouped around a small open area, with their doorways facing the same area. Caliche-capped mounds appeared, notably Mound 16 at Snaketown, with ball courts increasing in number and in the distance between them, which averaged 6.8-8 km (Wilcox 1979:106).

The Classic period saw changes to the Hohokam system. Although new sites emerged, many were abandoned, including Snaketown. Sites associated with this period are Casa Grande, Adamsville, and the Escalante Ruin. Contiguous adobe surface rooms, compound walls enclosing the dwelling structures within a relatively small area, monumental architecture such as platform mounds and "big houses" (Casa Grande), and polychrome ceramics make their appearance during this time. Platform mounds are irregularly distributed, and the average distance of sites from the river decreases to 2.1 km (early Classic period) (Wilcox 1979:106). Several canal systems were consolidated into single systems as agriculture further intensified and sociopolitical organization became even more complex. An elite segment of the population, administering separate polities and with special access to exotic or long distance trade materials may have occupied the platform mounds.

Post-Classic sites have not been identified in the area, although they are known along the Salt River. However, these later occupations have only recently been described and defined, and future archaeological work may discover such later occupations along the middle Gila. During this time, population decreased and settlement pattern reverted to a dispersed rather than nucleated pattern. Pithouses replaced the adobe architecture of the previous period, and no more platform mounds were constructed. No new canals were built, and most Hohokam sites were abandoned.

Upper Gila

Remains of the Paleoindian big-game-hunting tradition in the Southwest (10,000-8000 B.C.) have not been found along the upper Gila River. Possible Archaic (8000 B.C.-1 A.D.) sites have been found (Kinkade 1975) south of the river east of Safford. Securely dated Archaic sites are not known, but the Gila Valley is thought to be the northern boundary of the local Archaic occupation, the Cochise culture, in southeastern Arizona (Sayles 1945).

Following the Archaic period, the Gila River Valley (Figure 3) was settled and influenced by different culture groups. The western most portion of the upper Gila segment, in the area of the proposed Buttes Reservoir, was occupied primarily by the Hohokam; the Safford Valley and Clifton areas were occupied primarily by the Mogollon; and by approximately A.D. 1200, all of these areas were influenced by Salado cultural manifestations. Hohokam occupation, as noted above for the other Gila River segments, was centered around the Salt-Gila Basin along the middle Gila River. The Mogollon culture was originally defined as a population inhabiting mountain and mountain-lowland transition zones of east-central Arizona and western New Mexico (Wheat 1955). The Salado occupation, first identified by a series of pottery types such as Pinto, Gila, and Tonto Polychrome, is represented by a complex of characteristics that was centered around the Tonto-Globe area beginning about A.D. 1100-1500. Most archaeological investigations along the upper Gila River have been surveys; thus, little detail is available. Also, most have taken place around the Safford Valley, where many prehistoric remains have been lost because of historic and modern farming. However, based on surveys for the Graham-Curtis Project, Gilman and Sherman (1975) concluded that there were formerly villages of 50-200 rooms along the entire length of the Safford Valley and along the Pinaleño Mountain foothills (Gilman and Sherman 1975:5-6). Sites with agricultural features, such as gridded gardens, terraces, and canals, are found along the river floodplain and terraces, and Pinaleño Mountain foothills. Sites in the Gila Mountains were much smaller and included both open sites and rock shelters. Kinkade's (1975) survey southwest of Safford along two washes found numerous limited-activity sites that represented temporary camps associated with lithic manufacture and exploitation and possible check dams associated with water control.

Hohokam populations occupied the western portion of the upper Gila, and these sites are best represented by an archaeological survey associated with the proposed Buttes Reservoir. Two hundred fifty sites were recorded: 61 habitation sites, 36 prehistoric agricultural components, 22 rock shelters and caves, 91 temporary hunting or gathering sites, and 40 lithic procurement and tool production sites. Most of the prehistoric occupation of the area was during the late Colonial and Sedentary periods (Table 2) and was most intensive along the portion of the Gila River where the floodplain is widest (Debowski et al. 1976:104). General trends in Hohokam characteristics and culture history in this area follow those of the middle Gila, except that no canals were noted. This may be due to the absence of subsurface excavations in the area or because, as Debowski et al. (1976:91) indicate, "...the area is not amenable to canal irrigation due to the velocity of the Gila River." Most of the agricultural features, including check dams, diversion dams, terraces, and rock piles, were found on the north side of the river in areas that were least dissected and which were gently sloping, the most ideal conditions for farming in the area.

The earliest habitation site in the Buttes Reservoir area was occupied from the late Pioneer period to the Colonial period. A ball court and trash mounds were noted at the site. Colonial through Sedentary period occupations were represented by rectangular, subrectangular, and oval pithouses, ball courts, and trash mounds. Classic period sites exhibited evidence of Salado influence, with cobble structures and compound walls. Limited activity sites, such as plant-gathering sites, were usually found further away from the river, on the first and second geological terraces and in the upper bajadas, where the paloverde-saguaro community is common. Hunting sites usually were situated on high locations such as ridges, spurs, and knolls (Debowski et al. 1976:94). Rockshelters and caves were occupied from the Colonial through the Classic periods and were used for temporary or extended habitation and for limited activities (Debowski et al. 1976:99).

The rest of the upper Gila was occupied, for the most part, by the Mogollon (Table 4). Until approximately A.D. 1000, Mogollon populations lived in pithouse villages located in easily defensible positions (Teague 1974:8) in a dispersed pattern. Brown's research focused on early pithouses at five sites, including Buena Vista, in the Safford area. He found comparisons of Salado traits among these sites and other sites from both the Point of Pines-Reserve and the Tonto Basin areas. He called the Salado manifestations in the Safford area the Pueblo Viejo Salado. Sites investigated by Brown (1974) were pueblos with multiple (4 to 170), contiguous rooms and plazas, some of which were partially or fully enclosed by walls. He determined that they were occupied anywhere from post-A.D. 1250 to the early fourteenth century.

Table 4. Chronology for the Prehistory of the Gila River Valley, Mogollon Region

Tradition	Phase	Dates
Southwestern	Encinas	A.D. 950-1200
Southwestern	Cerros	A.D. 850-950
Southwestern	Galiuro	A.D. 650-850
Southwestern	Pinaleño	A.D. 400-650
Southwestern	Dos Cabezas	A.D. 100-400
Southwestern	Peñasco	300 B.C. - A.D. 100
Archaic		8000-300 B.C.
Paleoindian		10,000-8000 B.C.

oval or circular, and later (A.D. 950-1200) pithouses were rectangular. Rock-lined and masonry-lined rooms occur after the transition to surface structures. The AEPCO project (Simpson and Westfall 1978) found three Mogollon pithouse villages that were situated on terraces north and south of the river. Ranging between 22.2 and 49.4 acres in area, these sites contained numerous features, including rock alignments, possible terraces, and other possible agricultural remains. Occupations dated from pre-A.D. 900 to approximately A.D. 1000. One of the sites contained rectangular cobble-lined pithouses, possibly indicative of the transition to above-ground masonry rooms (Simpson and Westfall 1978:95). Excavations near Bylas (Johnson and Wasley 1966) on the San Carlos Indian Reservation examined two sites with occupations dating from A.D. 1100 to 1200. They contained 88 surface rooms of rock-reinforced adobe construction, 2 pithouses, 4 cremations, and 5 trash mounds.

From approximately A.D. 100 on, contact with other cultural groups increased, and by A.D. 950-1200 many Hohokam traits were present (Simpson and Westfall 1978:24). In the Safford Valley, prior to the introduction of Salado polychromes, culture contact was oriented in a north-south direction, stretching from the White Mountains in the north to Casas Grandes, across the modern international border, in the south. With the introduction of Salado traits, interaction expanded to include contact west of the Safford Valley. The appearance of the Salado complex added traits such as polychrome and other ceramic types, puebloan architecture of coursed masonry or solid adobe, cliff dwellings, compounds or defense walls, and inhumation burials. According to Brown,

> Salado polychromes have been found on terraces above the Gila River, mainly on sites downstream from Safford. Salado in the Safford area differs from Tonto Basin Salado by the presence of Point of Pines-Reserve ceramic types, the absence of compound architecture, and the absence of late northern tradewares [Brown 1974, cited in Simpson and Westfall 1978:26].

PREHISTORIC USE OF THE GILA RIVER

During the period of prehistoric occupation, the entire length of the Gila River played a major role in human settlement patterns and occupational success. As discussed above, most prehistoric habitations along the river were situated close to the river. In fact, along the lower Gila where Patayan populations settled, occupation was confined to the river valley (Breternitz 1957:1). Along the middle Gila, communities were able to settle about 2 km from the river floodplain because of the extensive canal systems that furnished irrigation water. In all segments of the river, site density dramatically decreased with distance from the river.

The river served as a focus for subsistence and cultural diversity. A variety of culture groups occupied the Gila Valley, and a mixture of traits among these groups attests to the communication link between populations, fostered by the river's course. Evidence of one of these linkage systems is the formalized network of ball courts. "The large Hohokam communities in the Gila Bend area, for example, are linked with those in the Phoenix Basin by a continuous string of settlements along the Gila River in which ballcourts appear to occur about every 3-5 km... (Wilcox, McGuire, and Sternberg 1981:201)." Other networks, such as trade or exchange, were set up to foster interaction with areas outside of the Gila Valley as well. Examples include the Salado influence and trails that connected populations along the lower Gila to those along the Colorado River and south to the Papagueria (Breternitz 1957:12). Diversification within culture groups also was fostered by the river. Characteristics of riverine versus non-riverine populations have been noted for both the Patayan (Schroeder 1957:177) and the Hohokam (Haury 1950). Diversity was produced by differences in subsistence strategies and diet, promoted by living either next to the river or in the desert without the benefit of the river as a permanent water source.

Prehistorically, the Gila River provided a wide variety of dietary and other subsistence resources. The river itself provided a permanent water source and fish as a source of protein (Miller 1955). Cobbles along the river bed were used extensively as raw material for tools and for Classic period structures. In addition, the river promoted great diversity in floral and faunal resources along its banks. Riparian vegetation was more lush than it is today. Excavations at Escalante Ruin determined that a saltbush-mesquite community was prevalent around Casa Grande and Escalante during the prehistoric occupation (Doyel 1974:16). Today, only dead mesquite trees and creosote bush are visible. In the past, mesquite bosques were common along the river, and the water table was relatively high. In fact, Haury (1978:9) describes a prehistoric well at the site of Snaketown no more than 3 m deep "...that tapped a reservoir fed by Queen Creek (Berry and Marmaduke 1982:20)." There was a significant riparian community historically as well.

> Along the formerly great Gila River (the now dry bed of which stretches across the Sonoran Desert of western Arizona) there were extensive marshes, swamps, and flood plains with cattail (*Typha domingensis*), bullrush (*Scirpus olneyi*), giant reed (*Arundo donax*), common reed (*Phragmites communis*), arrowweed (*Pluchea sericea*), and many trees. The dense vegetation of these well-developed riparian communities often stood 10 to 15 feet high and supported a tremendous quantity of wildlife [Lowe 1964:30].

The riverine environment supported a wide variety of animal species, particularly rodents, small mammals, birds, and fish. When Father Kino visited the Pima of the Gila Valley, he noted that "...all its inhabitants are fishermen, and have many nets and other tackle with which they fish all year" (cited in Berry and Marmaduke 1982:27). Fish remains (*Acipenser*) were also identified from prehistoric contexts at the site of Snaketown (Miller 1955:132).

Agriculture was a primary use of the river. Irrigation, dry farming, and floodwater farming were evident along most of the river, from the Gila Bend area to beyond the Safford Valley from the pre-Classic to the Classic period. Arable land and water availability were primary factors in settlement location, and the type of agriculture that was practiced was based on the character of the river at any given point as well as the character of the landscape and distance from the river. According to Debowski et al. (1976:90), the area around the proposed Buttes Reservoir did not have canals because the velocity of the river was not suited to canal irrigation; instead, water control features such as diversion dams, contoured terraces, rock alignments, and rock piles were used to capture rainfall or runoff for agricultural fields. These techniques maximized potentially arable land and expanded alternatives of procuring water for fields beyond the available irrigation canal zone. The inhabitants thus decreased the likelihood of failure by not relying on one system alone. This would have been important for an expanding Hohokam population that probably needed surplus to feed political and economic specialists. Moreover, river flooding would have washed out intakes and damaged canals, necessitating a backup system for crop production. Floodwater farming was practiced by Patayan inhabitants along the lower Gila (Schroeder 1957:177) and by Hohokam farmers. Canal irrigation was practiced by the Hohokam from the area around Gila Bend (Woodbury 1961) to the Pinaleño Mountain foothills (Doelle 1975b:12). Canals are known archaeologically from the Gatlin site (Wasley and Johnson 65:24), Casa Grande (Cummings 1927:9-10), and the surrounding area (Brooks and Vivian 1976:29-33; Midvale 1965), Snaketown (Haury 1978; Woodbury 1961), and other sites along the middle Gila (Berry and Marmaduke 1982:50; Fewkes 1909; Wilcox 1979:115), the Fortified Hill Site (McGuire and Schiffer 1982:106), the Gila Butte site (Greenleaf and Vivian 1971), the eastern Buckeye Valley (Midvale 1974), and near Gila Bend (McGuire and Schiffer 1982:133; Woodbury 1961).

ENVIRONMENTAL RECONSTRUCTIONS

Within recent years, enormous strides have been taken in understanding of the prehistoric natural environment. Reconstructions have included paleo-climatic and hydrological conditions in the lower Colorado Plateau that are applicable to southern Arizona in general (Dean et al. 1985; Euler et al. 1979) and paleo-botanical and paleo-faunal types native to the Gila River Valley used by the prehistoric inhabitants.

Euler et al. (1979) produced a paleo-environmental record for the American Southwest by plotting geo-climatic and bio-climatic indicators for the Colorado Plateau. Indicators consisted of data from tree-rings, pollen records, and alluvial sediments. These data were analyzed within a temporal framework, and fluctuations through time were noted (Table 5). Dean et al. (1985) used similar data to produce a model of interaction between the cultural system (prehistoric populations) and the natural system (environment), and identified periods of stress. In general, low water tables and channel entrenchment, or degradation, would have an adverse effect on agriculture; on the other hand, high effective moisture and aggradation, or surface stability, would be favorable to the development of irrigation systems, as well as other agricultural technologies. Variability in the dendroclimatic record might have produced some short-term responses prehistorically to accommodate unusually high or low precipitation, such as relocation of agricultural fields or the expansion of irrigation systems (Dean et al. 1985:542-543).

Prehistorically, the floodplain and terraces of the Gila River contained a wide variety of plant and animal species. Desertification and reduction in this habitat (Crosswhite 1981:67; Hastings and Turner 1965; Rea 1983) in recent times have decreased species diversity and changed some of the flora and fauna that characterize the Sonoran Desert landscape. Man's influence over only the past 100 years has created changes along the river in the amount of groundwater, erosion, and depletion of native vegetation. The riparian forest is mostly gone or replaced by feral salt cedar, and weedy

Table 5. Environmental Reconstructions Applicable to the Gila River Valley

A.D.	Effective Moisture *	Depositional and Erosional Cycles*	Dendroclimatic Variability*	Salt River Geomorphic Processes**
1500				
		Degradation	Frequent Oscillations	
1400				Marked lateral erosion and channel widening (A.D. 1356-1370)
				Stable Conditions; trend toward island-braided channel (infrequent high-magnitude flows); some channel avulsion probable; deepening of channel (A.D. 1197-1355)
1300				
	Low	Aggradation		
1200			Infrequent Oscillations	
		Degradation		Trend toward bar-braided channel (infrequent high-magnitude flows); some channel avulsion possible (A.D. 1052-1196)
1100				
1000		Aggradation		Trend away from bar-braided channel toward island-braided conditions; channel narrowing (A.D. 900-1051)
	High			
900				

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			Frequent Oscillations	Establishment of bar-braided channel; channel widening and bank erosion (A.D. 798-899)
800	Low	Degradation		
				Channel Stabilization (A.D. 740-797)
700				
	High	Aggradation	Infrequent Oscillations	
600				

*From Masse 1991, after Dean et al. 1985 and Euler et al. 1979.
**From Gregory 1991, after Nials, Gregory, and Graybill 1989.

species proliferate. The water table, previously a few feet below the surface, now averages hundreds of feet underground (Rea 1983:3). The archaeological and historic records document the change in riparian and desert scrub communities from historic to modern times. Yet the natural resources used prehistorically by the Hohokam remained relatively constant. Archaeological data, such as pollen, macro-botanical, and faunal remains, indicate that there were no radical changes in the natural environment, and thus the climate, prehistorically.

HISTORICAL ARCHAEOLOGY

Only a limited amount of archaeological research has been conducted on sites dating to the historic period along the Gila River. Two extensive surveys, one at the Barry M. Goldwater Gunnery Range east of Yuma and south of the Gila River, the other at the Florence Military Reservation, recorded historic sites. The survey of the Goldwater Range was conducted by Statistical Research, Inc. and resulted in the recording of one historic road, three historic homesteads, and one historic mining camp (Bruder et al. 1988). The survey of the Florence Military Reservation, also conducted by Statistical Research, resulted in documentation of the 1879-1881 mill and smelter town of Reymert (DeNoon Camp) and a site associated with the World War II Prisoner of War Camp at Florence. Most of the historic sites recorded during this survey, though, were associated with cutting ironwood for conversion to charcoal, which was then used in mining smelters. The archaeologists believed that the entire area was clearcut for charcoal production (Ayres 1992:33-34). More intensive archaeological investigations have occurred at Yuma, the Gila Bend Stage Station, and Alicia Station (north of the Gila River between Sacaton and Casa Blanca).

Historic sites in the Yuma area have been extensively investigated. Redondo Ruins, a late nineteenth-century ranch site where irrigation agriculture was practiced, was excavated by Janus Associates, Inc. in 1983 (Ayres 1983). In 1984, Janus Associates conducted test excavations at the downtown mall in Yuma and identified foundations of commercial buildings constructed between 1890 and 1930 and used by "grocers, tailors, cobblers, barbers, dry cleaners, and a Chinese laundry" (Ayres 1984:34). In 1988, areas around the Southern Pacific Railroad Station and Hotel were excavated by Archaeological Research Services, Inc. (Ayres 1988:34). Several historical archaeological studies have been conducted at the Yuma Quartermaster Depot (Stone 1980, 1983; Swanson and Altschul 1991). Swanson and Altschul (1991) summarize these studies and discuss the history of Yuma, presenting new data from archaeological and archival studies.

In their historical overview, Swanson and Altschul (1991:23-94) discuss Spanish exploration and missionization of the Gila-Colorado River transportation route, establishment of the Gila Trail by trappers from the United States, military use of the Gila Trail during the Mexican War in 1846, and conversion of the Gila Trail to the

Southern Overland Trail to California by the forty-niners. Ferry service across the Colorado, a military post, and civilian settlement at Yuma Crossing all date to 1849. Leach's Federal Wagon Road and the Butterfield Overland Stage Route were established through Yuma in 1858. The use of steamboats on the Colorado began in the 1850s. The Quartermaster Depot was established in 1867 and was supplied by steamboat. With the construction of the Southern Pacific Railroad to Yuma in 1877, the use of steamboats declined, but some were still in use during the first part of the twentieth century. The coming of the railroad also limited the need for the Quartermaster Depot, which was officially closed in 1883. Swanson and Altschul mention in passing that "the Gila, much smaller than the Colorado, has always been rather marginal for navigation" (Swanson and Altschul 1991:17), and that "The Gila was less attractive as a navigation artery, but it too was explored with the discovery of placer gold around Gila City in the early 1860s (Doyle et al. 1984:64)" (Swanson and Altschul 1991:38).

Irrigation agriculture began in the 1870s, and in 1902, the Reclamation Service began studies for the Yuma Project, a major irrigation project. Archaeological investigations of the Quartermaster Depot resulted in the identification of a trash deposit associated with steamboat-captain Isaac Polhamus's house, the depot guardhouse, a trash deposit associated with the final years of the depot, late nineteenth-century adobe structures, an early twentieth-century pumphouse and associated canals, and a 1909 corral (Swanson and Altschul 1991:ii).

The Gila Bend Stage Station, in use from 1858 to 1880, was excavated by the Arizona State Museum in 1960 (Berge 1968). The excavations were among the first historical archaeology projects in Arizona. The site consisted of five adobe structures. Two "structures" were actually two blocks of rooms under a single roof, separated by a hall, and probably functioned as guest rooms for travelers. The third structure was a kitchen and dining area, the fourth was a forge, and the fifth was a stable. The original stage station, called Gila Ranch, was built by the Butterfield Overland Stage Company in 1858 and then rebuilt in 1860 after it was destroyed by Indians. The stage station was used by a number of stage lines until the railroad arrived in 1880, and the town of Gila Bend was moved away from the Gila River and next to the railroad. The old stage station was heavily damaged by a flood in 1891.

Arizona State University conducted excavations at Alicia Station, located on the Maricopa, Phoenix, and Salt River Railroad. This site contained extensive historic Pima materials, which provided information on Anglo-Pima acculturation (DaCosta and Ditzler 1977; Upham n.d.).

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CHAPTER IV

History

A. Historical Overview/River Chronology

The history of human activity along the Gila River has been recorded in numerous books, journals, newspaper accounts, magazine articles, and U.S.G.S. Water Supply Papers (WSP). From the pre-historic Indian bands (some nomadic) who used it for its life-giving waters, to the Spanish *conquistadors* who followed it in their search for golden cities, to the more modern "Forty-Niners" who traveled along it on their way to the California gold fields, to turn-of-the-century Territorial Arizonans who occasionally plied it with various types of water craft, the river has been used as an silent guide and a source of life giving water. The following series of extracts is but a brief compilation of written materials which chronicle those activities.

1697 A party passing through the Gila River basin reported the following in November, 1697: "On the 18th we continued west over an extensive plain, sterile and without pasture; and at the end of five miles, we discovered, on the other side of the river (the Gila), other houses and edifices. The sergeant, Juan Bautista de Escalante, swam over with two companions to examine them; and they said that the walls were two yards in thickness, like those of a fort; and that there were other ruins about, but all of ancient date." ("Excavations at Snaketown", Harold S. Gladwin, et. al., p. 3, Tucson, University of Arizona Press, 1965).

1748 Fr. Kino visited Agua Caliente, named the site "Santa Maria del Agua Caliente"; considered locating a mission ("Arizona Place Names," p. 11).

1775 A Spanish expedition of about 180 persons, led by Don Juan Bautista de Anza, traveled from Horcasitas, Mexico to San Francisco. The party traveled the Gila from the Casa Grande Ruin to the Colorado River. Father Pedro Font's diary reports Indian agriculture, irrigation systems and describes various reaches as "dry," "half way up his legs," "reaching to the shoulder-blades of the horses," and "very deep and ran very slowly." The Gila River portion of the trek lasted from October 30 to November 28, 1775, covering 77 leagues (231 miles), according to Font ("Anza's California Expeditions - Volume IV, Font's Complete Diary of the Second Anza Expedition").

1824-7 A party of five, including James O. Pattie, trapped beaver and travelled the entirety of the Gila River ("The Personal Narrative of James O. Pattie of Kentucky," p. 90).

1846 Kearny's "Army of the West" performed what was probably the first systematic exploration of the Gila River, travelling from Silver City, New Mexico to the Colorado River junction department around October 20, 1846, and arriving November 23, 1846 ("The Gila: River of the Southwest," p. 140).

1846-1847 A United States Army expedition, including surveyors and geologists, explored along the Gila River on orders from the United States Congress to identify "practicable and economic" routes for a railroad from the Mississippi River to the Pacific Ocean (Extract from Report of a Military Reconnaissance, made in 1846 and 1847 by Lieut. Col. W.H. Emory," pp. 5-15).

1846-7 Captain Philip St. George Cooke and the Mormon Battalion made a one-way patrol from Santa Fe to San Diego during the Mexican War, reaching the Pima villages around December 22, 1846 after raising the American flag in Tucson on December 17, 1846. After taking the cutoff to Gila Bend, Cooke placed Lt. George Stoneman in charge of a detail to float supplies down the Gila from Gila Bend to Yuma. Stoneman's "raft" consisted of two wagon beds lashed together, went aground on numerous occasions and Stoneman was forced to jettison a portion of the cargo. Stoneman rejoined Cooke at the mouth of the Gila on January 8, 1847 ("The Gila: River of the Southwest," pp. 151-4).

1849 A party of 33, including John L. Chamberlin departed Lewisburg, Pennsylvania in February 1849, arrived in Santa Fe, New Mexico on July 7, 1849, reached the Gila River on July 9, 1849, and arrived in Yuma on August 9, 1849. The party followed Kearny's Gila Trail, also known as the "Devil's Turnpike" to the travelers. They encountered the Knickerbocker party on July 12, 1849. An estimated 600 men travelled the Gila Trail en route to California for the Gold Rush ("Traveling the 'Devil's Turnpike: The Heyday of the Upper Gila Trail, 1846-1849," pp. 8-12).

1849 The Edward Howard party constructed a boat and floated the Gila from approximately Gila Bend to Yuma; a child was born enroute ("The Gila: River of the Southwest," pp. 175-6).

1849 Camp Calhoun established, September ("Arizona Place Names," p. 498).

1849 An unnamed party of Forty-Niners, including Stanislaus Laselle, travelled from Fort Smith, Arkansas to vicinity of Los Angeles along the Gila Trail, departing Fort Smith on March 25, 1849, arriving at the Gila River on

July 3, 1849, and arriving at the Colorado River on August 6, 1849 ("The 1849 Diary of Stanislaus Lasselle," Overland Journal, pp. 21-4).

1849 A wagon train of Forty-Niners, identified as the "Peoria Train" and including Charles Edward Pancoast, travelled from Fort Leavenworth, Kansas to Los Angeles along the Gila Trail, departing April 29, 1849 and arriving January 1, 1850 ("A Quaker Forty-Niner," pp. 242-54). (See map end of Section A.)

1849 A wagon train of Forty-Niners, identified as the "Little Rock Company" and including Robert Brownlee, travelled from Fort Smith, Arkansas to Yuma along the Gila Trail, departing in the late months of 1849 and arriving in early 1850 ("An American Odyssey: The Autobiography of a 19th Century Scotsman, Robert Brownlee," pp. 67-8).

1849-1850 John W. Audobon (son of naturalist John James Audobon) and a party traveled from near Brownsville, Texas to Georgetown, California along the "Southern Route" passing through Tucson and the Pima Villages (September 24, 1849), apparently crossed the Gila just north of Gila Bend after taking the forty-mile shortcut and crossed the Colorado River downstream of the mouth of the Gila (October 14, 1849) ("Audobon's Western Journal: 1849-1850," pp. 154-63).

1850 Camp Calhoun renamed Camp Independence, November 27 ("Arizona Place Names," p. 498).

1850 An unsigned letter from a traveler at 'Camp Salvation' reported in part that the "expedient of lightening down teams by building small boats on the Gila" had been tried and succeeded and that many Gila Trail travelers had thus reached the Colorado River. (*New York Daily Tribune*, February 18, 1850).

1851 Camp Independence renamed Camp Yuma, March ("Arizona Place Names," p. 498).

1852 Camp Yuma reestablished as Fort Yuma, February 22 ("Arizona Place Names," p. 499).

1853-1854 A United States Army expedition, including surveyors and geologists, explored along the Gila River on orders from the United States Congress to identify "practicable and economic" routes for a railroad from the Mississippi to the Pacific. Vol. VII: Reported the Gila was ⅛ to ½ miles wide and up to 12 feet deep, had wide bottoms and lagoons, and that the Pimas were irrigating field crops in a 6 to 8 mile wide river bottom.

Vol. II: Reported that the river bed location had changed in a few locations and dry in mid-February. Vol. I: Reported that water was not available during certain seasons, that logs could probably be delivered from the Mogoyon mountains down the Gila, and that the river was approximately 9 feet deep for 35 miles up from the mouth during low water period ("Reports on Explorations and Surveys, . . . Route for a Railroad from the Mississippi River to the Pacific Ocean," 33C2S Senate Ex. Doc. No. 78 and 33C3S House Ex. Doc. No. 91).

1854 Town of Yuma surveyed and filed in San Diego as "Colorado City", the "Arizona City", the "Yuma City" ("Arizona Place Names," p. 499).

1854 Fort Yuma abandoned as military post and turned over to Interior Department, January ("Arizona Place Names," p. 498).

1857 A United States Army expedition, including surveyors, explored southern Arizona Territory to identify the Mexican-American boundary, including travels along the Gila River. Vol. I: Reported that near and below Florence the river was about 40 yards wide and an average 2 feet deep, with a 'sinuous course, with a swift current and turbid waters ("Report on the United States and Mexican Boundary Survey, . . . by W. H. Emory," 34C1S Senate Ex. Doc. No. 108).

1857-1858 An expedition of 18 officers, including John C. Reid, plus a number of others, travelled for ten months through Texas, New Mexico, Arizona, Sonora and California at the direction of Congress. Tucson to Sacaton to Yuma ("Reid's Tramp," pp. 227-31).

1858 Butterfield Southern Overland Mail Company established "early in 1858 from St. Louis to San Francisco, 2759 miles" ("Arizona Place Names," p. 69).

1858 Yuma (New Mexico) Post Office established, March 17, as Colorado City ("Arizona Place Names," p. 499).

1858 Colorado City (Yuma) Post Master appointed, March 17 ("Arizona Place Names," p. 499).

1858 Gila City Post Office established, December 24 ("Arizona Place Names," p. 177).

1858 Gila City stage station established about 24 miles east of Yuma, near modern-day town of Dome ("Arizona Place Names," p. 177).

1859 Act of Congress approved February 28, 1859 (II Stat., 401) established Gila River Indian Reservation. ("Indian Affairs - Laws and Treaties," Vol., III (Laws), Charles J. Kappler, ed., p. 804, Washington, GPO, 1904).

1866 Towns of Florence and Adamsville were established ("Arizona Place Names," p. 10).

1866 Early (first) house in Florence constructed by Charles G. Mason ("Arizona Place Names," p. 164).

1866 Yuma (Arizona) Post Office established, October 16 as Yuma ("Arizona Place Names," p. 499).

1867 Agua Caliente Post Office established, March 12 ("Arizona Place Names," p. 12).

1869 Phoenix Post Office established, June 15 ("Arizona Place Names," p. 327).

1869 Chase and Brady Irrigation Ditch constructed at Florence.

1869 The Stewart Party, including Harriet Bunyard, departed Collin County, Texas (near Dallas) on May 1, 1869 and headed for California along the Southern Trail through Tucson and the Pima Villages. The party reached the Gila on August 26, 1869 and reached Yuma on September 22, 1869 (Ho for California, pp. 239-47).

1870 The Shrode Party, including Mrs. Maria Shrode, departed Sulphur Bluff, Texas on or about May 10, 1870 and headed for California along the Southern Trail, reaching the Pima Villages on November 1, 1870 and arrived in Yuma around December 11, 1870 (Ho for California, pp. 288-93).

1871 San Carlos Indian Reservation, then known variously as the White Mountain or Camp Apache Reservation, established under Executive Order by President U.S. Grant, dated November 9, 1871 ("Indian Affairs - Laws and Treaties, Vol. I (laws)", Charles J. Kappler, ed., Washington, GPO, 1904).

1871 Gila Bend Post Office established, May 1 ("Arizona Place Names," p. 176).

1872 San Carlos military post office established October 12, later Town of San Carlos ("Arizona Place Names," p. 382).

1873 Solomonville (Solomon) Post Office established, April 10 ("Arizona Place Names," p. 415).

1873 Arizona City renamed Yuma by Territorial Legislature, February 2 ("Arizona Place Names," p. 499).

1873 Yuma (Arizona Territory Post Office established, October 16. ("Arizona Place Names," p. 499).

1875 Safford Post Office established, March 5 ("Arizona Place Names," p. 373).

1876 Gila River Reservation established under executive Order by President U.S. Grant dated August 31, 1876 ("Indian Affairs - Laws and Treaties, Vol. I (laws)", Charles J. Kappler, ed., p. 806, Washington, GPO, 1904).

1876 Sacaton Post Office established, January 3 ("Arizona Place Names," p. 372).

1877 Report of a pioneer party travelling west which occasionally encounters the Gila River; locations are somewhat vague. "Thursday, August 2nd: [near Safford] . . . terribly warm and dusty, grass burned up but plenty of water in the river. Vegetables look fine as they are irrigated from large ditches . . . Saturday, August 18th: [location unspecified] . . . we were follow the river for a mile and then leave it and it will be fifteen miles to water which we'll have to buy. What a blessing it is to have good water." (Craig, Helen Baldock. Within Adobe Walls, 1877-1973. Phoenix, Arizona: Art-Press Printers, 1975. pp. 25 & 31).

1877 Mohawk stage station established ("Arizona Place Names," p. 283).

1879 Gila River Reservation boundaries revised under Executive Order by President Rutherford B. Hayes dated January 10, 1879 ("Indian Affairs - Laws and Treaties, Vol. I (laws)", Charles J. Kappler, ed., p. 806, Washington, GPO, 1904).

1879 Gila River Reservation boundaries revised under Executive Order by President Rutherford B. Hayes, dated June 14, 1879 and canceling Executive Order by President Rutherford B. Hayes, dated January 10, 1879 ("Indian Affairs - Laws and Treaties, Vol. I (laws)", Charles J. Kappler, ed., p. 806-807, Washington, GPO, 1904).

1880 Glenbar first located by Joseph Mathews, December 1880 ("Arizona Place Names," p. 179).

1880 Pima Post Office established, August 23; Mormon settlement in 1879 or 1880 ("Arizona Place Names," p. 331).

1881 Dome identified as "Castle Dome". Dome Post Office established April 24, 1900 ("Arizona Place Names," p. 132).

1881 Hassayampa Post Office established, March 28 ("Arizona Place Names," p. 200).

1881 Three men including William "Buckey" O'Neill, departed Phoenix for Yuma in a 20 feet long, 5 feet wide boat christened "Yuma or Bust", and that they were "wading in water up to their knees". (*Phoenix Gazette*, November 30, 1881).

1881 The O'Neill party returned to Phoenix claiming to have successfully negotiated the river to Yuma in six days. The Gazette's editor, however, disputed that claim and reported that the party had been "compelled to wade in the water the greater part of the time, while pushing their craft ahead of them." (*Phoenix Gazette*, December 3, 1881).

1881 "Messrs. Cotton and Bingham will leave tomorrow for Yuma by way of the Salt and Gila Rivers. They have constructed for the trip, and 18-foot skiff, flat-bottom, which will draw very little water . . ." (*Arizona Gazette*, February 17, 1881).

1882 Town of San Carlos Post Office established, October 12; later submerged by San Carlos Reservoir ("Arizona Place Names," p. 382).

1882 Gila Bend Indian Reservation established under Executive Order by President Chester A. Arthur dated December 12, 1882 ("Indian Affairs - Laws and Treaties, Vol. I (laws)", Charles J. Kappler, ed., p. 804, Washington, GPO, 1904).

1883 Central settled ("Arizona Place Names," p. 86).

1884 "Mr. A.J. McDonald is building a large ferry boat for the Gila and Salt River Ferry Company to be put on the Salt River below town. It will be of the same dimensions as the one sent to the Gila, viz: 16 by 18 feet. It will be worked on an inch and a quarter steel cable and be a permanent arrangement." (*Phoenix Herald*, April 8, 1884).

1886 Central Post Office established, January 11 ("Arizona Place Names," p. 86).

1888 Thatcher Post Office established, March 10 ("Arizona Place Names", p. 441).

1888 Buckeye Post Office established, March 10 ("Arizona Place Names," p. 65).

1889 The United States Geological Survey reported forty-nine irrigation canals were taking water from the Gila River to serve at least 221440 acres of land (Twelfth Annual Report of the U.S.G.S.).

1889 United States Geological Survey stream gauging station established at the Buttes (Section 11, Township 4 South, Range 11 East).

1890 Mohawk Post Office established, June 25 ("Arizona Place Names," p. 283).

1891 "R.M. Straus of Aztec, senior partner in the house of Straus, Dallman & Co., made the SENTINEL a call yesterday. They have their new ferry-boat ready and at work crossing the Gila River. It is large enough to carry a loaded 6-horse team in safety." (*Arizona Sentinel*, March 28, 1891).

1892 Eden Post Office established, May 23 ("Arizona Place Names," p. 141).

1895 "Editor Arizona Sentinel: . . . to make an extended trip down the Gila River to its junction with the Colorado . . . I obtained 90 days vacation . . . built a boat 3½ x 18 feet of the flat bottomed type . . . the Graham (Gila?) Valley was reached, 35 miles from our starting point . . . and enjoys an unlimited supply of water for irrigating purposes . . . Fort Thomas on January 23rd . . . we left (San Carlos Post) January 28th . . . disembarking all of our camp equipage, we safely ran our sturdy little house boat through the rapids (of 'Bugaboo Canyon') . . . below us sounded the deafening roar of falls and waters which we had yet to pass . . . our little house boat was lowered through the (second) rapids and between boulders in a torturous route, by means of our long (200') rope . . . (which) suddenly slackened and I . . . plunged into the icy water and partly swam and was partly carried by the strong current downstream . . . the boat appearing much the worse for wear after its plunge down the rapids, one end being entirely submerged . . . my companion was bailing out the water from the stern . . . I swam to the boat . . . we repaired the boat in a couple of hours and continued our voyage . . . our boat was hauled on a train from Sacaton to Tempe. We spent two days visiting Phoenix and . . . a start was made for Yuma. Since arriving here . . . I would not engage to make the trip down (the Gila's) hazardous waters again." ("Four Hundred Miles Down the Gila River--Incidents of the Trip," J.W. Evans, *Arizona Sentinel*, March 9, 1895).

1895 "Yesterday morning Amos Adams and G.W. Evans arrived in Phoenix having come all the way from Clifton to Sacaton in a boat. These gentlemen enjoy the proud distinction of being the first men to pass through the box canyon of the Gila by water. They left Clifton on January second and launched their boat which had been especially constructed for the purpose on the San Francisco River, they journeyed down that stream to the Gila which they entered fourteen miles below Clifton. From that point they remained on the Gila, until they reached Sacaton, travelling by that stream about three hundred miles. There they disembarked and hauled their boat to Phoenix and after laying on provisions, etc., they will leave tomorrow on the Salt River, to the Gila, thence to the Colorado and by that stream to the Gulf." (*Phoenix Herald*, February 18, 1895).

1895 Congress enacted the Indian Appropriation Act of March 2, 1895 and allotted $3500 to investigate the Gila River Indian Reservation's water problem. The study concluded that turning flows back to the Reservation at the expense of upstream users would be inefficient and not recommended. ("The Campaign for Water in Central Arizona," *Arizona and the West*, pp. 132-133, Summer 1981).

1895 "The following letter was received this morning from Mr. Amos Adams...who passed through the Salt River Valley about a week ago. 'Gila Bend, February 23, Editor Herald--In terms of my promise to write I wish to say that we found nothing unusual on our voyage down the Salt and Gila Rivers except that ducks were plentiful..." (*Phoenix Herald*, February 25, 1895).

1896 Geronimo Post Office established, April 30 ("Arizona Place Names," p. 175).

1898 Congress appropriated $20,000 for the USGS to investigate two dam sites on the Gila River. The Buttes and Queen Creek sites were initially investigated but discounted due to bedrock and limited flow problems, respectively. San Carlos was discovered when the USGS went further upstream. ("The Campaign for Water in Central Arizona," *Arizona and the West*, pp. 134-135, Summer 1981).

1898 Drought illustrated need for water storage facilities in Central Arizona. ("The Campaign for Water in Central Arizona," *Arizona and the West*, p. 139, Summer 1981).

1899 "(Near San Carlos Indian agency) (t)he right bank is high, but the left is low and liable to overflow. The bed of the (Gila River) is sandy and shifting." (WSP No. 38, p. 314).

1899 "The channel of the (Gila) river at the Buttes is composed of quicksand and likely to change daily with any considerable amount of water in the river." (WSP No. 38, p. 317).

1899 United States Geological Survey paper by J.B. Lippincott recognized water supply problems related to Gila River Indian Reservation and diversions upstream of San Carlos. Recommended construction of San Carlos dam and reservoir to alleviate the problem (WSP No. 33, 1900).

1899 Arlington Post Office established, November 23 ("Arizona Place Names," p. 28).

1899 United States Geological Survey abandoned stream gauging station at the Buttes (WSP No. 38, p. 319).

1899 United States Geological Survey stream gauging station established at San Carlos, ½ mile south of Indian agency at San Carlos and below mouth of San Carlos Creek (river) (WSP No. 38, pp. 313-314).

1899 First reclamation appropriations legislation introduced; would have appropriated $1,000,000 for work at San Carlos site. Bill was for foundation work, plans preparation, bedrock investigations. Defeated. ("The Campaign for Water in Central Arizona," *Arizona and the West*, p. 138, Summer 1981).

1900 Mohawk S.P.R.R. railroad station established ("Arizona Place Names," p. 283).

1900 Dome Post Office established, April 24 ("Arizona Place Names," p. 132).

1900 Kelvin Post Office established, April 25 ("Arizona Place Names," p. 231).

1900 Kofa Post Office established, June 5 ("Arizona Place Names," p. 236).

1901 Liberty Post Office established, February 15 ("Arizona Place Names," p. 246).

1901 Representative Francis G. Newlands (Nevada) proposed federally managed funds for irrigation projects. Defeated in 1901, reintroduced and enacted as Reclamation Act in 1902. ("The Campaign for Water in Central Arizona," *Arizona and the West*, p. 139, Summer 1981).

1901 "It is the general impression among our people that the construction of the San Carlos reservoir by the government will make it easier for us to obtain federal aid in the building of the Tonto dam; that it will be an entering wedge, so to speak, and about all we will have to do is put our fingers in the slot and pull out an appropriation large enough to suit the most ambitious. The *Republican* thinks differently. If Congress appropriates money for the building of the San Carlos Dam we will be told by congressmen from other sections that we have enough. That Arizona is not the only duck in the puddle - there are others. It is probable that the San Carlos dam will be constructed and we hope it will be...But with its completion we believe our hopes for federal aid vanish for the present." (*Arizona Republican*, January 1, 1901).

1901 "Col. Walter Graves, of Washington, D.C., arrived at Sacaton Tuesday, ordered there, it is said, to investigate the underflow of the Gila River with the view of furnishing water for irrigation to supply the Indians on the reservation...the fact is that during the dry season there is not enough water in the river to dampen the sand at bedrock." (*Florence Tribune*, November 2, 1901).

1901 "The Gila River is still up and dangerous to ford. At Kelvin a wire rope is stretched across the river on which runs a cage for carrying passengers and freight. On Thursday a cart was carried over and an attempt was made to lead a horse across." (*Florence Tribune*, February 16, 1901).

1902 Reclamation Act enacted, including irrigation of privately held lands; opened up potential of Salt River Project. ("The Campaign for Water in Central Arizona," *Arizona and the West*, p. 140, Summer 1981).

1903 On October 12, 1903, Secretary of Interior E.A. Hitchcock designated the Salt River Project as the first federal reclamation project. ("The Campaign for Water in Central Arizona," *Arizona and the West*, p. 48, Summer 1981).

1903 United States Geological Survey stream gauging station established at Dome (WSP No. 100, p. 26, WSP No. 133, p. 204).

1904 Wellton Post Office established, August 4 ("Arizona Place Names," p. 479).

1904 Gila City name changed to Gila, March 3 ("Arizona Place Names," p. 177).

1904 United States Geological Survey stream gauging station established near Cliff, New Mexico, ½ mile below the mouth of the Mangos (Mancos) River, 40 miles from Silver City, New Mexico (WSP No. 133, p. 198).

1904 "The channel is straight for 400 feet above and 300 feet below the (Cliff, New Mexico) stations. The current is swift. Both banks are about 6 feet high, clean, and subject to overflow during extreme high water. The bed of the stream is composed of sand and gravel, free from vegetation, and shifting. There is but one channel at high and low stages." (WSP No. 133, p. 198).

1904 "The channel is straight for 100 feet above and 900 feet below the (Gila City) station. Velocity is swift. The right bank is low and not subject to overflow. The left bank is above high water. The bed of the stream is composed of silt and sand and is subject to continual change." (WSP No. 133, p. 204).

1905 "The point of gaging (at Dome, formerly Gila City) first established was one-fourth mile north of the depot at Dome. The river now flows in a channel fully 1 mile north of the original channel. The Gila carries an enormous amount of mud and sand. At times the waves of sand traveling along the bed of the stream are so large, the current is so swift, and the stream to (so?) shallow, that the water is broken into a uniform succession of waves 2 feet high and over...At every flood the channel shifts. The valley at its narrowest is half a mile wide and the waters may occupy any part or all of it." (WSP No. 175, p. 164).

1905 Christmas Post Office established, June 17 ("Arizona Place Names," pp. 93-4).

1905 United States Geological Survey stream gauging station at Cliff, New Mexico temporarily abandoned, February 17. Station reestablished, May 22 (WSP No. 175, p. 159).

1905 Jack Henness of Florence was employing a suspended cable-and-cage arrangement to transport passengers and cargo <u>over</u> the river. The article also reports that Henness smiled down on "the crew of the *Gila Queen* (ferry boat) as he passes over their heads." (*Arizona Blade Tribune*, March 4, 1905).

1905 The Gila was "that raging stream." The article also indicated that in at least one instance Henness had transported burros and prospecting equipment. (*Arizona Blade Tribune*, March 11, 1905).

1905 Two new boats had entered the thriving ferry boat business, the *Mayflower* and the *Rey del Gila*. The *Tribune* also indicated that a hand-driven side propeller boat was unable to negotiate the river. (*Arizona Blade Tribune*, March 18, 1905).

1905 A new ferry boat, the *Gila King*, had entered the ferry business. The boat was 20 feet long, 6 feet wide and capable of carrying a 3000 pound load. (*Arizona Blade Tribune*, April 1, 1905).

1905 A man named Jack Shibely launched from Phoenix enroute downriver. The boat capsized once, losing much of its cargo, but was uprighted and eventually reached Gila Bend. (*The Arizona Republican*, April 3, 1905).

1905 An attempt was made to cross the Gila in an 18 feet long, 5 feet wide, 3½ feet deep boat while the Maricopa and Phoenix railway bridge (vicinity Township 3 South, Range 3 East) was washed out. The attempt to even launch failed, however, because "the current was too swift." (*Phoenix Enterprise*, December 9, 1905).

1905 Heavy flows in Gila River washed away portions of bridge at Florence, "the one public road improvement in which the whole people of the territory have a common interest." Local interests recommended that the bridge be relocated "up the river about 300 yards," where "the channel of the river has never changed...within the memory of the oldest Pima Indian not living." (*Arizona Blade-Tribune*, February 11, 1905).

1905 A new model boat, with "hand-driven, side-propellers" failed to cross the Gila. It was speculated that "nothing short of a ten horse power engine" was required. River flow "cut away the head of the canal" near the Arthur ranch. (*Arizona Blade-Tribune*, March 18, 1905).

1907 United States Geological Survey stream gauging station at Cliff, New Mexico abandoned, December 31 (WSP No. 249, p. 176).

1908 "Except for fringe ice along the edges of the stream, ice conditions (near Bedrock, New Mexico) do not interfere with the accuracy of the (gauging) results...Because of...the constantly shifting channel..." (WSP No. 175, p. 165).

1908 United States Geological Survey stream gauging station established near Redrock, New Mexico, about 2 miles east of Redrock post office and about 300 yards above the Middle Box Canyon of the Gila, May 14 (WSP No. 249, p. 176).

1908 "It has been impossible to cross it without the use of boats..." (*Arizona Blade-Tribune*, August 1, 1908).

1909 Bilas (Bylas) appeared on G.L.O. mapping ("Arizona Place Names," p. 70).

1909 United States Geological Survey relocated stream gauging station near Redrock, New Mexico to about 1/8 mile upstream of original location, July 16 (eastern edge, Township 18 South, Range 18 West) (WSP No. 269, p. 219).

1909 Gila Bend Indian Reservation boundaries revised under Executive Order No. 1090 by President William H. Taft, dated June 17, 1909. ("Indian Affairs - Laws and Treaties," Vol. III (Laws), Charles J. Kappler, ed., p. 669, Washington, GPO, 1913).

1909 Price Post Office established, March 18 ("Arizona Place Names," p. 348).

1910 "The channel is straight for some distance above and below the (Guthrie, Arizona) station. The right bank is high and rocky; the left bank is lower, is covered with brush, and is subject to overflow at extreme high water. The bed of the stream is composed of shifting sand and silt. High-stage measurements are made from a car and cable 50 feet below the gage. At lower stages measurements are made by wading above the gage, as the current at cable section is very sluggish." (WSP No. 289, p. 203).

1910 "The channel has a slight curve above the station, but is straight for 1,500 feet below (San Carlos). Both banks are high and not subject to overflow. The bed of the stream is wide and composed of shifting sand. Discharge measurements are made from the railroad bridge, except at low water, when they are made by wading." (WSP No. 289, p. 204).

1910 United States Geological Survey stream gauging station established near Guthrie, Arizona, in Section 3, Township 6 South, Range 30 East, November 6 (WSP No. 289, p. 202).

1910 United States Geological Survey relocated stream gauging station at San Carlos to about 1 mile upstream of original location, August 17 (WSP No. 289, p. 203).

1910 "Work on the territorial road bridge is progressing rapidly..." and should be "...completed in time for...the Territorial fair." (*Arizona Blade-Tribune*, September 17, 1910).

1910 "Water is increasing in volume at the head of the Casa Grande Valley canal...probably due to the decrease in evaporation..." (*Arizona Blade-Tribune*, October 29, 1910).

1910 "Seventeen automobiles enroute from Tucson to Phoenix with fair visitors...balked at the river but all got across safely...the river was carrying...about 20 percent silt..." (*Arizona Blade-Tribune*, November 12, 1910).

1910 Act of Congress approved June 25, 1910 (36 stat., 847) provided Executive Branch with additional authority related to Indian affairs. ("Indian Affairs - Laws and Treaties," Vol. III (Laws), Charles J. Kappler, ed., p. 668, Washington, GPO, 1913).

1911 United States Geological Survey stream gauging station near Redrock, New Mexico washed away by flood, July 23. Station reestablished, October 3; operative, December 1. Temporary gage for interim period (WSP No. 309, p. 228).

1911 United States Geological Survey stream gauging station established near Silver City, New Mexico about 45 miles northeast of Silver City and 500 feet below the confluence of the East and West Fork of the Gila River (Northwest corner, Township 13 South, Range 13 West), June 20 (WSP No. 329, p. 202).

1911 United States Geological Survey stream gauging station established at Kelvin, ½ mile below mouth of Mineral Creek, 1 mile below Kelvin, operative, January 26 (WSP No. 309, p. 231).

1911 Gila River Indian Reservation boundaries revised under Executive Order No. 1387 by President William H. Taft, dated July 31, 1911 ("Indian Affairs - Laws and Treaties," Vol. III (Laws), Charles J. Kappler, ed., p. 668, Washington, GPO, 1913).

1911 Gila River Indian Reservation boundaries revised under Executive Order No. 1447 by President William H. Taft, dated December 16, 1911.

("Indian Affairs - Laws and Treaties," Vol. III (Laws), Charles J. Kappler, ed., p. 669, Washington, GPO, 1913).

1911 "Terry Branaman commenced running his big four-horse bus over the new bridge Wednesday morning...the old ford being uncomfortably deep...impassable by Wednesday evening." (*Arizona Blade-Tribune*, January 14, 1911).

1911 "Don't forget to explain [to inquirers] that the natural flow of the Gila River at Florence is sufficient to amply irrigate 25,000 acres of land...last year [was] a drought year..." (*Arizona Blade-Tribune*, March 18, 1911).

1911 "Heavy rains east of Florence...sent a volume of water down the Gila and the ranchers under the O.T. canal got an irrigation." (*Arizona Blade-Tribune*, June 17, 1911).

1911 "Copious rainfalls...sent a good volume of water...into the Gila and the local canals are all full of water." (*Arizona Blade-Tribune*, September 2, 1911).

1911 "Rains...have caused a large volume of water to pass down the Gila..." (*Arizona Blade-Tribune*, September 9, 1911).

1911 The Gila River, "when properly husbanded, carries sufficient water to irrigate nearly a half-million acres of land...the right to the [catchment basin] site, however, is disputed by the Southern Pacific railroad...[the Tucson] Chamber of Commerce adopted resolutions endorsing the proposed [San Carlos] reservoir as against the claims of the railroad...[Phoenicians] petitioned the Secretary of the Interior to grant the railroad the right of way to the exclusion of the proposed reservoir...with nearly 500,000 acres of irrigable land open for homestead and occupation..." (*Arizona Blade-Tribune*, March 18, 1911).

1911 "It will take two or three weeks to get ready for a barbecue and by that time the order reserving the San Carlos reservoir site for the use and benefit of this valley, will have been issued by the Secretary of the Interior, we believe..." (*Arizona Blade-Tribune*, March 4, 1911).

1912 "The volume of water in the river...is smaller now than it was ever before known to be at this time of the year...[probably due to] low temperatures...[which] prevented the snow from melting." (*Arizona Blade-Tribune*, February 3, 1912).

1912 "Drought was broken...good supply of water in the river..." (*Arizona Blade-Tribune*, March 9, 1912).

1912 "...8½ feet of water in the Gila River...In 1883-4 we had no rainfall here between September and March. But early in March it began to rain...at short intervals, up to August. The Gila River ran bank full for 90 consecutive days and Wm. Eaton, with a boat 4x14 feet in size, cleared $1500..." (*Arizona Blade-Tribune*, March 16, 1912).

1912 "...still a large volume of water going down the river...river was dry at this point long before this date last year..." (*Arizona Blade-Tribune*, May 4, 1912).

1912 "The normal flow of the Gila River, at Florence, is sufficient...to grow [crops] on at least 25,000 acres of land...never been, during the 32 years we have resided in Florence, a single year in which said normal flow was not sufficient for that purpose." (*Arizona Blade-Tribune*, July 27, 1912).

1913 Hayden Junction Post Office established, November 8 ("Arizona Place Names," p. 202).

1913 United States Geological Survey stream gauging station established near Sentinel, Arizona in Section 10, Township 5 South, Range 9 West, July 1 (WSP No. 359, p. 221).

1913 "It is only 12 feet to (underground) water" below Gila Bend. (*Arizona Blade-Tribune*, August 2, 1913).

1913 "...in the vicinity of Kelvin...the stream was swollen..." (*Arizona Blade-Tribune*, December 13, 1913).

1914 United States Geological Survey stream gauging station near Silver City, New Mexico was abandoned, December 31 (WSP No. 389, p. 148).

1914 United States Geological Survey stream gauging station established near Gila, New Mexico, April 8. Station abandoned, December 17 (WSP No. 389, p. 150).

1914 United States Geological Survey stream gauging station near Redrock, New Mexico was abandoned, December 31 (WSP No. 389, p. 152).

1914 United States Geological Survey stream gauging station established near Duncan, Arizona in Section 21, Township 19 South, Range 20 West

(New Mexico), about 15 miles above Duncan, May 10 (WSP No. 389, p. 154).

1914 United States Geological Survey stream gauging station established near Solomonville (Solomon), Arizona in Section 31, Township 6 South, Range 28 East, about 10 miles above Solomonville, April 21 (WSP No. 389, p. 156).

1914 United States Geological Survey stream gauging station briefly established near Florence, Arizona about 1 mile above Indian reservation line and 7 miles below Florence, July 7, abandoned, September 26 (WSP No. 389, p. 160).

1914 Suit was filed on December 9, 1913 (Geo. Lobb vs. Pete Avenente and others) which asserted, in part: "That the Gila River is an unnavigable stream of water...That plaintiffs said lands are...supplied with water diverted from said Gila River and carried there to by irrigation canals...That in the year 1868, the then owner...diverted and cause(d) to be diverted from the said Gila River...have ever since said year 1868, continuously diverted or caused to be diverted...from said river" (*Arizona Blade-Tribune*, January 31, 1914).

1914 Newspaper published article which included a standardized form for claiming water rights. The standard form, created by the O.T. Canal Company included a line which asserted "...the Gila River is an unnavigable stream..." (*Arizona Blade-Tribune*, February 14, 1914).

1914 "...heavy flow of water was in the river..." (*Arizona Blade-Tribune*, June 27, 1914).

1914 "...a good supply of water in the Gila River...farmers are taking advantage of the opportunity to make an irrigation." (*Arizona Blade-Tribune*, July 18, 1914).

1914 "...more water in the Gila River...than during the past two years." (*Arizona Blade-Tribune*, July 25, 1914).

1914 United States Geological Survey stream gauging station near San Carlos, Arizona washed away by flood, December 18. Station reestablished, September 11, 1915(WSP No. 409, p. 156).

1914 "...the Gila River (that is normally dry) is a raging torrent...since last Sunday...when the river...was ten and one-half feet deep at the bridge...the river was higher than at any time since the big flood of

January 1905...it is estimated that 100,000 acre feet of water...every twenty-four hours." (*Arizona Blade-Tribune*, December 26, 1914).

1915 Komatke Post Office established, December 22 ("Arizona Place Names," p. 237).

1915 "...the Florence-Casa Grande canal has been damaged to the extent of from $8000 to $10,000..." principally "...at the head gate, where fully a mile and a half of the canal has been entirely obliterated." (*Arizona Blade-Tribune*, January 2, 1915).

1915 "From the heavy rain of last Friday and the melting snows the river had risen to the four-foot mark and a whirlpool formed..." (*Arizona Blade-Tribune*, February 27, 1915).

1915 "For the third time this season...the bridge across the Gila River went out again..." (*Arizona Blade-Tribune*, April 3, 1915).

1915 "A rise in the river Thursday caused a change in the channel...cutting out the south bank of the river..." (*Arizona Blade-Tribune*, April 10, 1915).

1915 United States Geological Survey stream gauging station near Duncan, Arizona was abandoned, September 30 (WSP No. 409, p. 151).

1916 An automobile had slipped off a ferry boat into five feet of water in the Gila River. (*Arizona Blade-Tribune*, February 9, 1916).

1916 Ashurst-Hayden diversion works authorized by Act of Congress on May 18, 1916 creating Florence-Casa Grande Irrigation Project.

1916 A photo depicted members of the Third Battalion, 14th Infantry fording the river in their army vehicles. (*Arizona Blade Tribune*, September 30, 1916.

1917 United States Geological Survey stream gauging station near Sentinel, Arizona was abandoned, March 2 (WSP No. 459, p. 154).

1917 United States Geological Survey stream gauging station established at Winkelman, Arizona in Section 24, Township 5 South, Range 15 East, September 10 (WSP No. 479, p. 149).

1917 Bylas Post Office, September 13 ("Arizona Place Names," p. 70).

1918 United States Geological Survey stream gauging station at Winkelman, Arizona was abandoned, June 27 (WSP No. 479, p. 149).

1918 United States Geological Survey stream gauging station near Guthrie, Arizona was abandoned, July 11 (WSP No. 479, p. 144).

1920 United States Geological Survey stream gauging station established near Ashurst, Arizona in Section 30, Township 5 South, Range 24 East about 1½ miles east of Ashurst, Graham County, December 24 (WSP No. 549, p. 119).

1921 Calva appeared on GLO map, originally named Dewey ("Arizona Place Names," p. 72).

1921 Gillespie Dam constructed by Gila Water Company ("Arizona Place Names," p. 179).

1921 United States Geological Survey stream gauging station established at Gillespie Dam, Arizona in Section 28, Township 2 South, Range 5 West, August 4 (WSP No. 589, p. 106).

1921 Gillespie Dam completed, stream flow was recorded beginning August 4, 1921. Water-stage recorder was relocated July 28, 1924 (WSP No. 589, p. 106).

1923 United States Geological Survey stream gauging station established at York, Arizona in Section 19, Township 6 South, Range 31 East, May 15 (WSP No. 589, p. 98).

1923 United States Geological Survey stream gauging station established at Ashurst-Hayden Dam near Florence, Arizona in Section 8, Township 4 South, Range 11 East, July 1 (WSP No. 569, p. 112).

1925 Gillespie Dam Post Office established, August 24 ("Arizona Place Names," p. 179).

1926 Roll Post Office established, November 3 ("Arizona Place Names," p. 367).

1927 Olberg Post Office established, June 2 ("Arizona Place Names," p. 307).

1928 Construction of Coolidge Dam was completed. Flow through the dam regulated since November 15, 1928 (WSP No. 689, p. 70).

1928 Coolidge Dam Post Office established, May 7 ("Arizona Place Names," p. 109).

1941 Extracts from Thesis by Ava S. Baldwin: "One of the first ditches was the Chase and Brady Ditch, which was four or five miles in length and used for running the flour mill of Peter R. Brady, built in 1869 ... Patrick Holland from Ireland was the first white man to have the idea of damming the river; he built the Holland ditches ... Another worry to the people of Florence was the diversion of water along the upper Gila ... The upper Gila River had a comparatively consistent flow near the New Mexico line, but not infrequently the river near Florence was dry for several months at a time. There was one fight after another over water. Many of these were legal battles. The people of Graham County and especially the Mormons around Thatcher diverted great quantities of water ... " ("The History of Florence, Arizona, 1866-1940," by Ava S. Baldwin, A Thesis submitted to the faculty of the Department of History, University of Arizona, 1941).

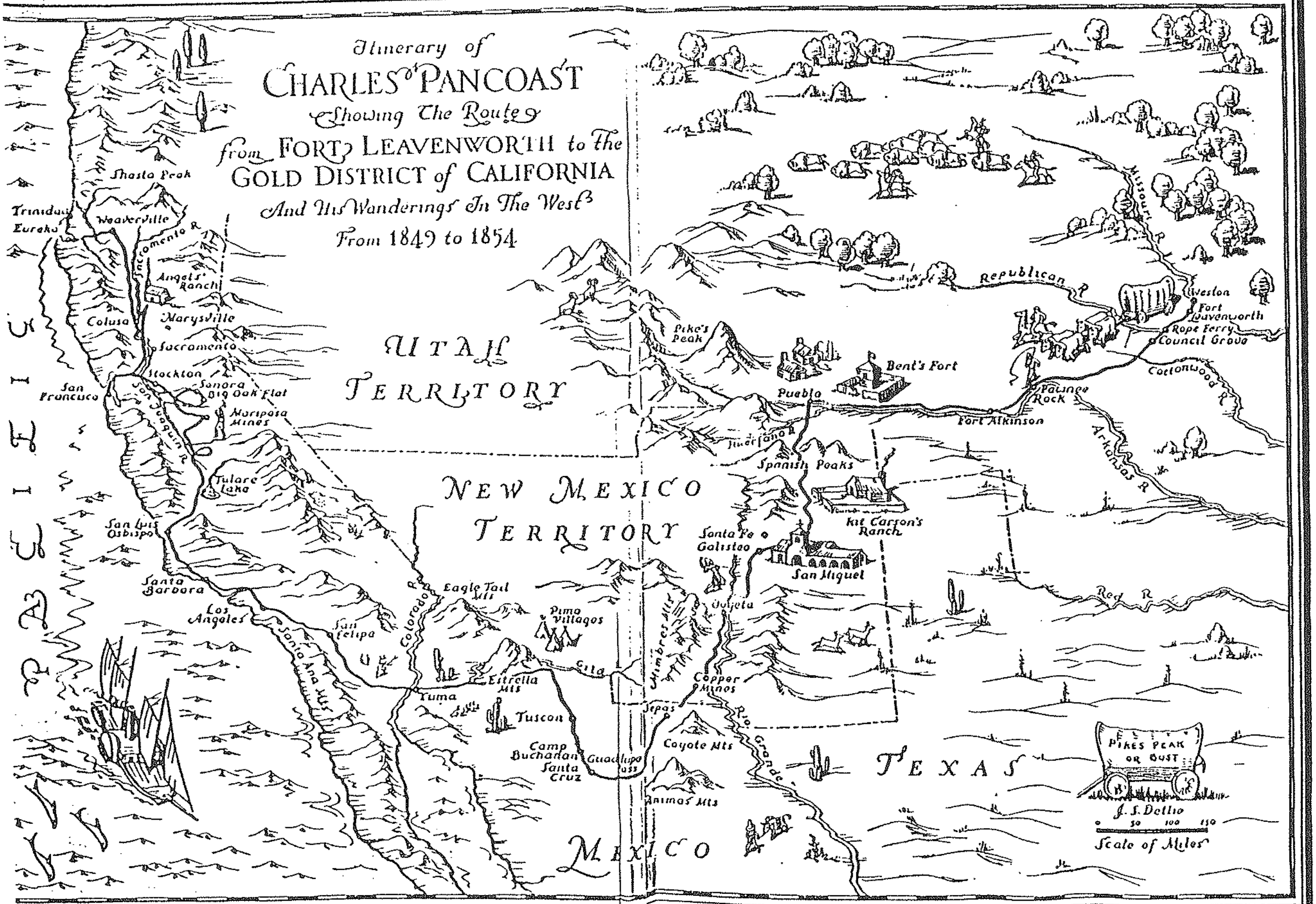
1959 Three men had entered the Gila River in the vicinity of Duncan with the intention of traveling to Yuma. A later account of the trip was reported on February 29, 1959 in the *Yuma Courier*. (*Arizona Sentinel*, February 8, 1959).

1959 United States Geological Survey Stream gauging station established at Painted Rock Dam, Arizona in Section 18, Township 4 South, Range 7 West, October 1 (WSP No. 1926, p. 505).

1964 ...in Bancroft's 'Annals of Arizona'...the footnote (p. 487) first referring to the boat, reads: E.H. Howard, in the San Francisco Bulletin, July 8, 1885, gives the most complete record. He says the boat, 16 ft. long by 5 ft. 6 in. wide, was built for the trip, and first launched on Lake Michigan, being mounted on wheels for land service but used to cross rivers on the way. The writer sailed in her later in San Diego Bay and he says '...the *boy* born on the Gila is still living in Lake Co., Cal.' ("Gift of a Boy," Roscoe G. Willson, *Arizona Republic* ("Sunday Magazine"), August 2, 1964).

1984 Henry Morgan operated Morgan's Ferry near Maricopa Wells for approximately 25 years, beginning in 1867. (*Arizona Magazine* (*Arizona Republic* newspaper), December 9, 1984).

A QUAKER FORTY-NINER



B. Historic Descriptions of the River

River location

In addition to the incidental descriptions included within published reports such as newspapers, books and journals, the Gila River has been surveyed and described periodically by the Bureau of Land Management and its predecessor agencies since 1867 and continuing to the present day. An index of the BLM's survey field notes is included in Appendix __ and copies of the field notes and accompanying survey plats created from those notes are located at the Arizona State Land Department. A review of the survey plats indicates that the Gila has moved periodically, considerably in some locations and negligibly in other locations. Selected extracts of the survey notes follow.

In 1875 the Gila River intersected the California border in Section 22, Township 8 south, Range 23 West, Gila and Salt River Base and Meridian (G&SRB&M), as displayed on BLM map 3921. In 1993 the river's mouth was located in Section 30, Township 8 South, Range 22 West, G&SRB&M (Yuma East Quadrangle, U.S.G.S. 7.5 minute series, 1979; and Federal Insurance Rate Map Panel 04009 0715C, revised November 15, 1985).

<u>Book</u>, <u>Date</u>, <u>Township/Range</u>, <u>Page</u>, <u>Remarks</u>

Book 1624, 12/1890, T8S/R1W

p.20 "The high water in the Gila River having flooded the bottom land east of this point, I am obliged to run on an offset line to avoid it.

p.23 East between Sections 1 and 2, @ 71.00 chains, "Left bank of Gila River, runs N.W. Bank of river is now about 10 ft above surface of river."

p.28 North between Sections 1 (R21W) and 6 (R20W), @ 3.91 chains, "As the cor. would come in the river 2.00 chs. from Left bank the distance of the meander corner on right bank is 3.91 chains," (2.00+3.91 chs)*66 ft = 390 ft
@ 4.00 chains, "having lost some of our tools in crossing the *swollen stream*"

Book 1214, 12/1890, T8S/R21W

pp.73-82 "Meanders of the Left bank of the Gila River, downstream"
"I commence at the Meander Corner to fractional Secs. 12 and 7 on the East boundary of the Township ... thence I run with meanders in Sec. 12 ... "Bank 4 ft high"

p.74 @ 10.20 chains, "Land along river bank level. Soil rich loam. No timber but a few young cottonwoods, and thick willows brush 7.00 chs. Thence in Sec. 1"

p.74 @ 6.00 chains, "bank 8 ft high"

p.74 @ 23.00 chains, "bank 8 ft high"

p.75 "dense brush of willows and mesquite 130.00 chs, 10.00 chs sand & mud" p.75 @ 32.00 chains, "bank 4 ft high"

p.76 "no timber, except scattering cottonwoods and some mesquite, dense brush 58.00 chs. Thence in Sec. 3."

p.76 @ 48.00 chains, "Banks 4 ft high at 6.00 chs, enter brush ... Land level and subject to overflow 10 ft deep"

p.76 "to meander cor. to frac'l Sec. 3 & 4. Land level and subject to overflow 10 ft deep. No timber except a scattering of cottonwoods. Dense brush 90.00 chs. Thence in Sec. 4."

p.77 "to meander cor. to frac'l Secs. 4 & 9. Land level, subject to overflow 10 to 12 ft deep as shown by drift on trees. Dense brush of small cottonwoods and willows and screw bean 59.00 chs. Thence in Sec. 9"

p.78 "No timber except a few scattered cottonwoods. Dense willow & mesquite brush 74.20 chs. Thence in Sec. 8"

p.79 "to meander cor, to frac'l Secs. 8 & 17. No timber, but dense brush 71.10 chs. Subject to overflow from 10 to 15 feet depth. Thence in Sec. 17."

p.80 "In thick willows & mesquite to meander cor... to frac'l secs. 17 & 18. No timber except a few cottonwoods and mesquites. Dense brush 23.70 chs. Thence in Sec. 18"

p.81 "to meander cor. on W. boundary of T8S, R21W. Dense brush 103.60 chs. The entire line of left bank except a very few chains is subject to overflow. Entire length of meander lines on left bank is 8 mi, 44.90 chs of which 7 mi, 79.80 chs are in dense brush. Thence in Sec. 19, in thick brush."

p.82 "to meander cor to frac'l secs. 18 & 19. No timber. Dense brush 23.10 chs."

pp. 83-90 "Meanders on right bank of Gila River, upstream."

p.83 "to meander cor. to frac'l Secs. 17 & 18. No timber, except a few cottonwoods. Dense brush 123.10 chs. Thence in Sec. 19."

p.84 "to flag and meander cor. to frac'l Secs. 18 & 19. Heavy brush 4.70 chs. Thence in Sec. 17"

p.85 "No timber, but a few cottonwoods. Dense brush 16.00 chs."

p.85 "No timber except scattering cottonwoods. Dense brush 79.80 chs."

p.86 "No timber, except some cottonwood. Dense brush 61.20 chs."

p.87 "No timber, except a few cottonwoods. Dense brush of willows and thorns 66.90 chs."

p.87 "Land level & subject to overflow 5 ft deep. No timber except a few cottonwoods. Dense brush 94.50 chs."

p.88 "No timber except scattering cottonwoods. Dense brush 85.00 chs."

p.89 "No timber except a few scattering cottonwoods. Dense brush 136.00 chs. Total length of meanders on right bank = 8 mi. 45.10 chs of which 8 mi. 27.20 chs are in brush."

p.91 General Description. "The bottoms are generally good land, alkaline in places, and generally covered with heavy growth of mesquite, arrowood and willow brush which is very dense in the bottoms along the river ... The only water in the township is that in the Gila River, which is sometimes dry for three months in summer but at the date of this survey and during all summer a large stream has constantly flowed into the Colorado near Yuma."

Book 1213, 9/1890, T5S/R21W

p.18 North between Sections 8 & 9 @ 24.10 chains, "Left bank of Gila River runs S.W."

p.34 North between Sections 18 and 19, @ 28.00 chains, "Descend 8 ft. to lower bottoms, and enter dense brush".
@ 37.40 chains, "Left bank of Gila River runs S.W. Bank about 4 ft. above surface of water ... Distance across river 7.50 chs."
@ 44.90 chains, "To meander point & flag on Right bank ... **my party cannot cross the river, except by swimming**" (Emphasis added.)

p.39 Between Sections 17 and 18, "marked ... 'T8S, S17' on E. and 'R21W, S18' on W. faces ... **I then cause 2 men to swim the river and set a post**" (Emphasis added.)

p.41 North between Sections 1 and 2, @ 16.46 chains, "Gila River runs nearly west"

p.44 North between Sections 2 and 3, "**I cross my flag in a boat to the right bank**" (Emphasis added.)

Book 1159, 2/1877, T5S/R11W

p.1C North between Sections 35 and 36, @ 1.10 chains, "Enter lower land"
@ 28.38 chains, "Intersect left bank Gila River, brs. S. of W....set flag on line, on opposite bank of river, and measure off base 100 lks E. to point whence flag brs. N6°16'W, making distance across stream, on line, 9.10 chs"
@ 37.48 chains, "Right bank of river, on line"

Book 4082, 2/1934, T5S/R11W

p.9 South between Sections 26 and 35, @ 24.00 chains, "Main channel of Gila R., 300 lks. wide, SW. Dry"
@ 67.20 chains, "N. bank of the Gila River bottom, 10 ft. high, bears NE. and SW."

Book 4081, 1/1934, T5S/R10W

p.6 near Agua Caliente, North between Sections 13 and 14, @ 70.00 chains, "Enter Gila River bottom land, bears, E. and W."
@ 78.00 chains, "Gila River channel, 100 lks. wide, course W. Dry."
@ 80.48 chains, "Set...cor. of secs. 11, 12, 13 and 14"

p.7 North between Sections 11 and 12, @ 17.50 chains, "High N. bank of the Gila River, bears E. and W.,"
17.50+(80.48-70)=27.98 chains wide

p.44 General Description. "The Gila River runs a steady stream of water only after heavy rains. Most of the year the channel is dry, but in some places the water rises and flows a short distance and then sinks in the sands, indicating an underground flow."

Book 1158, 1/1877, T5S/R10W

p.46 North between Sections 29 and 32, @ 70.65 chains, "The left bank Gila River, brs. SW....I now set flag on line on opposite bank of river, and measure off a base 100 lks. S. to a point whence flag brs N81°23'W, making distance across 6.6 chs."
@ 77.25 chains, "Right bank of river, on line."

p.48 North between Sections 29 and 30, @ 9.70 chains, "Old bank of river, brs. S. of W."

p.50 West between Sections 19 and 30, @ 67.80 chains, "Irrigating ditch runs S.W."

Book 4080, 3/1934, T5S/R9W

p.18 West between Sections 10 and 15, @ 1.00 chains, "Descend 92 ft. over NW. slope through scattering undergrowth:
@ 5.00 chains, "Thence over sandy river bed."
@ 21.00 chains, "Enter Gila River channel, course NW."
@ 30.00 chains, "Leave river channel, course NW.; asc. 132 ft. over NE. slope."

p.34 West between Sections 7 and 18, @ 64.00 chains, "Main channel of the Gila River, 200 lks. wide, course SW."

p.34 North between Sections 7 and 8, @ 58.00 chains, "Thence over sandy river bed."
@ 62.00 chains, "Main channel of the Gila River, 3 chs. wide, course W."
@ 75.00 chains, "Right bank of Gila River, bears E. and W."

p.35 West between Sections 5 and 8, @ 3.50 chains, "Enter Gila River channel, course NW., small stream of water."
@ 4.50 chains, "Left bank of channel; thence over dry sandy river bed."
@ 15.00 chains, "Right bank of river channel; thence along sandy river bar."
at 56.00 chains, "Leave river bottom; ascend 23 ft over SE. slope."

p.36 General Description. "...The general elevation is about 550 ft. above sea level, excepting along the Gila River bottom, where it is about 100 ft. lower....The Gila River enters the township near the northeast cor. of sec. 12, flows in a general westerly direction, and leaves near the northwest cor. of sec. 18. The river channel is seldom more than three chains wide. At times of high water, much of the bottom land is overflowed and the river frequently changes its channel. The river bottoms vary in width from twenty to eighty chains . . . The cottonwood trees and arrow weeds are found only along the river bottom....Along the cliff walls on the south side of the Gila River, about 25 chains west and 10 chains south of the ¼ section corner of sections 7 and 18, extending for a distance of a quarter of a mile, are numerous well preserved Indian hieroglyphics."

Book 3824, 12/1926, T5S/R9W

p.6 North between Sections 1 and 2, "Over level sandy river bottom land, thru scattering undergrowth."
@ 10.00 chains, "Intersect left shore of the Gila River, bears, N80°E. and S80°W. Distance across river by triangulation, 10.63 chs.
@ 20.63 chains, "Intersect right bank of Gila River, 3 ft. high, bears E. and W. Thence over level sandy bottom land, thru dense undergrowth."
@ 36.00 chains, "Leave low river bottom land. Ascend 13 ft.
@ 36.43 chains, "Top of old river bank, bears N80°W and S80°E."

p.7 North between Sections 10 and 11, @ 9.44 chains, "Intersect left shore of the Gila River, bearing 70°E. and S70°W."
@ 24.00 chains, "Intersect right shore of Gila River, bears N70°E. and S70°W. Thence over level sandy bottom land, thru dense undergrowth."

p.8 East between Sections 2 and 11, @ 62.00 chains, "Foot of bluff and right bank of Gila River, 3 ft. high, bearing N.10°E. and S.10°W. Distance across Gila River by triangulation, 4.94 chs.(x66' = 326')"
@ 66.94 chains, "Left shore of Gila River, bears N.10°E. and S.10°W. Thence over level sandy bottom land."

Book 1157, 1/1877, T5S/R9W

p.9 North between Sections 11 and 12, @ 50.15 chains, "Old river bank, brs. W."
@ 76.11 chains, "Intersect the left bank of the Gila River, brs, S. of W....I now set a flag on line, on opposite bank of river and measure off a base 100 lks. W. to point whence flag brs. N.11.5°E. which gives distance across, 4.91 chs, or at"
@ 81.02 chains, "On line on opposite bank."

p.10 West between Sections 1 and 12, @ 61.00 chains, "Gila river bank."

p.20 North between Sections 10 and 11, @ 4.00 chains, "Bluff and descend."
@ 6.30 chains, "Enter lower bottom."
@ 53.08 chains, "Intersect left bank Gila River...set a flag on opposite bank, on line, and measure off a base 200 lks. E. to point whence flag brs. N.21.5°W. making distance across, 5.08 chs, or at"
@ 58.16 chains, "Opposite or right bank of river."
@ 72.38 chains, "Ascend to table land."

p.30 West between Sections 10 and 15, @ 15.10 chains, "Intersect left bank of Gila River, brs. S.W."

p.31 North between Sections 9 and 10, @ 30.00 chains, "Enter bottom"
@ 53.25 chains, "Left bank Gila River, brs. N. of W....I now set flag on line on right bank of river, and measure off a base 100 lks. W. to point whence flag brs. N.14°E. making distance across 4.01 chs, or at"
@ 57.26 chains, "On line on right bank of river."

p.42 North between Sections 8 and 9, @ 41.20 chains, "Enter bottom"

@ 75.00 chains, "Left bank Gila River, brs. S. of W....I now set flag on line on right bank of river, and measure off a base 100 lks. W. to point whence flag brs. N.11.25°E. making distance across 4.95 chs, or at"
@ 79.95 chains, "Right bank of Gila River."

p.54 North between Sections 17 and 18, @ 61.00 chains, "Bluff and descend."
@ 67.85 chains, "Left bank Gila River, brs. S.W....I now set flag on line on right bank of river, and measure off a base 100 lks. W. to point whence flag brs. N.14°31'E. making distance across 3.86 chs, or at"
@ 71.71 chains, "Right bank of Gila River."

p.55 East between Sections 8 and 17, @ 69.50 chains, "The left bank Gila River, brs. S.W.... distance across river 4.50 chs."
@ 74.00 chains, "Right bank of river."

p.56 East between Sections 7 and 18, @ 11.30 chains, "The left bank Gila River, brs. N.W. ... distance across river 10.39 chs."
@ 21.69 chains, "Right bank of river."

p.61 General Description. "This township ... contains some good bottom land which can be irrigated from the river. The river contains an abundance of water not yet utilized."

Book 2233, 12/15/1910, T5S/R8W

p.74 North between Sections 5 and 6, @ 21.30 chains, "Right bank of Gila River and over dry bed of river through dense arrow and water mote brush"
@ 31.00 chains, "Cross small stream of running water 12 lks. wide 6 ins. deep, course SW"
@ 39.60 chains, "Left bank of Gila River and over level land through dense mesquite and chico brush."

p.6 General Description. "The Gila River runs through secs. 5 and 6, a small stream of water which sinks in the sand and rises again all along its course through these secs. The water is very brackish and not good for domestic purposes."

Book 4479, 2/1955, T5S/R8W, nothing apparent in the notes

Book 4707, 10/1964, T5S/R8W, nothing apparent in the notes

Book 2817, 7/10/1914, T4S/R8W

p.3 North between Sections 11 and 12, @ 9.00 chains, "Enter main channel of Gila River, course SW"
@ 49.00 chains, "N. bank of Gila R., 20 ft high, brs ENE. & WSW., asc"

p.3 West between Sections 12 and 13, @ 37.00 chains, "Bank of river, W. end of island, old bed runs to WSW., and S., present bed runs to NNE. & NE. around point of island, enter Gila River, lower bottom, subject to overflow, leave cottonwood and palo verde."

p.6 North between Sections 14 and 15, @ 29.00 chains, "N. bank of Gila River, brs. WSW. & ENE., asc. abruptly 15 ft. Thence over fine level land."

p.6 West between Sections 11 and 14, @ 5.00 chains, "Enter main river bed, course SW"
@ 29.00 chains, "W. bank of Gila River, brs. SW & NE, asc. abruptly" 10 ft. (near Rocky Point)

Book 2232, 8/1910, T4S/R8W

p.5 North between Sections 26 and 27, @ 51.62 chains, "Left bank of Gila River and over dry bed of river through dense arrow and water mote brush."
@ 80.00 chains, "Point for cor. of secs. 22, 23, 26 and 27 falls in bed of river where cor. cannot be permanently established."

p.5 West between Sections 23 and 26, @ 62.64 chains, "Left bank of Gila River and over dry bed of river through dense arrow and water mote brush."

p.7 South between Sections 27 and 28, @ 35.74 chains, "Left bank of Gila River and over dry bed of river through dense arrow and water mote brush."
@ 37.80 chains, "Cross small stream of water 15 lks. wide, 6 ins. deep, course S.W."
@ 80.00 chains, "Point for cor. of secs. 21, 22, 27 and 28 falls in bed of Gila River, and **as either bank of the river is more that 40.00 chs dist from the true point for this sec.** I am unable to establish a witness cor." (Emphasis added.)

p.7 East between Sections 22 and 27, @ 34.16 chains, "Cross small stream of water 13 lks. wide, course S.W., 6 ins. deep."
@ 40.01 chains, "Point for ¼ sec. cor falls in bed of Gila River where first high water would wash it away, ...nearest point on the bank of the river is S. of point for ~~cow~~ cor. . . . 30 chains."

Book 1163, 3/1871, T1S/R7W

p.1C North between Sections 35 and 36, @ 62.00 chains, "Intersect the left bank of the Gila River; runs west. Bluff bank 20 feet high & set a meander post ... Cross river on line, **water 16 inches deep & lively current.**" (Emphasis added.)
@ 64.70 chains, "Low sand bars between channels
@ 70.50 chains, "The north channel of same river."

p.9 East between Sections 26 and 35, @ 9.00 chains, "Intersect the left bank of the Gila River... Bluff bank 20 feet high, & bears N.W."
@ 15.40 chains, "Sand bars 1½ ft. above low water."
@ 32.00 chains, "North channel of river runs N.W."
@ 35.10 chains, "Dry sand bar."
@ 60.00 chains, "Same channel, runs S.W. 3 chains wide & water 12 inches deep."
at 71.00 chains, "Same channel, runs N.W. and 3 chains wide."

p.24 North between Sections 28 and 29, @ 14.00 chains, "Enter level bottom land, bears N.W. & S.E."

@ 43.00 chains, "Intersect the left bank of the Gila River, runs west. Bluff bank, 15 feet high.(Cross on line)"
@ 46.30 chains, "Right bank of River 20 feet high & set a meander post"
46.30-43.00=3.30 chains=217.8 ft

Book 1743, 4/1892, T4S/R6W

p.2 "With three assistants, team and wagon, I proceed up the Gila River, five miles to the ferry, but find it impossible to convey a wagon across; and learn also, there is a deep channel still north of the visable (sic) bank, which prevents reaching the ferry with a team on the north side. Therefore, I return to cor, to sec. 34-35-2-3, where I find an old mesquite post (thence East bet. secs. 35 & 2)"
@ 56.00 chains, "Left bank of River."
@ 73.73 chains, "Mesquite stub ... near edge of water. Left bank"

p.4 North between Sections 34 and 35, @ 38.44 chains, "Left bank of river"

p.11 North between Sections 31 and 32, "North to left bank of river. To all appearances the bank of river is several chains further south - here also - than before the flood of two years ago."

p.14 North on range line, Range 6W and 7W, "Thence to river bank, which from present land marks must be some 8 or 10 chains further south than before the flood of two years ago."

p.17 West on south boundary of Section 36, @ 25.50 chains, "Right bank of old river bed."
@ 75.02 chains, "Edge of water, main channel of river."

p.23 South between Sections 35 and 34, @ 6.85 chains, "Right bank of river; course N86°W. I find on this line, a middle ground to the south covered with dense growth of cottonwood and willow, with a deep and swift channel on each side. Therefore connection with line on south side of river at marked cottonwood tree cannot be made without jeopardizing life."

p.38 Diagram showing lines surveyed (of sections and Gila River alignment) dated June 2, 1890

Book 1153, 6/1890, T4S/R6W

p.46 "Meanders of the left bank of the Gila River"
p.46 "Low, sandy bed of old river"
p.47 "bank 4 ft high ... bank 6 ft high ... bank 10 ft high ... bank 15 ft high"
p.48 "Along low bed of river"
p.48 "Along bank 10 ft high ... leave high bank ... follow low bed of river"
p.49 "Along old bed of river ... bank 16 ft high"
p.50 "Along high banks ... leave high bank"
p.51 "on N side of Gila River... 8.90 chains to the South bank"
p.53 "Right bank of the Gila River, upstream ... bank 6 ft high"
p.56 "bank 8 ft high... leave high bank... along old bed of river"
p.57 "low bed of river... bank 12 ft high... leave high bank, along old bed of river"

p.57 "bañk 10 ft high ... old bed of river ... bank 10 ft high"
p.60 General Description. "Driftwood ... lies in the branches of cottonwood trees 14 ft above the level of the water ... The township is well watered by the Gila River which runs through the Southern portion of it"

Book 1616, 7/1890, T4S/R6W, Nothing apparent in the notes

Book 1743, 4/1892, T5S/R6W

p.15 North between Section 1, R6W and Section 6, R5W, @ 14.12 chains, "left bank of River... proceed up the river... **cross by ferry to opposite side**" (Emphasis added.)

Book 1156, 3/1871, T5S/R6W
p.63 General Description. "There is an abundance of mesquite timber for fuel and some other purposes."

Book 1164, 3/1871, T5S/R5W
p.64 General Description. "The Gila is at times subject to very high freshets - and at all times even at a low stage of water as at present runs a volume of water equal to about 100000 inches. It has a fall of about 20 feet to the mile in this township and flows over a sandy bottom and is fordable at nearly all points **except in time of high water, when it becomes almost impassible for boats, which precludes men from (unintelligible) lying on both side of the river - hence the necessity for meandering the stream. The lands in this township... can mostly be irrigated from the river by a system of canals. A company is also organized to construct a (unintelligible) canal, beginning 20 miles above here and leading the water down and parallel to the river to a point some 12 miles below this township.**" (Emphasis added.)

Book 1634, 3/1871, T5S/R4W
p.11 West between Sections 5 and 32, @ 4.50 chains, "Descend bank & enter low bottom subject to overflow & brs. N. & S."
@ 33.00 chains, "Left bank of Gila River bears South."
@ 35.50 chains, "Right bank of River & set a post."
p.13 General Description. "The lands in this township...can be irrigated by **a system of ditches** which will probably soon be constructed..." (Emphasis added.)

Book 1165, 3/1871, T5S/R4W
p.64 **Meanders.** (Emphasis added.) Nothing apparent in the notes.
p.65 General Description. "the left bank...is from 15 to 20 feet high while the right bank is not (unintelligible) than 5 feet and the narrow bottom lands on the right bank are soon pinched..."

Book 1152, 6/1892, T4S/R4W

p.4 North between Sections 7 and 8, @ 38.00 chains, "Left bank of Gila River."
@ 51.00 chains, "Right bank of Gila River."

Book 1635, 3/1871, T4S/R4W

p.23 General Description. "The Gila River flows along the East base of a high rocky mountain & has a wide sandy bed. Current smooth and lively, having a fall of six feet to the mile."

Book 1161, 3/1871, T4S/R4W

p.54 West between Sections 5 and 8, @ 15.00 chains, "Enter low land brs. N. & S."
@ 25.60 chains, "Intersect the left bank of Gila River 6 feet high."

p.55 West between Sections 5 and 8, @ 28.00 chains, "West bank of East channel of river, low sand bed."
@ 50.20 chains, "West channel of river runs S."
@ 53.00 chains, "The right bank of Gila River 18 feet high."

p.58 Meanders. Nothing apparent in the notes.

Book 1161, 3/1871, T3S/R4W

p.45 East between Sections 29 and 32, @ 54.00 chains, "Right bank of Gila River, 20 feet high, river runs S."
@ 57.00 chains, "Dry sand bed 2 feet above water."
@ 67.00 chains, "Middle channel of river runs S."
@ 77.40 chains, "East channel of river runs S."

p.45 West between Sections 29 and 32, @ 26.00 chains, "Right bank of river."

p.47 East between Sections 20 and 29, @ 48.00 chains, "Right bank of Gila River. Cross W. channel 3 chains wide runs South."
@ 67.00 chains, "Middle channel 2 chains wide runs S."
@ 74.60 chains, "East channel of river 240 links wide runs S."
@ 77.00 chains, "Left bank of river. 20 ft high, brs. N. & S."

p.47 West between Sections 20 and 29, @ 3.00 chains, "Left bank of river."

p.48 West between Sections 20 and 29, @ 32.00 chains, "Right bank of Gila River."

p.49 West between Sections 17 and 20, @ 19.40 chains, "Intersect the left bank of Gila River 8 feet high... East channel 3 chains wide, thin sand."

p.49 West between Sections 17 and 20, @ 40.50 chains, "West channel of river 2 chains wide runs S."
@ 43.00 chains, "Right bank of Gila River."

p.51 West between Sections 8 and 17, @ 11.00 chains, "Intersect the left bank of the Gila River. Bluff bank 20 feet high."
@ 14.00 West bank of East channel low sand, river runs S."
@ 33.00 Middle channel. 2 chains wide runs S."

p.52 West between Sections 8 and 17, @ 46.00 chains, "West channel of river 3 chains wide runs S."
@ 49.00 chains, "Right bank of Gila River, 20 feet high."

p.54 West between Sections 5 and 8, @ 25.60 chains, "Intersect the left bank of Gila River, 6 feet high."

p.55 West between Sections 5 and 8, @ 28.00 chains, "West bank of East channel of river, low sand bed."
@ 50.20 chains, "West channel of river runs S."
@ 53.00 chains, "Right bank of Gila River, 18 feet high."

p108 North between Sections 31 and 32, @ 29.70 chains, "Right bank of Gila River 15 feet high & runs S.E."

p109 East between Sections 29 and 32, @ 17.00 chains, "East channel of Gila River 3.20 links wide runs S."
@ 20.20 chains, "Left bank of Gila River 18 ft high & runs South."

p110 West between Sections 29 and 32, @ 59.80 chains, "Left bank of Gila River...Bluff bank 18 feet high. Cross East channel on line 320 links wide runs South."

p111 West between Sections 30 and 31, @ 22.00 chains, "West channel of Gila River runs South."
@ 24.70 chains, "Right bank of Gila River."

p113 West between Sections 20 and 29, @ 72.50 chains, "Left bank of Gila River...Bluff bank 20 feet high, brs. N & S. Cross East channel on the line."
@ 74.75 chains, "Dry sand bed."

p115 East between Sections 19 and 30, @ 41.20 chains, "Right bank of Gila River 20 feet high, runs S."
@ 44.00 chains, "Dry sand bed on East side of West channel of river, runs S."
@ 63.00 chains, " Middle channel of river 2 chains wide runs S."

p117 North between Sections 19 and 20, @ 11.00 chains, "East channel of Gila River brs S.E."
@ 14.20 chains, "Left bank of Gila River 20 feet high."

p119 West between Sections 18 and 19, @ 19.00 chains, "Right bank of Gila River runs S. - 20 feet high."
@ 45.00 chains, "East channel of Gila River 3.80 chains wide runs S."
@ 48.80 chains, "Left bank of Gila River 20 feet high."

p123 West between Sections 7 and 18, @ 43.50 chains, "Left bank of Gila River 12 feet high runs South & 3 chains wide to sand bed."
@ 59.00 chains, "Middle channel 2 chains wide."
@ 70.00 chains, "West channel. 2 chains wide & runs South."
@ 75.00 chains, "Right bank of Gila River 18 feet high."

p124 West between Sections 7 and 18, @ 3.60 chains, "Right bank of Gila River."
@ 35.10 chains, "Left bank of Gila River."

p131 General Description. "The Gila River flows through the S.W. corner of the township & has a lively current."

Book 1151, T3S/R5W

p.17 East between Sections 12 and 13, @ 41.20 chains, "Enter low bottom"
@ 66.25 chains, "Right bank of river brs. S20°E, measure across"
@ 70.60 chains, "Left bank of river, low banks and deep water"

p.58 General Description. "There is an abundance of water in the river for irrigating."

Book 1162, 2/21/1883, T2S/R5W

p.40 North between Sections 33 and 34, @ 61.00 chains, "enter low bottom"
@ 76.00 chains, "right bank of Gila River"

p.42 East between Sections 27 and 34, @ 3.38 chains, "Left bank of River, deep water, low banks"
@ 20.00 chains, "Leave low bottom, enter mesquite and greasewood"

p.59 East between Sections 28 and 33, @ 27.5 chains, "Enter river bottom"
@ 78.84 chains, "Right bank of Gila River, low banks brs. S10°E" 78.84-27.5=51.34 chains=3388.44 ft

p.70 East between Sections 9 and 16, @ 68.00 chains, "Right bank of Gila River"

p.71 @ 71.15 chains, "Left bank of Gila River, low banks & low bottom land"
@ 78.00 chains, "...leave bottom enter high land"

p.75 East between Sections 4 and 9, @ 68.10 chains, "Enter low bottom"
@ 74.00 chains, "Right bank of Gila River brs N & S30°W from this point, measure across".
@ 77.40 chains, "Left bank of River, low banks, deep water" 77.40-74.00 = 3.40 chains = 224.4 ft

p.79 East between Sections 29 and 32, @ 53.00 chains, "Dry wash, 30 ft. deep, 60 lks wide, course N60°E"

p100 General Description. "there is ... an abundance of water in the River".

Book 1161, 3/1871, T2S/R5W

p137 North between Sections 34 and 35, @ 47.50 chains, "Right bank of Gila River runs S.E."
@ 57.00 chains, "Dry sand bed, 1 foot above water."
@ 74.50 chains, "N. channel of Gila 3 chains wide and runs S.E."

p139 West between Sections 26 and 35, @ 71.80 chains, "Left bank of Gila River 20 feet high."

p141 West along 1/4 Section line, Section 27, @ 48.30 chains, "Left bank of the Gila River...Gila River about 4 chains wide here, deep water".

Book 1635, 3/1871, T3S/R4W

p.45 General Description. "The Gila River has a smooth lively current and at low water has about 150,000 inches [miner's inches?] of water all of which can be diverted to the use of irrigation."

Book 1635, 3/1871, T3S/R4W

p.52 General description. "A portion of the lands in Sections 25, 26, 27, 35 and 36 are of good quality."

Book 2874, 3/1915, T1S/R5W, Nothing apparent in the notes.

Book 1169, 12/1882, T1S/R5W

p102 General Description. "There is enough timber for all purposes, and **water for irrigation in abundance.**" (Emphasis added.)

Book 1168, 1/1883, T1S/R4W

p.96 General Description. "There is a dense under growth of all kinds of bushes in the bottom land while the hills produce greasewood, catclaw and arrowbrush. **There is plenty of water for irrigation in the Gila River.**" (Emphasis added.)

Book 1167, 1/1883, T1S/R3W

p.97 West between Sections 7 and 18, @ 9.00 chains, "Left bank of Gila River course S31°W, low bank, measure across."
@ 17.30 chains, "Right bank of Gila River, brs. S31°W, high bank."

p.99 North between Sections 7 and 8, @ 2.87 chains, "Left bank of river, brs. E. & W., measure across."
@ 6.54 chains, "Right bank of Gila River brs. E. & W. **Deep water**, low banks on south." (Emphasis added.)

p107 General Description. "The land... can be irrigated from the Gila River and than it will produce most any thing."

Book 1632, 12/1882, T1S/R2W, Nothing apparent in the notes

Book 3930, 3/1931, T1S/R2W

p.65 North between Sections 4 and 5, @ 47.25 chains, "Left bank of Gila River channel, 6 ft. high, bears NE. and SW."
@ 49.75 chains, "Center of channel of Gila River, water 5 ft. deep, course SW."
@ 54.25 chains, "Right bank of Gila River, 40 ft. high, bears NE. and SW. thence over cultivated farm lands."
@ 69.75 chains, "Irrigation canal, 12 ft. wide, course SW."

p.81 General Description. "Along the Gila River bottom there is a dense growth of will and desert tamarack brush and cottonwood timber... The Gila River leaves the township near the ¼ sec. cor. on the W. boundary of sec. 7 and north of it in secs. 4, 5, 6, 7 and 8 there is an extended area of irrigated land now being intensively cultivated... Except the Gila River there are no springs nor live streams in the township."

Book 1166, 1/1883, T1S/R2W

p.97 General Description. "**There is plenty of water in the Gila River for irrigation.**" (Emphasis added.)

Book 2056, 6/1907, T1N/R2W, Nothing apparent in the notes.

Book 2055, 6/1907, T1N/R2W

p133 General Description. "The soil is generally adobe, and... if supplied with water would raise abundant crops. There is no timber in the township excepting a scattering growth of cottonwoods along the Gila River. The Gila River runs across the southeastern cor. of the township."

Book 1006, 2/1882, T1N/R2W

p.92 General Description. "...if the waters of the Gila River, would be conducted in a ditch to the land for irrigation (which could be done with some expense) the land could be made very valuable and productive."

Book 2980, 4/1915, T1N/R1W

p.31 General Description. "The township is watered by the Gila and Agua Fria rivers, and canal systems already constructed over the major part of the township."

Book 1, 2/29/1868, T1N/R1W

p423 **The Gila River** runs west through the Tp at the northern base of these mountains. It **is a fine stream of water about 10.00 chains wide**. The right bank and bed are sandy and has a rapid current generally... **The Agua Fria Creek** enters the Tp in Sec 2 and runs southerly through it and empties in the Gila River. It **is a wide but shallow water course**, and sandy banks and bed and dry except during times of great freshets." (Emphasis added.)

Book 2647, 1/1913, T1S/R1W, Nothing apparent in the notes.

Book 2, 3/12/1868(?), T1N/R1E, Nothing apparent in the notes.

Book 3457, 1/1912, T1N/R1E, Nothing apparent in the notes.

Book 3457, 1/1912, T1S/R1E

p193 General Description. "The southeastern portion (of the township) is inhabited by the Pima Cooperative Company of Indians who formed an association to build a canal and irrigation system... These Indians farm about twenty acres each, and are very prosperous. **The Gila River traverses the township in a Northwesterly direction and contains water at all seasons of the year.**" (Emphasis added.)

Book 609, 2/1868, T1S/R1E

p.31 General Description. "The Gila River enters the Tp on the East boundary of sec. 36 and flows in a NW direction through it leaving it at the NW cor. of sec. 6."

Book 3959, 1/1933, T4S/R8E

p.4 South along West boundary of Section 30, @ 36.24 chains, "The right bank of the Gila River, vertical, 5 ft. high, bears NW. and SE."

p.5 South on North-South centerline of Section 30, @ 49.80 chains, "Descend bank, 4 ft. high, bears NW. and SE. Thence over level bottom land, through scattering cottonwood".
@ 52.40 chains, "Descend bank, 2 ft. high, bears NW. and SE. Leave fence, bears NW."
@ 53.50 chains, "Bank, 3 ft. high, bears NW. and SE. Thence over low sandy bottom land".
@ 63.87 chains, "The right bank of the Gila River, sloping, 2 ft. high, bears NW. and SE."

p.6 South on the West 1/16 section line of Section 30, @ 18.20 chains, "Record distance for old meander cor. No trace found ... Descend bank 3 ft. high and enter bottom, bears E. and W. ... Set an iron post, 3 ft. long, 1 in. diam., 30 ins. in the ground, for special meander cor., with brass cap mkd. ... Descend bank 3 ft. high and enter bottom, bears E. and W."
@ 42.50 chains, "Descend bank, 2 ft. high, bears NW. and SE."
@ 47.60 chains, "Descend vertical bank, 5 ft. high, bears E. and W. Enter low sandy bottom."
@ 49.33 chains, "The right bank of the Gila River, vertical, 4 ft. high, bears NW. and SE."

p.7 West on East-West midline of Section 30, @ 6.00 chains, "Descend bank, 5 ft. high, bears NW. and SE. Enter bottom land and cottonwood"
@ 21.10 chains, "Descend sloping bank, 2 ft. high, bears NW. and SE."
@ 35.36 chains, "The right bank of the Gila River, vertical, 5 ft. high, bears NW. and SE."

p.8 In Sec. 30, Meanders; "bank, 2 ft. high ... Bank 3 ft. high ... Bank 5 ft high".

Book 3477, 10/1919, T5S/R8E

p.27 Meanders.

Book 631, 6/1869, T5S/R9E

p.24 North between Sections 4 and 5, @ 47.00 chains, "To bed of Gila River in ordinary stage of water. At present it is dry."
@ 57.00 chains, "channel of River bearing S 80° W & N 45° E."

p.32 West between Sections 6 and 7, @ 65.00 chains, "Gila River bearing S 75° W & N 45° E"
@ 70.00 chains, "Cross the same and run parallel" $5\sin 15° = 1.294$ chains

p.34 "A great portion of (the land in this township) would produce good crops ~~is~~ if water could be brought upon it. This is almost an impossibility. There is barely enough in the Gila River for the use of the Settlements as they are."

Book 3836, 7/1929, T5S/R9E

p.56 General Description. "There is no surface water, save in the two canals ... The Gila River carries a shallow flow of water thru the winter and early spring months, only".

Book 1471, 4/1869, T5S/R9E

p.20 East between Sections 4 (R5S) and 33 (R4S), @ 5.50 chains, "To bank of Gila River which bears N45°E & S45°W".
@ 12.50 chains, "Cross the same into low bottom with dense undergrowth..."
@ 50.00 chains, "To low overflowed bottom".

p.20 East between Sections 3 (R5S) and 34 (R4S), @ 1.60 chains, "Cross irrigation ditch bearing N & S.

Book 1471, 4/1869, T4S/R9E

p.24 North on the east boundary of Section 25, @ 15.50 chains, "To Gila River running S45°W & N45°E".
@ 18.00 chains, "Cross the same to low sandy bottom".
@ 60.00 chains, "To table land".

Book 1471, 4/1869, T4S/R10E

p.42 North on the east boundary of Section 12, @ 47.12 chains, "To a willow 6 in. dia. on bank of Gila River, which bears S45°W".
@ 60.00 chains, "Cross Gila River to 3rd rate sandy bottom".

Book 624, 5/1869, T4S/R9E

p.39 nothing apparent in the notes

Book 3838, 7/1929, T4S/R9E

p.42 "Water in the Gila River is underground except at intermittent points and in stormy periods".

Book 625, 2/1869, T4S/R10E

p.7 East between Sections 12 and 13, @ 12.50 chains, "To Gila River running N45°W & S45°E".
@ 16.00 chains, "Cross the same to low overflow bottom".
@ 27.50 chains, "To River bearing S45°W & N45°E".
@ 30.50 chains, "Cross the same to 2nd rate bottom".

p.8 North between Sections 11 and 12, @ 2.00 chains, "bank of the Gila River".

p.46 "The land in this township is of no value except that in the Gila bottom".

Book 643, 6/1892, T4S/R11E

p102 "wash 2.00 chains"

p.93 Meanders.

p106 "There are two excellent dam sites in Sec. 11 between the North and South Buttes".

p105 "The Gila River flows through this township in a westerly direction".

Book 3695, 3/1926, T4S/R12E

p.51 South of township line, @ 54.46 chains, "Right bank of Gila River, brs E. and W".

@ 54.86 chains, "Center of channel of Gila River, 2.00 chains wide, course W."

@ 56.64 chains, "Left bank of Gila River, brs. E. and W.; a spring...and the Gila River running westerly...offer the only water supply".

Book 3603, 5/1924, T4S/R13E

p.32 West between Sections 1 and 12, @ 66.05 chains, "Right edge of bed of Gila River, brs. N50°W and S50°E, across dry sandy bed of Gila River".

@ 74.00 chains, "Right edge of *water* in Gila River brs. NW and SE, across *water* flowing NW".

@ 77.00 chains, "Left edge of *water* in Gila River brs. NW and SE. Leave Gila River."

p.33 North between Sections 1 and 12, @ 70.55 chains, "Right edge of bed of Gila River, brs. NW and SE, across dry sandy bed of Gila River".

@ 75.00 chains, "Right edge of *water* in Gila River brs. NW and SE, across *water* flowing NW".

@ 77.75 chains, "Left edge of *water* in Gila River".

p.39 North between Sections 10 and 11, @ 66.40 chains, "Left bank of Gila River, brs. E. and W., across river bed".

@ 66.90 chains, "Left edge of water, brs. E.and W. ... across water, flowing W."

@ 68.90 chains, "Right edge of water, brs. E.and W. ... across river bed".

@ 72.00 chains, "Right bank of Gila River, brs. E. and W. Leave Gila River".

p.40 West between Sections 2 and 11, @ 16.35 chains, "Left bank of Gila River, brs. NE. and SW. Thence across river bed."

@ 19.40 chains, "Left edge of water, brs. N.32°E. & S.32°W. Thence across water flowing SW."

@ 21.35 chains, "Right edge of water, brs. N.32°E. and S.32°W. Leave water. Thence across river bed."

@ 23.10 chains, "Right bank of Gila river, brs. N.32°E. and S.32°W. Leave Gila river."

p.70 General Description. "The Gila river affords water all thru the year."

Book 626, T4S/R14E

p.35 West between Sections 6 and 7, @ 35.20 chains, "Gila River 100 lks. wide, flows N.W."
p.38 "narrow valley extending N.W. along the Gila River, with deep rich soil and abundance of water for irrigation purposes".

Book 632, T4S/R15E
p.61 General Description. "There is rich bottom land along the river"

Book 633, 2/1878, T5S/R15E
p.54 "There is an abundance of water for irrigating purposes ... The Gila River where it passes through this township is not an 'impassable' object".

Book 634, 1/1878, T5S/R16E
p.60 North between Sections 5 and 6, 2.00 chains, "Intersect the left bank of the Gila River ... The river runs S. of W. and is 80 lks. wide".
p.61 Meanders
p.67 General Description. "This township lies in the junction of the Gila and San Pedro Rivers. There is agricultural land along the rivers and water to irrigate it".

Book 1961, T4S/R16E
p.61 General Description. "The Gila River runs diagonally nearly through the center of this township. Along the river is rich bottom land from a mile to two miles in width, which will produce heavy crops".

Book 1563, T4S/R16E
p.5 North between Township 5, Ranges 23 & 24 East, between Sections 7 and 12, @ 72.35 chains, "Intersect left bank of Gila River ... distance across the river, 2.40 chains".
@ 74.75 chains, "Right bank of Gila River".
p.27 _ between Townships 4 and 5 South, Range 23 East,
@ 75.41 chains, "Intersect right bank of Gila River ... distance across river 1.08 chains".
@ 75.49 chains, "Left bank of river".
p.37 North between Township 4 South, Ranges 22 and 23 East, between Sections 7 and 12.

Book 1961, Meanders.

Book 635, 1/1876, T5S/R23E
p.61 General Description. "This township covers mostly grazing land. The N.E. corner lies along the Gila River and contains some very rich bottom land".

Book 676, T5S/R24E

p.61 General Description. "The Gila River runs through the S.W. portion of this township, and along its bottom there is much rich land that can be brought under cultivation".

Book 674, 2/1875, T6S/R24E
p.61 Meanders
p.66 General Description. "The Gila River runs through the N.E. part of the township. Along this on either side for a width of from one to two miles the land is rich bottom which can be easily irrigated from the river".

Book 675, 2/1875, T6S/R25E
p.1D North between Sections 35 and 36, @ 19.95 chains, "Intersect the left bank of the Gila River ... distance of 2.05 chains across".
@ 22.00 chains, "To right bank".
p.62 Meanders.
p.71 General Description. "The Gila River runs diagonally through this township. Along the river on both sides is a wide bottom of rich land".

Book 690, 3/1875, T7S/R25E
p.61 Meanders.
p.62 General Description. "The Gila River runs through the extreme N. Eastern part of the township. Along the valley is rich bottom land".

Book 692, 2/1875, T7S/R26E
p.56 Meanders.
p.63 General Description. "This township includes the bottom land on both sides of the Gila, more than two miles in width in places on the south side".

Book 693, T7S/R27E
p.55 Meanders.
p.61 General Description. "This township lies along the river and on both sides of it. The bottom averages about a mile in width on either side of the river".

Book 662, 2/1896, T6S/R27E
p106 Meanders.
p108 Meanders.
p110 General Description. "Secs. 35 & 36 ... are well watered and irrigated by ditches taking water out of the Gila River which runs along their respective south boundaries ... Some cottonwood and willow along the Gila River".

Book 1591, xx/yyyy, T6S/R28E
p.66 North between Sections 1 (R28E) and 6 (R29E), @ 19.90 chains, "Enter Gila bottom".
@ 23.85 chains, "Center of Gila River, 120 lks.wide flows, S.W."

@ 24.50 chains, "Begin ascent".
@ 25.75 chains, "Top, bears E & W, descend".
@ 27.00 chains, "Enter Gila bottom, bears, E & W".
@ 28.00 chains, "Center of Gila River, 100 lks. wide, flows S.E."
@ 40.00 chains, "Point for ¼ sec. ~~cow.~~ cor. in bed of Gila River, subject to overflow".
@ 42.12 chains, "Center of Gila River, 110 lks. wide, flows S.W."
@ 42.85 chains, "Ascend from Gila River, and E. slope of ridge."

There are also accounts describing the Gila River included in U.S.G.S. Annual Reports and Papers in the late 19th century. Following are a number of those accounts.

Tenth Annual Report, 1888-89

"Self-recording instruments are not practicable at any place thus far found to be available for gauging, owing to the shallowness of the streams and the unstable character of their channels. Mr. Farish, however, with rare energy and devotion has done much in grappling with these difficulties. Three stations have been established by him: on the Gila about 14 miles above Florence, on the Salt a little above the junction of the Verde, and on the Verde near the latter locality. Continuous records have been maintained and repeated gaugings made. About forty rain-gauges have been placed in various localities in Arizona whence observations are specially desired and needed. An evaporation station has ben located at Tempe, where the correlated meteorologic observations are maintained." [p. 87]

Eleventh Annual Report, 1889-90

"In place of the regularly recurring annual floods of spring and early summer, so strongly marked on the discharge diagrams of other basins, these rivers show conditions almost the reverse, being at that season at their very lowest stages - even dry - and rising in sudden floods at the beginning of and during the winter. These floods are of the most destructive and violent character; the rate at which the water rises and increases in amount is astonishingly rapid, although the volume is not always very great. For instance, in an ordinary flood the Salt River, the principal tributary of the Gila, has risen in about three hours from 500 second-feet to 30,000 second-feet, falling again almost as rapidly, so that the average for the day or for two or three days would not be more than 10,000 or perhaps 5,000 second-feet. From this it will be recognized that the onset of such a flood is terrific. Coming without warning, it catches up logs and bowlders [sic] in the bed, undermines the banks, and, tearing out trees and cutting sand-bars, is loaded with this mass of sand, gravel, and driftwood - most formidable weapons for destruction ... Along the headwaters of the river are several open valleys, and in those of southeastern Arizona agriculture is steadily increasing by the use of water from the river or from side streams. On the extreme eastern edge of the territory, near the town of Duncan, some 2,000 acres have been reclaimed, and in the valley from Solomonville westward for 20 miles down the river fifteen irrigating ditches, covering in the aggregate 45,000 acres, have been constructed. There are in addition several other irrigated areas near the mouth of the San Pedro. The principal tributaries are the San Pedro and Santa Cruz Rivers, on the south side, and the Salt, Aqua [sic] Fria, and Hassayampa Rivers, on the north side. The floods of the upper Gila and its tributaries are usually short and violent, the highest water occurring during the months of January and February. During a freshet the river rises from 8 to 12 feet and increases in width from 3000 feet to a mile and a half. It is sometimes impassable for weeks, and in places has the appearance of a vast sea of muddy water. The season of low water occurs during the months of June and July, the river bed being then dry in places for miles." [pp. 58-9]

Twelfth Annual Report, 1890-91

"The spring of 1891 was characterized by the greatest flood of which a record has been kept. This came, as have most of those of February and March, from the Gila Basin, where a large amount of damage was done by the extraordinary rains ... The Gila Basin (Pl. LXXV), the most southerly portion of the great Colorado drainage basin, includes the greater part of Arizona, as well as a portion of New Mexico and of Sonora, in the Republic of Mexico. In all this area of 66,020 square miles the success of agriculture depends upon the artificial application of water to the crops. This water is derived from the Gila River and its tributaries by means of canals and ditches, which distribute it to the fields of each farmer. These streams fluctuate greatly, being at times subject to sudden floods, especially during summer rains, when they often sweep out bridges, dams, and canal head works, while at other times they may diminish until the water almost disappears. In floods there is, of course, far more water than can be used, although at this season as much as possible is put upon the crops, especially the forage plants, and great quantities are turned upon the fields in order to saturate the ground; but, on the other hand, during the ordinary low stages of the streams, the acreage of crops is limited to that which can be watered by the diminished flow. On Pl LXXV is given a map of the basin on a scale of 40 miles to the inch, with contour interval of 1,000 feet. This is taken from the U.S. Geological Survey map of 1891 and shows in a general way, as is necessary on this scale, the elevations in this basin. It has been derived from all material accessible and gives at a glance the present condition of our knowledge of this important region ... Assuming that this map (Pl. LXXV) of the drainage basin is approximately correct, sufficiently so for general purposes, computations have been made of the area of land lying at different elevations, the result being as follows: The total area of the basin is 66,020 square miles. Of this area - 9 per cent is under 1,000 feet; 19 per cent is between 1,000 and 2,000 feet; 16 per cent is between 2,000 and 3,000 feet; 14 per cent is between 3,000 and 4,000 feet; 15 per cent is between

4,000 and 5,000 feet; 12 per cent is between 5,000 and 6,000 feet; 8 per cent is between 6,000 and 7,000 feet; 7 per cent is over 7,000 feet. The greater portion of the land lying at an elevation of less than 3,000 feet, may be classed as sandy plains, in large part agricultural if water could be supplied; in other words, about 44 per cent of the entire area of the basin would fall into this class. The lands over 5,000 feet in elevation may be considered as mountainous catchment areas. These aggregate 27 per cent of the entire basin, and it is from this 27 per cent, or a portion thereof at least, that all of the water comes. The greater part, if not all, of the grazing and mining regions are included within this 27 per cent, as well as all the timber. The land from 3,000 to 5,000 feet above the sea is partly plain and partly foothill. A small part is agricultural, especially at the headwaters of the Verde and those of the Upper Gila, but in the main it is broken country, of little value even for grazing. ... The Gila basin includes, besides the greater part of southern Arizona, a small portion of the Territory of New Mexico, and the State of Sonora, in the Republic of Mexico. In the case of this latter country, the rim of the basin has been arbitrarily assumed, as there are no available maps which define it, and on the southwestern edge the boundary between the United States and Mexico is taken as the limit of the basin. This area, by countries, is shown in the following table:

	Square miles
Socorro County, New Mexico	3,893
Sierra County, New Mexico	156
Grant County, New Mexico	2,818
	6,867
Republic of Mexico	1,168
Apache County, Arizona	2,550
Graham County, Arizona	6,152
Cochise County, Arizona	3,212
Gila County, Arizona	5,300
Pinal County, Arizona	10,596
Pima County, Arizona	9,685
Yavapai County, Arizona	9,815
Maricopa County, Arizona	4,671
Yuma County, Arizona	57,985
TOTAL:	**66,020**

"Nearly 88 per cent of the entire area is in Arizona, a little over 10 per cent in New Mexico, and nearly 2 per cent in Mexico ... Its total length from the source in New Mexico [sic] to the junction with the Colorado River, not including its many windings, is fully 500 miles ... The floods of the Gila are usually short and violent, the highest water occurring during the months of January and February. During a freshet the river rises in some places from 8 to 12 feet, and increases in width from 300 feet to a mile and a half. It is sometimes impassable for weeks, and has the appearance in places of a sea of muddy water. The season of low water occurs during the months of June and July, the river bed being then dry in places ... Eliminating the floods, it has been found, for example, by the hydrographers of the Geological Survey that about 200 second-feet passed through the buttes above Florence during the year in which, as ascertained by the census, there were about 6,600 acres of crops successfully irrigated ... In this basin a number of excellent sites are know to exist; two in particular have been so often discussed that it is sufficient merely to refer to them. The first is in Pinal County, 15 miles above Florence, where the Gila flows between two 'buttes,' forming a canyon 200 feet or more in width, with perpendicular walls on each side. In this canyon a dam of sufficient magnitude would impound, from various estimates, enough water to irrigate a large part of the plains below. The second is at Oatman Flats, in the western part of Maricopa County. The Gila at this point flows between bluffs of limestone from 111 to 126 feet high, and at a distance of 1,195 feet from each other. There is a large storage basin above, in which, by means of a suitable dam, sufficient water could be stored during the storm floods to serve the Lower Gila Valley during the dry season ... As a general thing, it may be said that in this basin, owing to the diversity of topography in the high lands, the rainfall increases with the altitude, and therefore the greater part of the precipitation occurs along the northeastern edge of the basin, while out on the great plains through which the Gila flows, and where the best agricultural land is situated, there is the least moisture, the average at Yuma being less than 3 inches, at Texas Hill, 4 inches; at Maricopa, 5 inches; and at Casa Grande, a little over 4 inches; while, on the other hand, near and among the mountains, or rather the slopes of the edge of the great plateau, the rainfall increases to 10, 15, or even 20 inches and over ... The year 1884 was an unusually rainy one throughout this basin, as well as throughout a great part of the West, as previously noted, while 1885 was a year of minimum precipitation. since those years, the average rainfall has been nearly constant, and perhaps diminishing slightly through 1888 and 1889 ... The Upper Gila district or headwaters of the main Gila may be considered as including that part of the basin from the highest catchment down to the buttes above Florence, excluding, however, the San Pedro ... The Gila in this portion of its course flows throughout the year, and is subject to sudden and violent floods, especially during the summer season ... The middle Gila district is a trunk river division, and depends for its water supply upon the amount which comes from the two districts above mentioned, namely, the upper Gila and the San Pedro. The limits of this district are somewhat arbitrary, the district being considered as extending from the Buttes above Florence to the junction of the Gila with the Salt, and including on both sides of the river that portion of the great plain which can be irrigated from the Gila River ... In the latter part of June the bed of the river is often dry, its water being diverted by the numerous canals of this district. Floods are liable to occur with great violence in July and August, as well as in January, February, and March. There is usually sufficient water to mature one crop, but it reported that the second crop has been lost repeatedly. According to the statements of the irrigators, the year 1890 was one of the dryest (sic) known, while during 1889 the supply may be considered as about at an average ... The amount of water available for this basin was accurately determined by the Geological Survey during about one year; but their work was stopped at the end of this time by lack of further appropriation ... The Lower Gila District may be said to include the arable land from Gila Bend to Yuma, where the Gila River empties into the Colorado. This is a main-trunk district, receiving the waters which escape from the Middle Gila District and from the Lower Salt ... There were only 555 acres on which crops were reported raised by irrigation in 1889, but a far greater acreage has been brought under ditch. There are a large number of extensive canals and ditch systems projected or under construction in this district, but whose success must apparently be a matter of some doubt. The land of the Lower Gila District is of great fertility and is adapted to the cultivation of many fruits of the semitropic zone, as, for example, oranges, lemons, and other citrus fruits. It is thus known as the citrus belt of Arizona, and promises to become of great importance in these productions. Besides the fruit, alfalfa, barley, and wheat are reported to be cultivated, and vineyards have been successfully planted." [pp. 291-5, 299, 301, 305-6 & 314]

Sixteenth Annual Report, 1894-95

"A considerable number of canals and ditches have been constructed, taking water from the Salt and Verde, as well as from the Gila itself; and the ordinary summer flow is needed for the lands now under cultivation. There is, however, an enormous amount of water going to waste at various times of the year, following the sudden storms or 'cloud-bursts' in the mountains, but these floods occur at such irregular intervals and come with such violence that it is impracticable to attempt to save much of the water ... With the exception of the great Colorado River, which, however, flows in stupendous canyons or gorges thousands of feet below the arable lands, the streams of the Territory are small, and usually intermittent." [p. 505]

Eighteenth Annual Report, 1896-97

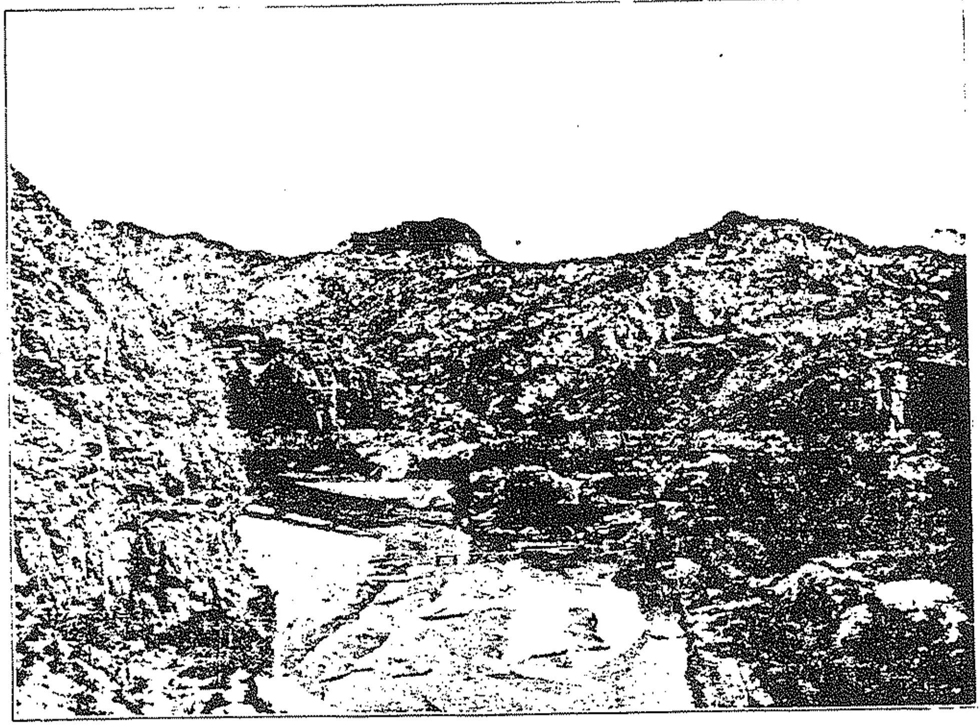
A Key Map of the proposed "Buttes Reservoir Site On Gila River, Arizona" is displayed on Pl. XX [following p. 292]

Twentieth Annual Report, 1898-99

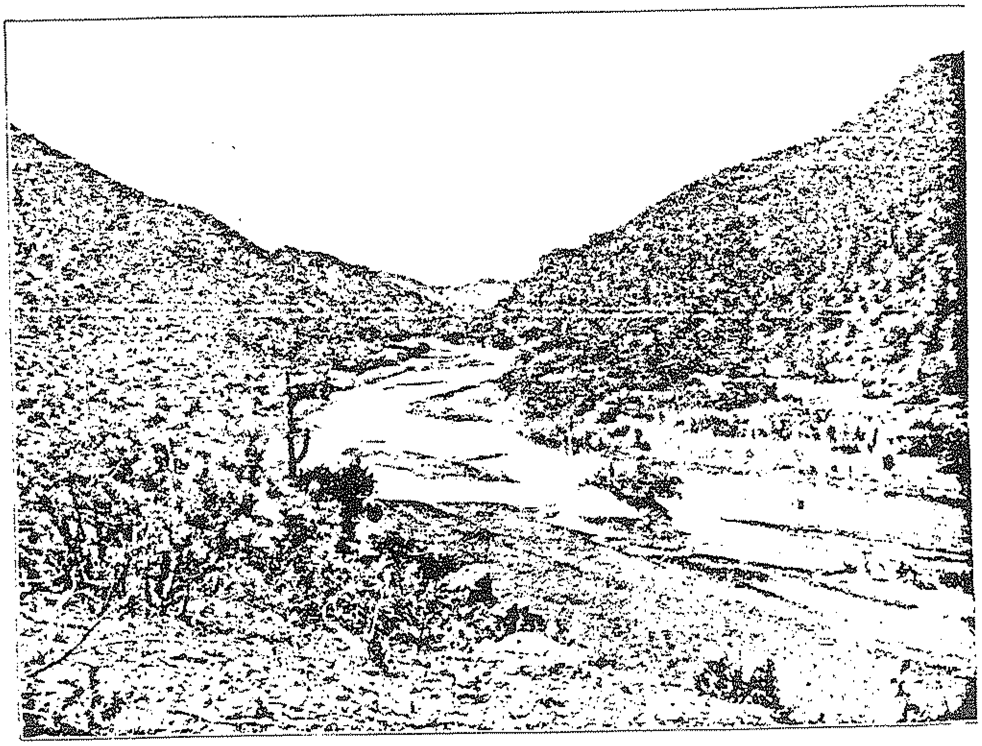
"On Pl. XLIII are shown two of the localities where the river enters a narrow gorge. Above both of these gorges the river valley widens, being comparatively flat, so that, except for the depth to bed rock at the dam sites, the conditions are highly favorable for the construction of storage reservoirs." [p. 405]

Twenty-First Annual Report, 1899-1900

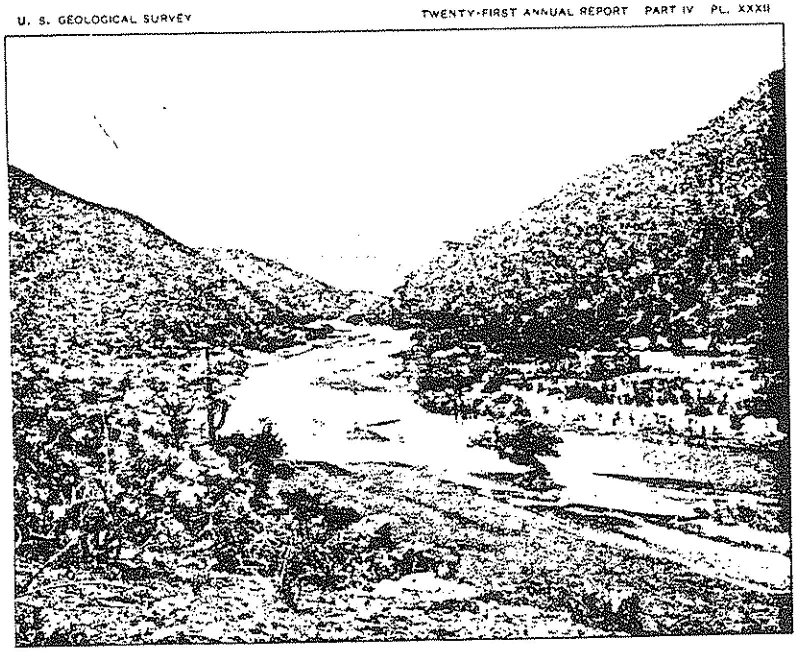
"[Gila River] passes alternately through narrow canyons and out upon valleys, where its waters are diverted for irrigation ... About 10 miles before Gila River reaches the Arizona line the canyon broadens into a valley of considerable width, known as Duncan Valley ... March 22, 1899, [the Gila River in Duncan Valley] was carrying in the canyon above the head of all ditches 160 second-feet." [p. 334-5]



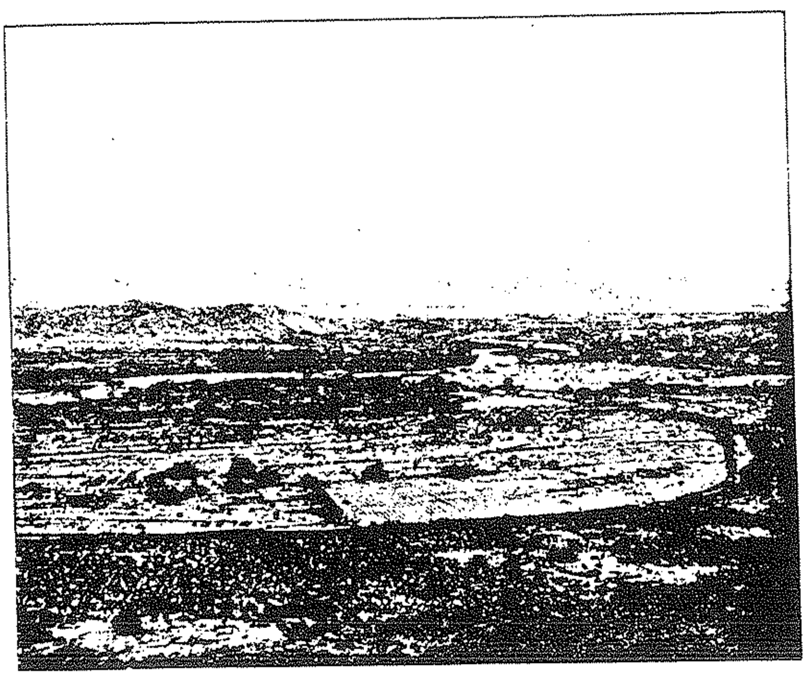
A. DAM SITE AT BUTTES, ARIZONA, LOOKING DOWNSTREAM.



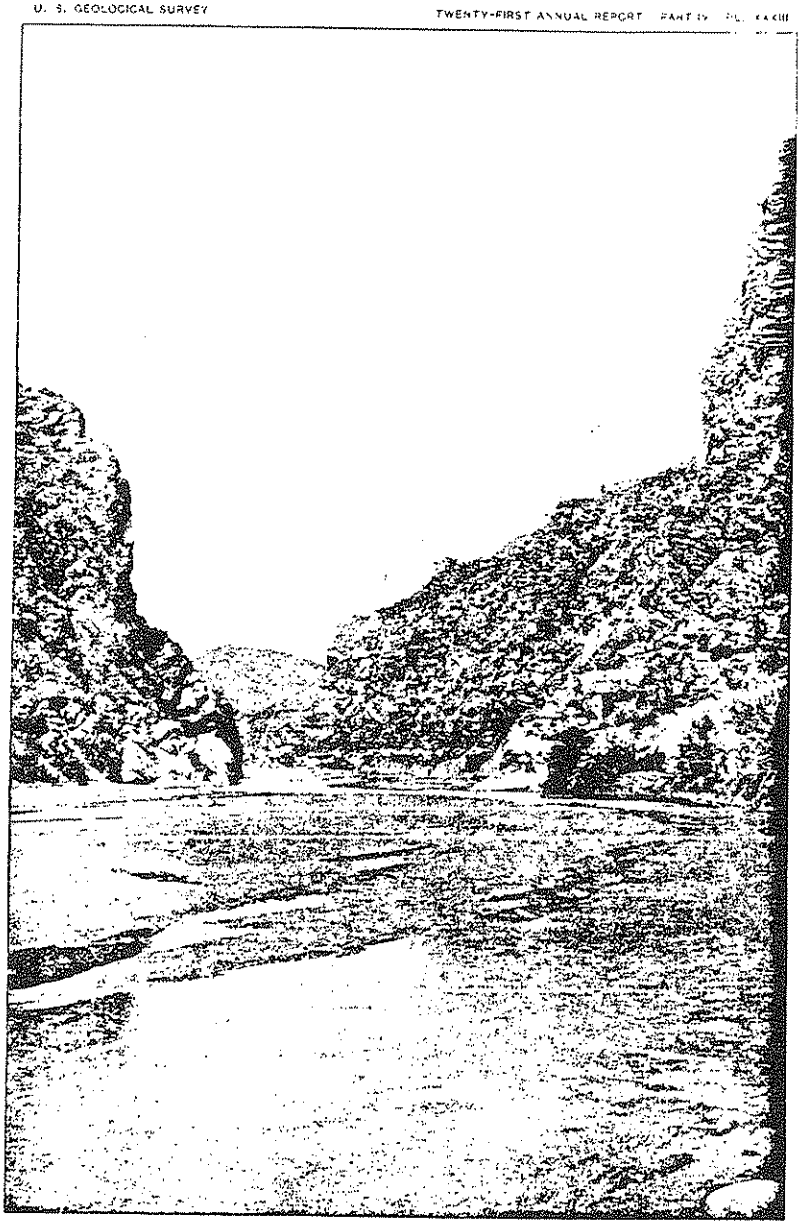
B. DAM SITE BELOW RIVERSIDE, ARIZONA, LOOKING DOWNSTREAM



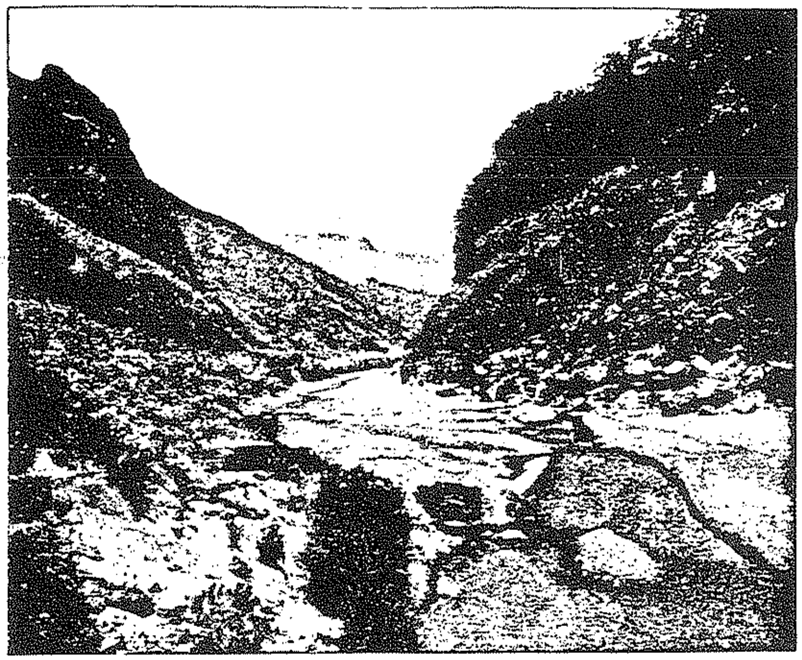
A. RIVERSIDE DAM SITE, ARIZONA, LOOKING DOWNSTREAM.



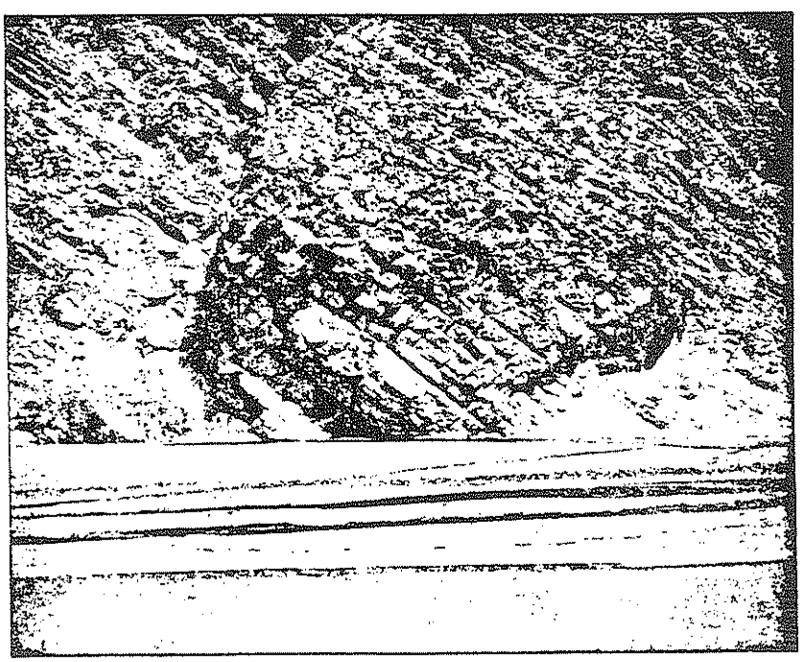
B. RIVERSIDE RESERVOIR SITE.



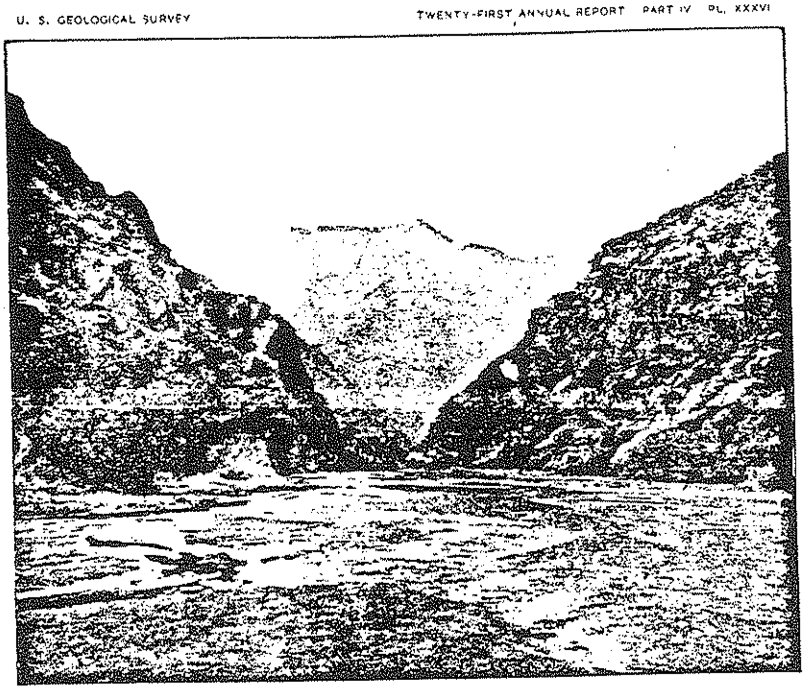
SAN CARLOS DAM SITE, ARIZONA, LOOKING UPSTREAM.



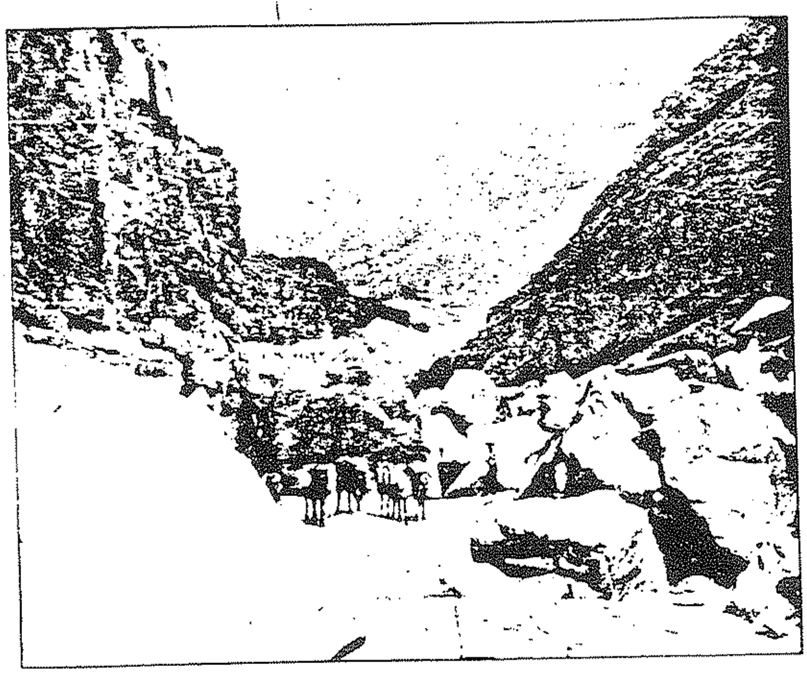
A. SAN CARLOS DAM SITE, ARIZONA, LOOKING DOWNSTREAM.



B. LEFT ABUTMENT OF SAN CARLOS DAM SITE



A. GILA RIVER CANYON, 15 MILES BELOW SAN CARLOS DAM SITE.



B. GILA RIVER CANYON, 8 MILES BELOW SAN CARLOS DAM SITE.

C. Historical Uses of the River

2. Irrigation

Canals: Pre-Statehood Activity

In the early 1890's the Gila River Basin was defined by the United States Geological Survey as containing three reaches or "districts" with a number of tributary districts (San Pedro, Verde, Upper Salt, Lower Salt, Agua Fria, Hassayampa, and Santa Cruz). Numerous diversions for irrigation occurred in these districts (see table below). The total area of the Gila Basin was estimated at 66,020 square miles, or approximately 42,252,800 acres, and includes the greater portion of southern Arizona, a small portion of the western New Mexico and a portion of Sonora, Mexico. The river flows through a number of Arizona's agricultural irrigated areas including Duncan Valley near Duncan; Safford Valley from San Jose to Fort Thomas; farming areas around Florence and Coolidge; the Gila River Indian Reservation; Buckeye Valley west of Phoenix to Arlington; Dendora Valley just downstream of Painted Rock Dam; Hyder Valley; and Mohawk Valley east of Yuma.

The Upper Gila district was defined as being a "headwater basin" of the Gila from the highest catchment down to the Buttes above Florence, excluding the San Pedro River. The Gila was perennial in this reach and provided waters to irrigate 14.3 square miles, or 9,137 acres.[1]

The Middle Gila district was defined as a "trunk river division" which reached from the Buttes area above Florence to the confluence of the Gila with the Salt. The district drew its flows wholly from waters in the Gila River (Upper Gila and San Pedro districts). The Gila was often dry during the early summer in this reach, at least in part due diversions by the "numerous canals" upstream and within the district, but was able to irrigate 6,619 acres in 1890. The periodic "violent" floods of late winter and late summer provided sufficient flows to mature one crop but were frequently too erratic to support the second crop.[2]

The Lower Gila district was defined as a "main-trunk district, receiving the waters which escape from the Middle Gila District and from the Lower Salt," depending largely on diversion activities in the upstream districts. Approximately 4,000 acres were irrigated in 1889, but it was felt that this area was capable of greater things, and to that end the Gila Bend Irrigating Company was in the process of building an ambitious, 75 mile long canal to irrigate the valley all the way to the Yuma county line.[3]

The San Pedro district was defined as a "headwater basin" of the Gila and was somewhat undefined in the late 1800's owing largely to limited mapping. The San

Pedro rises in Sonora, Mexico and flows north through Cochise, Pima and Pinal Counties. No storage occurred on the San Pedro at this time, although the Director of the Geological Service recommended that consideration be given to developing such facilities; irrigation diversions for more than 5,800 acres were taking place in the upper and lower portions of the San Pedro Valley.[4]

The Verde district was considered a "headwater basin" of the Gila and encompassed approximately 6,000 square miles. The Verde and its tributaries rise in Yavapai County, Arizona and flows south into Maricopa County. Approximately 1,948 acres of crops were identified as being irrigated by diversions from the Verde and its tributaries in 1889-90. No storage facilities existed on the Verde at this time, but the problems associated with crop irrigation were related to canal damage or turnout difficulties.[5]

The Upper Salt district was considered a "headwater basin" of the Gila and encompassed approximately 6,260 square miles. The Upper Salt and its tributaries rise in Yavapai, Apache, Gila, Graham and Pinal Counties and flow west to the mouth of the Verde. Only 815 acres of crops were being irrigated in the district in 1889-90, largely due to the mountainous nature of the terrain.[6]

The Lower Salt district was considered a "trunk river division" of the Gila. The district received flows only from the Salt River and stretched from the mouth of the Verde to the Salt River mouth at its confluence with the Gila southwest of Phoenix. A reported 29,171 acres of crops were irrigated in the district in 1889-90 and it was estimated that number could be doubled with strategically located storage facilities to impound the periodic flood flows.[7]

The Agua Fria district was considered a "lost river basin" in 1890 due to the small supply of water conveyed in the river and the relatively large amount of arable land it was diverted to irrigate. The estimated area of the basin was 1,420 square miles at Gillete, near the confluence of the Agua Fria and New River. Most years, no flows reached the Salt River of which it is a tributary and lost crops were not uncommon.[8]

The Hassayampa district was considered a "lost river basin" due to the small supply of water in the river and the large amount of arable land it was diverted to irrigate. The district comprised 1,810 square miles, almost evenly split between Yavapai County (source of its headwaters) and Maricopa County. Most years the river sinks into its bed before reaching the Salt.[9]

The Santa Cruz district was considered a "lost river basin" due to the small supply of water in the river and the large amount of arable land it was diverted to irrigate. The river rises in the Canelo Hills east of Patagonia, flows south past Lochiel into northern Sonora, Republic of Mexico. There are approximately 3,500 square miles in the district. It was reported that 2,672 acres of crops were irrigated in the district in 1889. Most times the river sinks into its bed before reaching the Gila.

Canals which existed, along with reported estimated lengths and acreage irrigated on the Gila and its tributary rivers, are identified in the "Canals reported as taking water from the Gila River in 1889" table at the end of Section C.[10]

Canals: Since Statehood to Present Day

On June 29, 1935 the Gila River Decree, Globe Equity No. 59 was entered in the United States District Court (Arizona District) as a result of *The United States of America v. Gila Valley Irrigation District, et. al.* The Gila River Water Commissioner was created by the Decree and assumed his duties on January 1, 1936. The Decree set out water rights priorities for water users along the Gila River from New Mexico to the Salt-Gila River confluence. Senior priority was for 35,000 acres of land in the Gila River Indian Reservation, followed by 1,000 acres of land in the San Carlos Indian Reservation, and a number of priorities for other lands along the river including 100,546 acres of land in the San Carlos Project.[11]

At the present time, numerous irrigation canals and other diversions withdraw water from the Gila River and its tributaries for irrigation, industrial and municipal uses. Diversions from the Gila for irrigation of about 500 acres occur above Gila, New Mexico (river miles 572.5); 5,000 acres above Redrock, New Mexico (river miles 539.2); 6,200 acres above Blue Creek, near Virden, New Mexico and above Duncan Valley diversions; 14,300 acres above San Francisco River, near Clifton and below Duncan Valley diversions; 17,500 acres plus mining and municipal use above the head of Safford Valley; 69,000 acres plus mining and municipal use above Calva, San Carlos Reservoir and Winkelman; 82,000 acres plus mining and municipal use above Kelvin; up to an additional 100,000 acres for the San Carlos Project diverted at Ashurst-Hayden Dam approximately 7¼ miles upstream of Florence; and "large," untabulated diversions above Laveen, Gillespie Dam, Painted Rock Dam and Dome owing to irrigation on the Gila River Indian Reservation and tributary rivers. On the San Carlos River, about 600 acres are irrigated above Peridot. Under the San Carlos Project up to 100,000 acres are irrigated annually. On the San Pedro River, about 10,800 acres were irrigated in Arizona in 1978. On the Santa Cruz River, about 26,000 acres are irrigated above Tucson, while more than 240,000 acres (not including the San Carlos Project) are irrigated above Laveen. On the Salt River system, approximately 3,100 acres are irrigated above Lake Roosevelt on the Salt and its tributaries, while another 12,500 acres are irrigated above Horseshoe Dam on the Verde River; all flows reaching Stewart Mountain Dam (Saguaro Lake) are diverted at Granite Reef Dam either for irrigation in the Salt River Valley or municipal use by the City of Phoenix except in periods of high flood flow. As of 1988, since the dam began regulating flow in 1911, the average discharge for the Salt River below

Roosevelt Dam has been 896 cfs. Since 1934, the average discharge below Stewart Mountain Dam to Granite Reef Dam has been 978 cfs, which does not include flow in the Verde River. Since 1961, the average discharge on the Verde River below Bartlett Dam and near the confluence with the Salt River has been 645 cfs. Combined average flow to Granite Reef Dam has been over 1500 cfs since 1961, all diverted for irrigation or municipal use except in cases of high flood flows.[12] On the Agua Fria River, about 600 acres are irrigated above Mayer, while flows impounded in Lake Pleasant behind Waddell Dam are diverted to Beardsley via the Beardsley Canal (approximately 20,000 acre-feet in 1989). There are only small diversions reported on the Hassayampa River. At Gillespie Dam on the Gila River, there are regular diversions into the Enterprise and Gila Bend canals.

The following canals have removed water from the Gila River since U.S.G.S. records have been maintained[13]:

in Duncan Valley, NM-AZ:

Sunset Canal (diverts flow in New Mexico)
Cooper-Windham Canal
Moddle Canal (diverts flow in New Mexico)
New Model (diverts flow in New Mexico)
(New Model Canal formerly known as Moddle Canal)
Shriver Canal (diverts flow in New Mexico)
(Shriver was combined with Moddle Canal, January 1, 1948)
Valley Canal (diverts flow in New Mexico)
Duncan Canal
Black & McClesky Canal
Colmenero Canal
Sexton
York
R. Sexton

in Safford Valley, AZ:

Brown Canal, Solomon, AZ
Tidwell Canal, Solomon, AZ
Fourness Canal, Solomon
Sunset Canal
San Jose Canal, Solomon
Montezuma
Union
Graham Canal, Safford
Oregon Canal, Thatcher
Smithville Canal, Thatcher
Dodge-Nevada
Curtis
Fort Thomas Canal, Ashurst

Colvin-Jones
T.D. Burton

near Florence:

Florence-Casa Grande Canal
Florence Canal, Florence
O.T. Canal, Florence
Pierson-Nicholas Canal, Florence

above Gillespie Dam:

Gila Bend Canal, Gillespie Dam
Enterprise Canal, Gillespie Dam

The following canals removed water from the Gila River (or were reported as under construction) prior to Arizona's Statehood:

Upper Gila District (above Florence):

#Cooper(Casper)-Windham Canal (diverts flow in New Mexico)
#Moddle(Model) Canal (diverts flow in New Mexico)
#Shriver(Schriver) Canal (diverts flow in New Mexico)
#Johnson (diverts flow in New Mexico)
#Martin (diverts flow in New Mexico)
#Wilson (diverts flow in New Mexico)
#Hill (diverts flow in New Mexico)
#Rucker (diverts flow in New Mexico)
#Telles (diverts flow in New Mexico)
#Hughes (diverts flow in New Mexico)
#Valley Canal (diverts flow in New Mexico)
#Franklin (diverts flow in New Mexico)
#Waters
#Owen
#Duncan Canal
#Black & McClesky (McCloskey) Canal
#Ward & Courtney
#Day
#Brown Canal
*#San Jose Canal
*#Montezuma
*#Union
#Graham Canal
*#Oregon Canal
*#Smithville Canal
*#Nevada
#Curtis
#Fort Thomas Canal
*#Central Canal
*#Sunflower Canal
*#Gonzales
*#Mejia
*#Maxey
*#Darby
*#Michelana
#Saline
#Mexican
#Lower Thompson
#Upper Thompson
#Reid

#Vogel
#Kempton
#Mathewsville
#Brice
#Dodge
#Union Branch
#Lee
#Old San Jose
#Sanchez
#Enterprise
#Shields
#Winkleman
#Brannaman

Middle Gila District (Florence to Salt mouth):

*Florence Canal
*Moore's
*McClelland
*Sharp
*Stiles
*Swiss
*Brash
*Montezuma
*Pat Holland
*Alamo Amarillo
*Brady
*Adamsville
*White
*Walker & Dempsey

Middle Gila District (on Gila River Indian Reservation):

#Blackwater
#Sacaton Flats, or Hassankoek
#Cottonwoods, or S'oufpack
#Santan
#Lower Santan, or Hirlchirlechirk
#S'totonnick
#Wakey
#Babechirl
#South Sho-otk
#North Sho-otk
#Railroad Crossing, or South Shonnick
#Highland, or North Shonnick

Lower Gila District (below Salt mouth):

*Gila Bend Canal Company
*Enterprise Canal, Gillespie Dam

*Buckeye
*Gila River
*Gould Bros
*Palmer
*Citrus
*Monarch
*Gila River Irrigating Co

Sources:
* Twelfth Annual Report of the United States Geological Survey, 1890-91, pp. 303, 306, 314
# Twenty-First Annual Report of the United States Geological Survey, 1899-1900, pp. 335-6, 340-1, 356-7

The following canals currently exist to divert flow from the Gila River (not all canals are active at this time):

(The Gila Water Commissioner was first appointed by the United States District Court for Arizona effective January 1, 1936, following the *Gila River Decree*, which affirmed diversion priorities.)

in Duncan Valley, NM-AZ:
- *Sunset Canal (diverts flow in New Mexico)
- *New Model (diverts flow in New Mexico)
- *Valley Canal (diverts flow in New Mexico)
- *Duncan Canal
- *Black & McClesky Canal
- *Colmenero Canal
- *Albert
- *Sexton
- *York
- *R. Sexton

in Safford Valley, AZ:
- *Consolidated Brown Canal (formerly Brown Canal)
- *Tidwell Canal (formerly Michelana Canal) (combined with Brown Canal after March 1, 1976)
- *Fourness Canal
- *San Jose Canal
- *Montezuma
- *Union
- *Graham Canal
- *Smithville Canal
- *Dodge-Nevada
- *Curtis
- *Fort Thomas Canal
- *Colvin-Jones
- *T.D. Burton

near Florence:
- *Florence-Casa Grande Canal

above Gillespie Dam:
- *Gila Bend Canal, Gillespie Dam
- *Enterprise Canal, Gillespie Dam

Source:
- * USGS Water-Resources Data for Arizona, AZ-80-1

The average annual diversions for reaches along the Gila River are as follows:

Location	Acre-feet diverted	Average cfs diverted
in Duncan Valley (above Clifton)	25529	35.3
in Safford Valley (above Solomon)	3309	4.6
in Safford Valley (above Calva)	109272	150.9
@ Ashurst-Hayden Dam (above Florence)	230088	317.8
above Gillespie Dam	46205	63.8

The cumulative average annual diversions for reaches along the Gila River are as follows:

Location	Acre-feet diverted	Average cfs diverted
in Duncan Valley (above Clifton)	25529	35.3
in Safford Valley (above Solomon)	28838	39.9
in Safford Valley (above Calva)	138110	190.8
@ Ashurst-Hayden Dam (above Florence)	368198	508.6
above Gillespie Dam	414403	572.4

Sources:

USGS Water Supply Papers Number 1313
USGS Water Supply Papers Number 1733
USGS Water Supply Papers Number 1926
USGS Water Supply Papers Number 2126
USGS Water Resources Data for Arizona, AZ-71-1
USGS Water Resources Data for Arizona, AZ-72-1
USGS Water Resources Data for Arizona, AZ-73-1
USGS Water Resources Data for Arizona, AZ-74-1
USGS Water Resources Data for Arizona, AZ-75-1
USGS Water Resources Data for Arizona, AZ-76-1
USGS Water Resources Data for Arizona, AZ-77-1
USGS Water Resources Data for Arizona, AZ-78-1
USGS Water Resources Data for Arizona, AZ-79-1
USGS Water Resources Data for Arizona, AZ-80-1

The following canals have existed to divert flow from the Gila River since Statehood (not all canals are active at this time):

in Duncan Valley, NM-AZ [1]:

*Sunset Canal (diverts flow in New Mexico)
*New Model (diverts flow in New Mexico)
*Shriver (combined with Moddle Canal January 1, 1948)
*Valley Canal (diverts flow in New Mexico)
*Duncan Canal
*Black & McClesky Canal
*Colmenero Canal
@Albert
*Sexton
*York
*R. Sexton

in Safford Valley, AZ [1]:

*Brown Canal (Consolidated Brown Canal after March 1, 1976)
*Tidwell Canal (formerly Michelana Canal; combined with Brown Canal after March 1, 1976)
*Fourness Canal
*San Jose Canal
*Montezuma
*Union
*Graham Canal
*Smithville Canal
*Dodge-Nevada
*Curtis
*Fort Thomas Canal
*Colvin-Jones
#T.D. Burton

near Florence:

*Florence-Casa Grande Canal
*Florence Canal
*O.T. Canal
*Pierson-Nicholas Canal

above Gillespie Dam:

*Gila Bend Canal, Gillespie Dam
*Enterprise Canal, Gillespie Dam

[1] USGS WSP 1049, p. 173 and *The United States of America v. Gila Valley Irrigation District, et.al.*, June 29, 1935; The Gila Water Commissioner was first

appointed by the United States District Court for Arizona effective January 1, 1936, following the *Gila River Decree*, which affirmed diversion priorities.

Sources:

* USGS Water Supply Paper 1313
\# USGS Water Supply Paper 1926
@ USGS Water Resources Data for Arizona AZ-73-1

Dams

Dams and irrigation diversions located on the Gila River and other rivers have affected flow within the Gila River since before the turn of the century.

At this time there are four major dams operating along the Gila River within the limits of the study area. These are Coolidge Dam, Ashurst-Hayden Dam, Gillespie Dam and Painted Rock Dam. Also on the river, but just upstream of the study area, is San Jose Canal diversion dam.

Coolidge Dam and San Carlos Reservoir are located in the SW¼ Section 17, Township 3 South, Range 18 East, latitude 33°-10'-10", longitude 110°-31'-50" and approximately 18 miles northeast of Winkelman, Gila County. The dam was completed October 25, 1928, and has regulated flow since November 15, 1928. Coolidge Dam impounds Gila River flows in San Carlos Reservoir. The Gila River has an estimated drainage area of 12,886 square miles at this location. The current estimated usable capacity of the reservoir is 866,600 to 1,073,600 acre-feet between elevations of 2382.63 feet (the sill of the lowest outlet gate) and 2510.4 feet (the revised crest of the spillway). The maximum recorded storage of the reservoir is 1,090,000 acre-feet, which occurred from February 26 to March 6, 1980. Due to sediment, which has accumulated since the dam's completion in 1928, there is no dead storage behind the dam at this time. The reservoir stores water for irrigation of approximately 100,000 acres of crop lands in the San Carlos Project, and is also used for power development dependent on irrigation demands. In the late 1970's, the Bureau of Reclamation performed a safety evaluation of Coolidge Dam at the request of the Bureau of Indian Affairs, which owns and operates the dam. The evaluation revealed safety deficiencies related to the dam's inability to pass a Probable Maximum Flood (PMF), and a deterioration of the dam's outlet works and penstocks. Another Reclamation report in mid-1989 identified a "significant failure potential" related to a PMF due to overloaded spillways and dam overtopping. The Bureau of Reclamation indicates that repair construction is approximately six months to one year behind schedule due to delays related to the excessive runoff of late 1992 and early 1993.[14]

Ashurst-Hayden Dam is located in the SW¼ NW¼ Section 8, Township 4 South, Range 11 East, latitude 33°-06'-00", longitude 111°-14'-50" and approximately 9 miles east of Florence, Pinal County. The dam has been operational since July 1923.

The Gila River has an estimated drainage area of 18,305 square miles at this location. There is a diversion for the Florence-Casa Grande irrigation canal at the dam, with four sluice gates in the dam with top of opening at 6.5 feet below the crest of the dam. The crest of the dam is at elevation of 1583.0 (mean sea level). Flow to the dam is partly regulated by storage in San Carlos Reservoir.

Gillespie Dam is located in the SE¼ NE¼ Section 28, Township 2 South, Range 5 West, latitude 36°-13'-45", longitude 112°-46'-00" and approximately 6 miles south of Arlington, Maricopa County and 8 miles downstream from the Hassayampa River. The Gila River has an estimated drainage area of 49,650 square miles at this location. There are diversions for the Enterprise and Gila Bend irrigation canals at Gillespie Dam. The dam has been operational since August 1921. The maximum recorded discharge at this location was 178,000 cfs, recorded February 16, 1980; the maximum estimated discharge (outside of period of record), at this location was 250,000 cfs, which occurred during February 1891. The average discharge of the river above diversions at the dam for the 56 year period of record is 391 cfs.

Painted Rock Dam and Reservoir are located in the SE¼ Section 18, Township 4 South, Range 7 West, latitude 33°-04'-30", longitude 113°-00'-50" and approximately 19 miles northeast of Sentinel, Maricopa County. The Gila River has an estimated drainage area of 50,910 square miles at this location. The dam has been operational since October 1959. There are no diversions for irrigation at this location, although there are many diversions above the dam for irrigation. Flow above dam is regulated by many reservoirs, including: Painted Rock, San Carlos, Bartlett and Horseshoe on the Verde River; Lake Pleasant on the Agua Fria River and Saguaro; Canyon, Apache and Theodore Roosevelt Lakes on the Salt River. The largest of these is Painted Rock Reservoir, which has an estimated capacity of 2,492,000 acre-feet for control of flood runoff. The maximum recorded discharge at this location was 9,190 cfs, which occurred on May 3, 1983.

On the Salt River, the combined capacity of Saguaro Lake, Canyon Lake, Apache Lake and Theodore Roosevelt Lake reservoirs is an estimated 1,755,000 acre-feet, on the Verde River, the combined capacity of Bartlett Lake and Horseshoe Lake reservoirs is an estimated 317,700 acre-feet, and on the Agua Fria River, the capacity of Lake Pleasant is estimated at 157,600 acre-feet.

United States Geological Survey records report that local farmers have been removing water from the Gila since at least 1889. At that time nearly 450 miles of ditches delivered water for irrigation to over 220,000 acres along the Gila.[13] A list of these ditches is attached at the end of this section. Over 20 canals remove water from the Gila at this time, serving over 100,000 acres of crop land.[15]

Upstream of the study area is San Jose Canal diversion dam, which is located in the SE¼ Section 36, Township 6 South, Range 27 East, latitude 32°-51'-40", longitude 109°-32'-30" and about 5 miles northeast of Solomon.

NOTES ON SOURCES:

Information related to irrigation canal flows and dams along the Gila River has been primarily obtained from the Twelfth Annual Report of the United States Geological Survey, 1890-91; United States Geological Survey Water Supply Papers Number 1313, 1733, 1926 and 2126, and United States Geological States Water-Resources Data Reports AZ-71-1 through AZ-80-1 (in cooperation with Arizona Department of Water Resources).

[1] Twelfth Annual Report of the United States Geological Survey, 1890-91, Part II -- Irrigation, p. 302
[2] ibid., p. 305
[3] ibid., p. 314
[4] ibid., pp. 302-3
[5] ibid., pp. 309-10
[6] ibid., pp. 310-1
[7] ibid., pp. 311-3
[8] ibid., p. 315
[9] ibid., p. 315
[10] ibid., pp. 315-6
[11] "Water Service Organizations in Arizona," p. 124, Arizona Department of Water Resources, April 1991, Phoenix
[12] U.S.G.S. Water-Data Report AZ-89-1, pp. 135-267
[13] U.S.G.S. Water Supply Paper Number 1313, p. 595
[14] "Coolidge Dam Rehabilitation Fact Sheet," Bureau of Reclamation, undated
[15] Twelfth Annual Report of the United States Geological Survey, 1890-1891, Part II -- Irrigation, pp. 302-3, 305-9, 314

D. Regional Transportation

1. Railroads

Southern Pacific Railroad Company entered the State from the west through Yuma. During the summer of 1877 work gangs constructed the first bridge across the Colorado River, spanning 667 feet. On September 29, 1877 construction was halted based on orders by the Secretary of War. Until the proper paperwork was completed and authorization was granted, the railroad was not to lay its rails and bridge the Colorado, a federal stream. Work was halted under the watchful eye of the Fort Yuma garrison. Before midnight the railroad began laying track across the bridge and around sunrise work was complete and the first locomotive rolled into Yuma. By May 19, 1879 work had progressed to Casa Grande. Following a temporary suspension, construction resumed, reaching Tucson by March 1880.

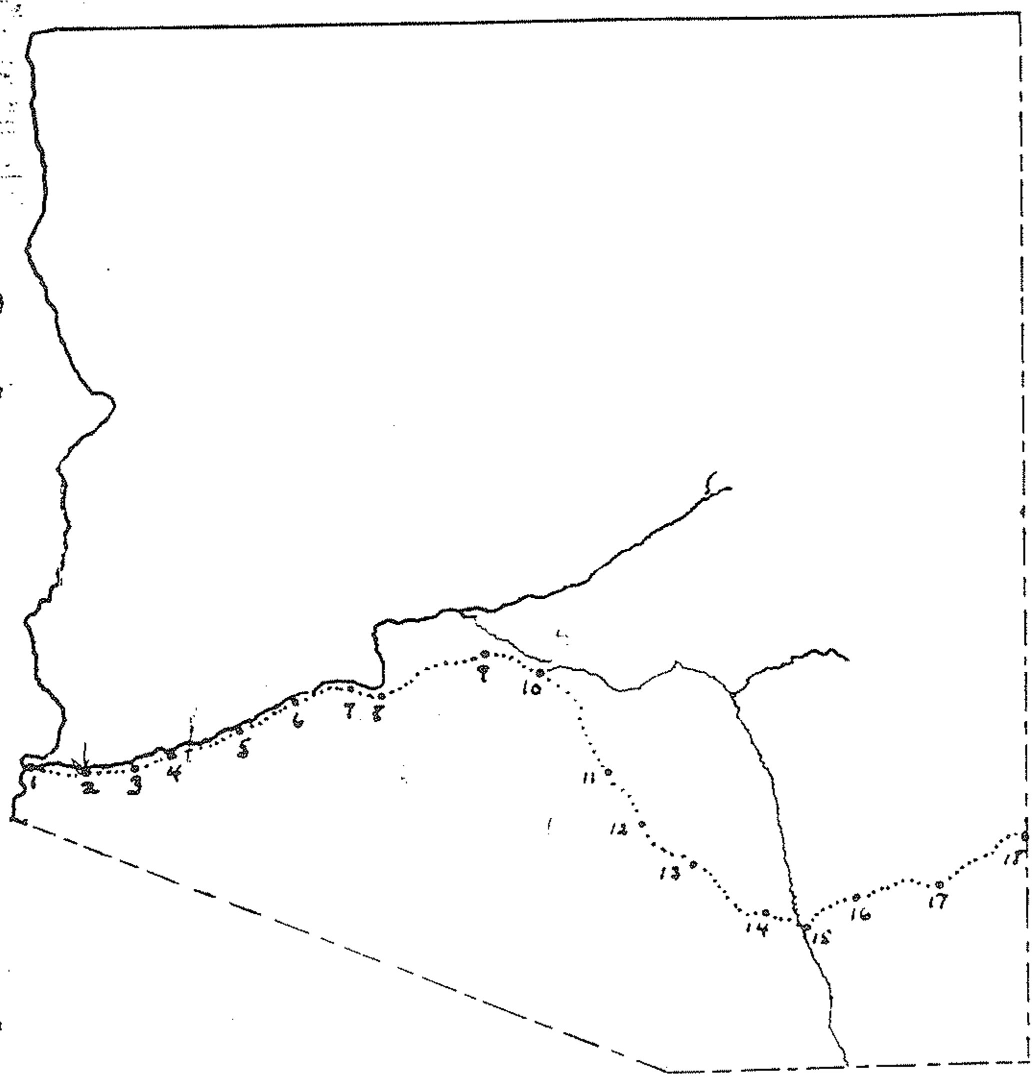
2. Stage Lines

The San Antonio and San Diego Mail Line (or Mail Route 8076) was established by James Birch in 1857 in response to a need for reliable mail delivery to the Pacific Coast which would not be routed on a turn-around through Saint Joseph, Missouri. The Arizona portion of the route included legs through Tucson, the Pima Villages (near Sacaton) and Yuma. The route was authorized to commence July 1, 1857 on a semi-monthly basis. The contract was amended on September 10, 1858 when it conflicted with the Butterfield Overland Mail.

The Butterfield Overland Mail (Route 12587) was established on September 16, 1857 and commenced one year later. The route was semi-weekly and replaced the portion of the San Antonio-San Diego Mail lying between El Paso and Yuma. The service was suitable for transporting passengers. This service was discontinued in March 1861. The attached map at the end of Section D displays the route and stations within Arizona. The Mileage Table following the map indicates the approximate distance from station to station as reported to the Postmaster General. From March 1861 through 1865 (1866?), no mail service other than courier or individual existed in Arizona. The Civil War was the apparent cause.

In 1867, service was re-established along the old Butterfield route by an unnamed company. The Texas and California State Company commenced operation in 1875. By 1879 several local stage lines operated within the Arizona Territory.

(Source: <u>Overland Butterfield Mail Across Arizona</u>, Arizona Pioneers' Historical Society Tract)



EASTBOUND BUTTERFIELD OVERLAND MAIL ROUTE
ACROSS ARIZONA

	Miles
1—Yuma	
2—Swiveller's Ranch	20
3—Filibuster Camp	18
4—Peterman's	19
5—Stanwix	
6—Oatman Flat	47
7—Murderer's Grave	20
8—Gila Ranch (Gila Bend)	17

	Miles
10—Sacaton	22
11—Picacho Pass	37
12—Point of Mountain	22
13—Tucson	18
14—Cienega	35
15—San Pedro River (Benson)	24
16—Dragoon Springs	23
17—Apache Pass	40
18—Stein's Pass	35

Total across Arizona 437

MILEAGE TABLE ACROSS ARIZONA OF THE FIRST EASTBOUND BUTTERFIELD STAGE FROM SAN FRANCISCO

G. Bailey — Special agent

Report to Hon. A. V. Brown, postmaster general, accompanied first Overland Mail to east.

Fort Yuma to:

Swiveller's Ranch	20 miles
*Filibuster Camp	18 "
Peterman's	19 "
Griswell's	12 "
Flap-jack Ranch	15 "
Oatman Flat	20 "
Murderers' Grave	20 "
Gila Ranch	17 "
Maricopa Wells	40 "
Sacaton	22 "
Picacho del Tucson	37 "
Pointer Mountain (Charcos de los Pimos)	22 "
Tucson	18 "
Total	280 miles

Tucson to:

Cienega de los Pimas	35 miles
San Pedro River	24 "
Dragoon Springs	23 "
Apache Pass (Puerto del Dado)	40 "
Stein's Pass	35 "

(No water except at stations)

Total 157 miles

Across Arizona 437 miles

Approximate distance
St. Louis to San Francisco 2800 miles
Contract time 25 days
Average speed approximately 5 miles per hour
Left San Francisco, 12:10 a.m., September 14, 1858
In Tucson September 25,1858
Arrived Tipton, Mo., 9:05 a.m., October 9, 1858

*(*Crabb's Filibustering Expedition into Sonora*, 1857, started from here).

From the

DECENNIAL CENSUS 1860

Territory of New Mexico, County of Arizona

Aggregate population 6,482

Names with probable connection with Overland Mail, Arizona City, Territory of New Mexico and Ft. Yuma, Colorado Township, California.

Name	*Age*	*Sex*	*Occupation*	*Property Value*	*Place of Birth*
Andrews, George	26	M	Mail Conductor		New York
Baker, Andrew	32	M	Stage Driver		" "
Brewer, Louis	35	M	Mail Conductor		Maryland
Doran, Hugh	28	M	Mail Conductor		New York
Doten, James	42	M	Coach Maker		Sonora, Mex.
Doten, Rose	25	F		1,000	Massachusetts
Doten, Adele	2	F			California
Doten, Mary	4/12	F			"
Hosmer, Newell	30	M	Stage Driver		New York
Jacobs, George W.	38	M	Overland Mail Agent		
Lloyd, John	37	M	Mail Conductor		" "
McTurk, John	35	M	Mail Conductor		" "
Parks, Oliver M.	40	M	Stage Driver		" "
Stafford, Henry	33	M	Stage Driver		Pennsylvania
Stevens, Edward C.	32	M	Overland Mail Agent	7,200	New York
Tyler, Smith	32	M	Mail Conductor		New York
Weld, Benjamin G.	24	M	Driver	10,000	Maine

GILA CITY (Ft. Yuma)

Baine, Josiah	33	M	Stage Driver		Maine
Neeley, Sam	30	M	Stage Driver		Tennessee

Great Overland Mail Stations between Pima Villages and Gila City (Post Office, Gila City)

Safford, Henry	26	M	Stage Driver	2,000	Pennsylvania

40 names, mostly farmers, hostlers, teamsters, machinists, one lawyer, 2 sailors, miners

Frame, Geo. Craton	34	M	Owned Station, Gila Bend		Ohio

Great Overland Mail Stations between Tucson and the Pima Villages (Post Office, Tucson)

Hooker, Van	26	M	Stage Driver		Virginia

33 names, several hostlers and teamsters.

PIMA VILLAGES

25 names — blacksmiths, hostlers, teamsters.

T U C S O N

Bartlett, P. M.	28	M	Stage Driver		Tennessee
Hitchings, Jepe	30	M	" "		New York
Lyon, King	24	M	" "		" "
Quin, John	24	M	" "		" "
Smith, James	25	M	" "		" "
Wallace, James F.	32	M	" "		Massachusetts

CHAPTER V

Oral Histories and Interviews

A. Sources

Oral histories and Interviews were discovered in the Arizona State University Library (Arizona Collection), Yuma (Arizona Historical Society) and various locations along the river. Complete copies of the histories and interviews are included in Appendix D.

B. Discussion

Following are excerpts of those oral histories and interviews which have to date been discovered during research along the Gila River. It is not felt that this is a complete index of existing oral histories or possible interviews, nor is this presented as such.

Donald Clyde Pace (interviewed by Kristina Minister, May 6, 1982, Arizona Oral History Project):

(pp.17-8) M: "Can you tell us what the occupations of most of these people (near Solomonville, Safford and Thatcher) was?"

P: "Well, all right, the people came in from Utah and other places, Alabama and one place or another. They settled in Pima first, then came up to Central and then they settled across the river ... I remember one of them telling me that they got down to the Gila River, and it was flooding, and they couldn't get across ..."
(pp.77-9)

M: "Were there speeches that were made, plays?"

P: "Yes, and ... I remember taking the team and wagon and going out to the reservoir to go swimming for Easter ... We rode the flume. The flume ran from the sawmill down to the foot of the mountain. They would saw the timber on the mountain and then put it in this flume ..."

Ralph W. Bilby, Sr. (interviewed by Kristina Minister, March 17, 1982, Arizona Oral History Project)

(pp.4-5) B: "... We went right down the Blue River into Clifton. We must have crossed that river a hundred times. It was not a big stream. It'd be knee deep for the horses ... I remember we got down to Solomonville -- or right near Solomonville where the Gila River comes into the Gila Valley there -- on the first day of June, 1890 ..."

Laura Killman (interviewed by Carol Brooks, March 1, 1990, Wellton Library District records), occurrences in the vicinity of Dome

(pp.1-2) B: "Laura, tell us about where you were born and when, and about your family."

K: "... my Dad went to Camp Verde ... which was in 1916 ... It's a little hill across the river from Wellton ... and they loaded Grandpa in there and they headed for Wellton and crossed the river ... it was probably, oh ---- three, four hundred yards down to the river bank, and down at the river bank, then, where the main Gila River hit, it came in and hit the side of this little mountain and it kept, there was a big hole of water there all the time, because there was no dams up the river and the water, the river ran all the time. We had to cross the ferry at Dome to get out here ..."

(p.6) B: "How long did it take you to get into town?"

K: "... The road was rough --- deep ruts, and we crossed the ferry at Dome --- a little Mexican by the name of Juan Nunez poled the ferry across --- he had one arm off right here, and he would put the pole under his arm and then pole the ferry back and forth across, and my Daddy said the first year that we were out here, it cost him $250.00 in ferry crossing. Every time we crossed, it was $2.50. And we had to ship our feed out on the car --- box car, to Dome ..."

(p.8) B: "How did people find out about the Springs."

K: "Just word of mouth ... There was one old --- two Frenchmen ... they met this old Indian some place and he told them that, if they would come to Yuma and come up the river from Yuma, he didn't know how many miles ..."
(p.10) B: "What kind of problems did people out here face as they started growing crops?"

K: "Well, when they commenced puttin' in the dams up above, then they dried us up completely."

(p.11) B: "When did they start that (the Mohawk Municipal Water Conservation District)?"

K: "Oh, it must have been in the middle twenties because by that time the railroad was coming through ... as the river dried up, the dams up above dried the river up ..."

(p.14) B: "You said you watched them building the bridge. Which bridge was that?"

K: "The Antelope bridge, I mean, the railroad bridge ... And the river still ran a couple of times enough that it would --- they had a little spur line across down, just below the big bridge that they was workin' on and they would haul some of their equipment across it, and the river washed it down one time --- washed it out and they had to rebuild it and all that stuff, but that must have been in --- they began working on that in '24, I think is when they started workin' on that railroad bridge."

<u>Daniel Wilford Colvin</u> **(statement September 6, 1993)**
"As a child of eight years of age before Statehood in 1911 until I was grown, I spent many hours swimming and playing in the Gila River which was located about one half mile from my home in Eden, Arizona ... As a boy, I would float down the river on a log when there was enough water in the river to do so ... As a boy, I saw no commercial use of the Gila River between San Jose and Sunnyside. The bigest [sic] reason was the diversion dams. The second bigest [sic] reason was the lack of water. During the dry months of the year, the river would dry up and leave only sand and gravel in the river bed just as it does today. The only boat that I ever saw on the river was the hand made boat of David Colvin's. He used the boat one year during a flood to ford the river. He had to haul the boat up the river whenever he wanted to cross ... During a flood, people on the North side of the river would cross either by swimming or on horse back, but they did not do it very often. It wasn't until 1915 that the first bridge was built in Bryce. It made the crossing much easier ... In my 90 years of living in Eden, I have seen a lot of things but the use of the Gila River for navigation was not one of them. Commercial fishing for Razorback Sucker fish was another thing that did not happen in the area where I grew up ..."

<u>LaVena Coffen</u> **(interviewed by Carol Brooks, June 11, 1987)**

(p.2) C: "When did they (your parents) first come to Yuma?"

L: "In 1906. Down at the old depot. That I can remember because I wanted my little red hat so bad in the morning so I could see the bridge open, when the boats would start out in the morning and they never did and I always regretted that..."

(pp.2-4) C: "Which block of Main Street?"

L: "... Well, that's where it was. Right there. The old school was there and then the theater. The theater must have been built in 1910, 1911 or 1912. They had that in the paper wrong because they said it was 1915 or 1916 but I think it's because it went down in the 1916 flood and then redone ... When we left Main Street, was when the land open out at Dome. That open up in 1914. Papa never would stay at anyone's farm long enough to ... I guess he was used to going along with the railroad from pillar to post, but anyway, he went out there to sell land, like McCune did, but the first year, they had a big flood and water was from mountain to mountain out there ... Evidently, the river bed had been up there at one time and oh! that water was high! I think it was Christmas Day and that water was coming down there in torrents, with trees and everything and papa built a boat. And he told my mother, "Etta, when the water gets up to our door sill, we're getting out of here!" With a boat that he had just built, I don't think we'd ever have made it ... But darned if that water didn't come up to our door sill and start to recede. So, we got through that. Then, we moved across the river and papa built up high, next to the railroad track. That was in 1915. Then, we had another flood with the water up the mountain ..."

<u>Mrs. Hazel Shepard</u>, Florence (interviewed by James Latham, September 16, 1993)
Summary: Mrs. Shepard lived with her family in Phoenix and her father worked as a carpenter in Florence. During the flood of 1915, it was necessary for her father to be transported across the Gila River by boat. The boat landing was about ½ mile upstream of Florence, the boats were put in the river, would catch the current and cross to the other side. These boats were used to carry not only passengers, but lumber and other supplies. The boats were small wooden, flat bottomed, rowed by two men. Mrs. Shepard recalls seeing Indians crossing the Gila River in boats in the area of Ashurst-Hayden dam in the 1920s.

<u>Mr. Juan Gutierrez</u>, Florence (interviewed by James Latham, September 16, 1993)
Juan Gutierrez, 89 years old, has lived in Florence since the age of 13. He states that his father worked on the boats ferrying passengers and supplies across the Gila river in 1917. The boats were small rowboats, a fee was charged to cross and the boat landing was at the extension of Main Street in Florence.

<u>Ms. Violet White</u>, Florence (telephone interview by James Latham, September 16, 1993)

Ms. White recalls small boats being used to transport passengers and supplies for a fee across the Gila River at Florence around 1916-1917.

CHAPTER VI

Hydrology

A. Introduction

Since the late nineteenth century two distinct actions have combined to change the nature of flow in the Gila River: 1) Indian populations initially (and apparently well before the 19th century) and the white man subsequently both withdrew water from the Gila to irrigate crops at various locations; and, 2) water conservation and flood control dams have been constructed to regulate flow.

Numerous pioneer accounts have related the fact that Indian cultures had been, apparently, withdrawing water from the Gila, most notably the Pimas near modern day Sacaton.

A paper written by Joseph Barlow Lippincott for the United States Geologic Survey (U.S.G.S.), and published in 1900, took note of the Pima's irrigation history and cautioned that construction of proposed diversion structures near and upstream of Safford would put the Pima's agriculture at risk. This would only serve to aggravate a shortage which commenced around 1886 following the construction of a diversion dam (Ashurst-Hayden) and irrigation canal (Florence Canal) by the Florence Canal Company, approximately 15 miles upstream of the Gila River Indian Reservation.[1]

Since that time additional diversion and storage dams have been constructed and, as U.S.G.S. Water Supply Papers indicate, irrigation canals were constructed near Safford, Arizona as early as water year 1914; near Virden, NM, Duncan, AZ, Thatcher, AZ, and Ashurst, AZ, as early as water year 1915; and at Gillespie Dam as early as water year 1935.[2] Additionally, Gillespie Dam was completed in 1924, Coolidge Dam was completed in 1928, and Painted Rock Dam was completed in 1959. Irrigation ditches, however, were pulling water out of the Gila near Safford, Florence, Buckeye, Gillespie Dam and Gila Bend as early as 1890.[3]

The total area of the Gila Basin is estimated at 66,020 square miles. It includes the greater portion of southern Arizona, a small portion of western New Mexico and a portion of Sonora, Mexico. The Gila River rises in southwestern New Mexico and has a general southwesterly direction until it enters Arizona about 3½ miles southeast of Duncan, where it turns northwest. Its principal sources of supply are from the Black Range on the east, and from a number of ranges on the west, including Little Range, Mogollon Range, and Diablo Range. The average elevation of these mountain peaks is from 9,000 to 10,000 feet. The general character of the country is a high and rolling plateau, with the river flowing through it in a deep canyon, and with practically no agricultural lands within its area. The river emerges from its upper canyon about 10 miles before it reaches the Arizona line, and then flows northwest through the Duncan Valley, until just before it receives the waters of the San Francisco River. Duncan Valley contains a number of canals which divert water for irrigation purposes.

The Gila River then flows southwest in canyon for about 20 miles below the mouth of the San Francisco, or to within 10 miles of Solomon. At this point the hills separate, forming a large valley, Safford Valley, which is extensively populated and is one of the finest irrigated portions of the State. This valley extends northwest from a point 10 miles above Solomon to a point about six miles below the mouth of San Carlos River on the San Carlos Indian Reservation. At this latter place the mountains suddenly close in again, and the river enters a box canyon with a width of 100 feet. Coolidge Dam is located at this point.[4]

The river remains in a southwesterly canyon from a short distance just below the Coolidge Dam, to about one mile above the mouth of the San Pedro River at Winkelman/Hayden. The country then broadens into an unnamed valley of considerable size, extending northwest for a distance of about 20 miles from Hayden, past Kearny, to below the mouth of Mineral Creek. From the mouth of Mineral Creek the river flows west in canyon again until North and South Buttes are reached, a distance of about 15 miles, where the river opens onto the plains region of south-central Arizona.[5] It then winds northwest for about 75 miles before receiving the waters of the Salt River southwest of Phoenix. From there, the Gila turns west, receives the waters of the Agua Fria River about three miles downstream of the Salt, and continues west through the Buckeye Valley for about 25 miles before reaching the Arlington Valley, where it receives the waters of the Hassayampa River. From here the river flows south through an unnamed valley for about 25 miles to Gila Bend and enters the Citrus Valley. The river passes through the Gila Bend Indian Reservation and Painted Rock Reservoir and flows northwest to the Painted Rock Dam at the mouth of the Gila River Canyon which lies between the Gila Bend Mountains and Painted Rock Mountains. The river then opens into Dendora Valley and flows southwest for about 10 miles before reaching the Oatman Flat and briefly contracting. It then enters Hyder Valley on the Sentinel Plain and winds southwest for about 25 miles to the San Cristobal Valley near Horn, continues southwest for about 10 miles and enters the Mohawk Valley at Texas Hill. The river continues west-southwest for about 30 miles through the Mohawk Valley past Wellton, turns northwest into Dome Valley for about 15 miles, and enters a brief contraction between the Dome Mountains and the Laguna Mountains before opening onto the North Gila Valley about 10 miles east of Yuma. The river then flows west to its confluence with the Colorado River about four miles east of Yuma.

The principal tributaries of the Gila are the San Francisco, Salt, Agua Fria and Hassayampa rivers from the north, and the San Pedro and Santa Cruz rivers from the south.

The San Francisco River, the principal tributary of the upper Gila River, rises in the southeastern part of Apache County, near the town of Alpine and passes into the southwestern part of Socorro County, New Mexico within a distance of about 15 miles. In this reach the river drains about 75 square miles in Arizona. Its course through New Mexico is southerly, with the river returning to Arizona near latitude 33° north into Graham County. The river courses through a succession of canyons alternating with short valley openings, with an average fall of about 35 to 40 feet per mile.[6] It joins with the Gila about six miles southwest of Clifton.[7] The basin comprises approximately 2800 square miles, of which 1800 square miles are in New Mexico and 1,000 in Arizona.[8]

The San Pedro River rises in the northern part of the State of Sonora, Mexico, flows northward for more than 100 miles, and empties into the Gila below the town of Hayden, 45 miles above Florence. Rising in a country of very light snowfall, the river depends for the greater part of its water supply on the frequent showers of the rainy seasons. It flows over a sandy bed between high, steep banks, and during the dry season, it shrinks to an insignificant stream of clear water, which rises and sinks in the sand with the varying depth of bed rock.[9]

The Salt River, though considered a tributary of the Gila, is in fact larger both in catchment area and in discharge. It receives the drainage from central Arizona, and its principal tributary, the Verde, flows southeasterly and south from the mountains and table-lands south of the Colorado River. The Verde Valley is situated in Yavapai County, on the headwaters of the stream, and extends from a canyon above Camp Verde to a point about 10 miles below. About a mile above the junction of the Verde and 30 miles above Phoenix, the Salt enters the plains of the Salt River Valley.[10]

The floods of the upper Gila and its tributaries are usually short and violent, occurring during the months of January and February. The season of low water occurs in June and July. The average annual precipitation over the greater part of the tributary drainage area of Gila and San Francisco rivers in New Mexico is between 10 and 15 inches and in the high mountains of the headwater region it rises above 20 inches. The winters are mild except in the mountainous sections, and very little ice forms on the rivers.[11]

The drainage basin of the Gila includes 7,000 square miles of timberland, 11,000 square miles of woodland, 45,000 square miles of land upon which there is no timber, 1,300 square miles of scattered timber, and 300 square miles of open land.[11]

Irrigation in New Mexico is confined chiefly to the bottom lands along the main streams and their tributaries, and the total area irrigated comprises only a few thousand acres.[11] Irrigation in Arizona occurs in the Duncan Valley, the Safford Valley, on the plains west of Hayden to Phoenix, in the Buckeye Valley west of Phoenix, south of Gillespie Dam to Gila Bend, in Dendora Valley west of Gila Bend, and in the Wellton-Mohawk Valley east of Yuma, although the Wellton-Mohawk area is now irrigated by waters from the Colorado River. Irrigation also occurs on many of the Gila tributaries, including the San Francisco River (many diversions above Clifton), the San Pedro River (at its mouth at Winkelman and many small diversions upstream), the Santa Cruz River (many small diversions above Laveen upstream to above Nogales), the Verde River (near Fort McDowell and many small diversions above Bartlett Reservoir), the Salt River (at Granite Reef Dam), the Agua Fria River (above Lake Pleasant and many small diversions upstream) and the Hassayampa River (many small diversions above Morristown).[12]

Additionally, irrigation occurs on both the San Carlos and Gila River Indian Reservations. Irrigated lands on the Gila River in Arizona total between 100,000 and 200,000 acres of privately held lands, and up to 100,000 acres of Indian Reservation lands.

B. Streamflow records

The best apparent source of information relating to stream flow is the gauge records maintained by the U.S.G.S. The U.S.G.S. has been in existence since approximately 1879, and a review of the U.S.G.S. Annual Reports and Water Supply Papers indicates the U.S.G.S. has been studying the Gila River drainage basin since 1888 when the Survey began establishing gauging stations on numerous rivers around the country including the Gila, Salt and Verde Rivers in Arizona. The first Gila River gauge was established in 1889 approximately 14 miles upstream of Florence at a location referred to as 'The Buttes,' and was driven directly into the river bed.[13] This gauge proved to be unworkable and was replaced. Record flows for the current gauge stations (following statehood) are reported in U.S. Geological Survey Water Date Report AZ-91-1 (see Appendix E).

B.1. Pre-1912

A. The gauging station at Dome was initially established by the United States Geological Survey in 1903, and is located at latitude 32° 45' 39" north, longitude 114° 25' 11" west in the SW1/4 Section 4, Township 8 South, Range 21 West. This station is identified as number 09520500 by the Geological Survey. The current stream gauge is a water-stage recorder and records at the station are considered poor by the Geological Survey, in part due to the many diversions above the station for irrigation.

Early Geological Survey gauge records at this station consist of gauge height, rating curve and sporadic discharge records. The initial daily average, monthly average and peak discharge records were recorded and reported in January, 1903. During the period prior to Statehood the average monthly flow was 1,277 cfs and the maximum recorded flow was 95000 cfs which occurred on March 20, 1905 and on November 29, 1905 (U.S.G.S. Water Supply Paper 1683, Appendix E).

B. The gauging station at the Buttes dam site was initially established by the United States Geological Survey in 1889 and is located at latitude 33° 05' 30" north, longitude 111° 11' 30" west in the SW1/4 Section 11, Township 4 South, Range 11 East. The station was discontinued in 1899. Up to that time the Buttes site had been under consideration as a reservoir, but it was superseded by the San Carlos site.

Early Geological Survey gauge records at this station consist of gauge height, rating curve and sporadic discharge records. The initial daily average, monthly average and peak discharge records were recorded and reported in August, 1889. During the period prior to Statehood, the average monthly flow was 630.2 cfs and the maximum recorded flow was 102,000 cfs which occurred on February 22, 1891.

C. The gauging station at Kelvin was initially established by the United States Geological Survey in 1911 and is located at latitude 33° 06' 10" north, longitude 111° 58' 33" west in the NE1/4 NW1/4 Section 12, Township 4 South, Range 13 East. The station is identified as number 09474000 by the Geological Survey. The current stream gauge is a water-state recorder-type gauge and records at the station are considered good by the Geological Survey. [WSP 1683]

Early Geological Survey gauge records at this station consist of gauge height, rating curve and sporadic discharge records. The initial daily average, monthly average and peak discharge records were recorded and reported in January, 1911. During the period prior to Statehood the average monthly flow was 739.4 cfs, and the maximum estimated flow was 190,000 cfs, which occurred on November 28, 1905 (see U.S.G.S. Water Supply Pater 1683, Appendix E).

D. The gauging station at San Carlos/Coolidge Dam was initially established by the

United States Geological Survey in 1899, and is located at latitude 33° 10'" north, longitude 110° 31' 50" west in the SW1/4 Section 17, Township 3 South, Range 18 East. The station was relocated approximately one mile upstream in 1910. The station is identified as number 09469500 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered excellent for flows above 5 cfs, which are considered fair by the Geological Survey.

Early Geological Survey gauge records at this station consist of gauge height, rating curve and sporadic discharge records. The initial daily average, monthly average and peak discharge records were recorded and reported in 1899. During the period prior to Statehood, the average monthly flow was 272 cfs and the maximum estimated flow was 150,000 cfs, which occurred on November 28, 1905 (see U.S.G.S. Water Supply Paper 1683, Appendix E).

B.2. Following Statehood (February 14, 1912)

A. The gauging station at Dome was initially established by the United States Geological Survey in 1903 and is located at latitude 32° 45′ 39" north, longitude 114° 25′ 11" west in the SW1/4 Section 4, Township 8 South, Range 21 West. The station is identified as number 09520500 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered poor by the Geological Survey, in part due to the many diversions above the station for irrigation.

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period 1903 to 1991, with a break in the record for the years 1917 to 1928. During the record period the average monthly flow was 455 cfs, and the maximum estimated flow was 200,000 cfs which occurred on January 22, 1916.

B. The gauging station near Sentinel was first established by the United States Geological Survey on December 17, 1912 and was located in Section 10, Township 8 South, Range 9 West above the diversion dam of the Southwestern Fruit & Irrigation Company. The gauge was destroyed June 2, 1913 due to a break in the dam. The gauge was re-established June 3, 1913 downstream of the dam, with the first gauge heights reported July 1, 1913. The station was discontinued March 2, 1917, apparently due to the shifting character of the river's sandy bed. The gauge was a vertical staff in the left bank. A rating curve was never developed and daily discharges were reported only for the months of November and December, 1913, January through May, 1914 and July through December, 1914. A peak flow of 120,000 cubic feet per second was estimated for January 31, 1915.

C. The gauging station at Painted Rock Dam was initially established by the United States Geological Survey in October, 1959, and is located at latitude 33° 04′ 30" north, longitude 113° 00′ 50" west in the SE1/4 Section 18, Township 4 South, Range 7 West. The station is identified as number 09519800 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered fair by the Geological Survey, since diversions occur above the station for irrigation.

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period October, 1959 to 1991, with no breaks in the record. During the record period the average monthly flow was 344.6 cfs and the maximum recorded flow was 5060 cfs which occurred on September 17, 1980.

D. The gauging station below Gillespie Dam was initially established by the United States Geological Survey in 1921 and is located at latitude 33° 13' 45" north, longitude 112° 46' 00" west in the SE1/4 NE1/4 Section 28, Township 2 South, Range 5 West. The station is identified as number 09519500 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered fair by the Geological Survey.

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean, and instantaneous peak discharge records. Daily average, monthly average, and peak discharge records have been recorded and reported since August, 1921 to the present, with no breaks in the record. During the record period, the average monthly flow was 393.4 cfs. The maximum observed flow of 178,000 cfs occurred on February 16, 1980. Prior to the period of record, the estimated maximum flow was 250,000 cfs which occurred in February, 1891.

E. The gauging station at Laveen was initially established by the United States Geological Survey in January, 1940 and is located at latitude 33° 15' 25" north, longitude 112° 09' 59" west in the SW1/4 NW1/4 Section 16, Township 2 South, Range 2 East. The station is identified as number 09479500 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered fair by the Geological Survey.

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period of January, 1940 to the present, with a break in the record for the period of October, 1946 to November, 1947. During the record period the average monthly flow was 31.64 cfs and the maximum recorded flow was 35,000 cfs which occurred on October 4, 1983.

F. The gauging station at Kelvin was initially established by the United States Geological Survey in 1911 and is located at latitude 33° 06' 10" north, longitude 111° 58' 33" west in the NE1/4 NW1/4 Section 12, Township 4 South, Range 13 East. The station is identified as number 09474000 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered good by the Geological Survey. [AZ-91-1]

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period of January, 1911 to the present, with no breaks in the record. During the record period the average monthly flow was 491 cfs and the maximum recorded flow was 132,000 cfs which occurred on January 20, 1916.

G. The gauging station at Winkelman was initially established by the United States Geological Survey in 1917 and is located at latitude 33° 00′ 21" north, longitude 110° 45′ 21" west in the SW1/4 SW1/4 Section 13, Township 5 South, Range 15 East. The station is identified as number 09470000 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered good to fair by the Geological Survey.

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period 1917 to present, with occasional breaks in the record for the years 1918 to 1941 and 1981 to 1984. During the record period the average monthly flow was 332.1 cfs and the maximum recorded flow was 55000 cfs which occurred on August 9, 1944. This station was discontinued after September, 1991.

H. The gauging station at Coolidge Dam/San Carlos Reservoir was initially established by the United States Geological Survey in 1899 and is located at latitude 33° 10′ 10" north, longitude 110° 31′ 50" west in the SW¼ Section 17, Township 3 South, Range 18 East. The station is identified as number 09469500 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered excellent by the Geological Survey. [AZ-91-1]

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period 1899 to 1991, with occasional breaks in the record for the years 1906 to 1909, and 1911 to 1913. During the record period the average monthly flow was 379.4 cfs and the maximum recorded flow was 130,000 cfs which occurred on January 20, 1916.

I. The gauging station at Calva was initially established by the United States Geological Survey in 1929 and is located at latitude 33° 11′ 08" north, longitude 110° 13′ 10" west in the SW1/4 Section 8, Township 3 South, Range 21 East. The station is identified as number 09466500 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered good by the Geological Survey.

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period 1929 to the present, with no breaks in the record. The peak flow for January 20, 1916 has been estimated in excess of 100,000 cfs. During the record period the average monthly flow was 334 cfs and the maximum recorded flow was 150,000 cfs which occurred on October 3, 1983.

J. The gauging station at Solomon was initially established by the United States Geological Survey in 1914 and is located at latitude 32° 52′ 06" north, longitude 109° 30′ 38" west in the SE1/4 NE1/4 Section 31, Township 6 South, Range 28 East. The station is identified as number 09448500 by the Geological Survey. The current stream gauge is a water-stage recorder-type gauge and records at the station are considered good by the Geological Survey.

Geological Survey gauge records at this station consist of gauge height, rating curve, daily mean, monthly mean and instantaneous peak discharge records. Daily average, monthly average and peak discharge records were recorded and reported for the period 1914 to the present, with no breaks in the record. During the record period the average monthly flow was 480.9 cfs and the maximum recorded flow was 132,000 cfs which occurred on October 2, 1983.

B.3. Influence of Dams and Reservoirs

There are two major reservoirs located along the Gila River which regulate its daily flow. The first is the San Carlos Reservoir, located in Township 3 South/Ranges 18 and 19 East, impounded by Coolidge Dam, and has a usable capacity of 935,000 acre-feet. The dam was completed October 25, 1928 and flow was first regulated after November 15, 1928. The reservoir regulates flow for irrigation projects downstream to Gillespie Dam, south of Arlington, west of Phoenix.

The second reservoir is the Painted Rock Reservoir, located in Township 4 South/Ranges 4, 5, 6 and 7 West and Township 5 South/Ranges 4, 5, 6 and 7 West, impounded by Painted Rock Dam, and has a usable capacity of 2,492,000 acre-feet. The dam was completed in 1959, and flow was first regulated after 1960. The reservoir mitigates flood flow for areas downstream to the Colorado River confluence east of Yuma.

C. Flow Frequency and Rating Curves

After assembling available stream flow data for the various gauging stations it was necessary to determine the anticipated flow rates for various return periods. To do this a generally accepted statistical method referred to as log-Pierson Type III was employed. These analyses are presented in Appendix G and the results of these analyses are summarized in the table at the end of Section C.

For this investigation, flows on the Gila fall into three time periods: (1) prior to 1912, when the Roosevelt Dam was completed on the Salt, and flow records for stations below the Salt-Gila confluence are affected; (2) prior to 1928, when Coolidge Dam was completed and flow records for stations above the Salt-Gila confluence and below Coolidge Dam are affected; and (3) the total period of record for those stations above Coolidge Dam, which have flow regulated only to the extent that water is diverted for irrigation purposes.

Event flows on the Gila fall into five alternative conditions:

(1) Unregulated flow. This applies to Gila River stations upstream of Coolidge Dam which are unregulated within Arizona. Conversations with the New Mexico Public Lands Commissioner and the Bureau of Reclamation indicated that there are no conservation or flood-control structures on the Gila within New Mexico;

(2) Regulated flow following completion of Coolidge Dam. This applies to stations downstream of Coolidge Dam and upstream of the Salt River confluence;

(3) Regulated flow following completion of Roosevelt Dam and prior to completion of Coolidge Dam. This applies to stations downstream of the Salt River confluence.

(4) Unregulated flow following completion of Roosevelt Dam and following completion of Coolidge Dam. This applies to stations downstream of the Salt River confluence.

(5) Unregulated flow prior to construction of Roosevelt Dam. This applies to all stations downstream of Coolidge Dam, which are now regulated.

Obviously, not all of these conditions apply to every station on the Gila. Also, not all Gila stations existed prior to completion of Roosevelt Dam, while some have only been maintained since completion of Coolidge Dam.

Typical stream flow characteristics (flow rate, normal depth, average velocity and hydraulic radius) were identified for various flow events by developing a rating curve for the river at either the gauging station or a more typical cross section nearby. The rating curve data and assumed cross sections are presented in Appendix F.

D. Climatic Variation

In gathering data and making assumptions it was necessary to identify the potential for changes in local climate and its possible effects on rainfall within the Gila River basin and runoff within the river. In identifying a rational basis for determining flood flow frequency the materials repeatedly referred to the United States Water Resources Council's "Guidelines For Determining Flood Flow Frequency," Bulletin 17A. A review of the assumptions discussed in the document revealed the following:

> "A. Climatic Trends
>
> There is much speculation about climatic changes. Available evidence indicates that major changes occur in time scales involving thousands of years. In hydrologic analysis it is conventional to assume flood flows are not affected by climatic trends or cycles. Climatic time invariance was assumed when developing this guide."[14]

In 1978, Daniel M. Johnson of the Department of Geography, Portland State University asserted that existing climatic records have "deceived" researchers and that the period of 1905-1930 was a "persistently wet period" throughout much of the American West. As a result of this 'deception' water appropriations have exceeded naturally occurring water supplies which in turn resulted in costly legal actions to resolve disputes.[15]

Climatological data for selected stations along the Gila River were acquired from the Office of Climatology at Arizona State University, Tempe. Mean monthly maximum temperature, mean monthly minimum temperature, and total precipitation data for United States Weather Bureau stations at Buckeye, Clifton, Florence, Gila Bend, Sacaton, and Yuma Citrus Station were collected and reviewed. The data for these stations was averaged and presented in Appendix H. Annual mean maximum temperatures, annual mean minimum temperatures and annual total precipitation values were averaged for those years with complete records. Monthly mean maximum temperature, monthly mean minimum temperature, and monthly total precipitation values were averaged for all available data.

Annual mean maximum temperatures and annual mean minimum temperatures were computed as weighted values, e.g., the mean value for January was multiplied by 31 days, the February mean value was multiplied by 28 days (29 for leap year), etc. The products for all months were summed, divided by 365 days (366 for leap year) and displayed as the 'Annual Average.' The 'Mean Annual average' was similarly computed, using the mean monthly values. Annual total precipitation is a simple sum of the monthly precipitation for years with complete records, while mean annual total precipitation is the sum of mean monthly precipitation.

In those instances where either temperature or precipitation data are incomplete or not recorded, no value is displayed and mean values are unaffected. Where either no rainfall was recorded, or no more than a 'Trace' amount was recorded, "0.00" is displayed in the table.

Annual average mean maximum temperatures, annual average mean minimum temperatures, and annual total precipitation are displayed graphically in relation to the respective mean annual values. Discontinuities in the graphs reflect gaps in the data sets.

Data sets for Weather Bureau stations at Safford Experimental Farm, Winkelman 6S, and Yuma Valley were collected, but these data are relatively recent (no earlier than 1930) and were not analyzed. Mean temperature data were also collected, but were not analyzed. Temperature and precipitation data are displayed in Appendix H.

A comparison of the mean and extreme values suggests that fluctuations of extrema have been minor. Mathematical analyses suggests that variations have, indeed been negligible. It is therefore recommended that the USWRC assumption of climatic time invariance be accepted for this study.

[1] "Storage of Water on Gila River, Arizona," U.S.G.S. Water Supply Paper Number 33, pp. 10-12

[2] Compilation of Records of Surface Waters of the United States through September 1950, Part 9. Colorado River Basin, USGS Water Supply Paper Number 1313

[3] Twelfth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1890-91, Part II - Irrigation, pp. 302-314

[4] U.S.G.S. Water Supply Paper Number 38, p. 313

[5] ibid., pp. 316-7

[6] Twenty-First Annual Report of the U.S.G.S. to the Secretary of the Interior, 1899-1900, p. 338-9

[7] U.S.G.S. Water Supply Paper Number 269, p. 217

[8] U.S.G.S. Water Resources Data for Arizona, Water Year 1971, AZ-71-1, p. 94

[9] WSP 269, pp. 217-8

[10] U.S.G.S. Water Supply Paper Number 211, p. 121

[11] WSP 269, p. 218

[12] WSP 929, pp. 263, 286, 294, 297, 300, 306

[13] Tenth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1888-89, Part II - Irrigation, pg. 87.

[14] "Guidelines for Determining Flood Flow Frequency," United States Water Resources Council, Bulletin #17A of the Hydrology Committee, p. 6, revised June 1977.

[15] "Our Changing Climate -- Its Impact on the Availability of Water," by Daniel M. Johnson, Department of Geography, Portland State University, Climatological Publications, Scientific Papers No. 4, 1978.

Summary of estimated peak flows, various return periods, log–Pierson III method 09/03/96

Gila River Navigability Study

Location	2–year event	5–year event	10–year event	25–year event	50–year event	100–year event	num. of records	period of record
Buttes	9195	27651	57509	142399	274715	521562	6	total record
Calva	6466	18650	34744	71376	117079	186670	63	total record
Clifton	6171	12546	17486	24237	29514	34876	69	total record
Coolidge Dam	763	1571	2111	2965	21699	173769	63	post–Coolidge Dam
Coolidge Dam	1216	4476	10742	31933	70547	153039	82	total record
Coolidge Dam	9303	27442	52668	113088	192505	318911	24	pre–statehood
Dome	2348	14987	37858	98809	180580	306862	89	total record
Dome	17619	56260	101357	187552	277011	391115	18	post–Roosevelt Dam, pre–Coolidge Dam
Dome	27398	82818	133443	206692	263605	322883	9	pre–Roosevelt
Dome	894	3330	6013	10541	14619	19173	64	post–Coolidge Dam
Gillespie Dam	3532	21952	58520	169490	339895	640936	72	total record
Gillespie Dam	29470	72848	126439	242568	382718	590743	10	pre–Coolidge Dam
Gillespie Dam	26152	49632	70490	125350	133958	169411	9	post–Roosevelt Dam, pre–Coolidge Dam
Gillespie Dam	2342	14182	38853	119756	255347	513707	63	post–Coolidge Dam
Kelvin	8738	22383	39520	77056	122741	190993	83	total record
Kelvin	21494	56368	96005	173318	257043	396332	21	pre–Coolidge Dam
Kelvin	6830	14636	23086	39284	56791	80518	62	post–Coolidge Dam
Laveen	911	4678	10214	22268	35785	53704	53	total record
Laveen	834	3527	6693	12241	17349	23119	50	post–Coolidge Dam
Painted Rock Dam	377	1812	3930	8670	14202	21833	32	total record
Solomon	9471	23142	38115	66538	96760	136695	78	total record
Winkelman	3514	8825	15498	30178	48154	75167	47	total record

flowsums.wk3

CHAPTER VII

HISTORICAL GEOMORPHOLOGY OF THE GILA RIVER

Introduction

Integral to ascertaining the navigability of the Gila River at time of statehood is an understanding of the river's geomorphology. The Gila River has been the topic of several geomorphic studies that have focused on changes in channel position and form through time (e.g., Burkham, 1972; Graf, 1981; Huckleberry, 1993b; Stevens and others, 1975). Although detailed historical descriptions of the Gila River only extend approximately 120 years, within that short interval of time the river has changed between narrow, meandering and wide, braided conditions (see Leopold and Wolman, 1957 for common channel patterns). Channel changes on the Gila River are driven primarily by changes in the frequency of large floods (Burkham, 1972, Huckleberry, 1993b), however, one cannot ignore the effects of human disturbances (Bahre, 1991). Irrigation diversions, dams, exotic vegetation, and channelization have also undoubtedly affected the hydraulics and hydrology of the channel.

Historical channel changes on the Gila River are not the same along all reaches of the river. Alluvial reaches, i.e., segments not confined by bedrock, are prone to greater changes in channel position and form. Furthermore, because of physiographic variability and a climatic gradient across the Gila River watershed, different reaches have unique hydrologic characteristics (Hirschboek, 1985), and thus as one might expect, channel transformations along separate reaches are not synchronous or uniform. In addition, dams and irrigation diversions have altered different reaches of the Gila River.

In this study, the historical channel changes were reviewed for three primary alluvial reaches of the Gila River (Figure A). The upper Gila River includes two reaches: a larger reach located in the Safford Valley and a smaller reach located between Winkelman and Kelvin. The middle Gila River is an alluvial reach extending from Florence to its confluence with the Salt River. The lower Gila River is a largely alluvial reach extending from the mouth of the Salt River to Yuma (excluding Painted Rock Reservoir). These divisions of the Gila River are partly arbitrary and partly based on hydrologic and physiographic boundaries. The upper Gila River is located within the mountainous Central Highland zone and receives considerable baseflow from snowmelt. In contrast, the middle Gila River is located within the Basin and Range physiographic province and is supplied by lower elevation watersheds such as the San Pedro and Santa Cruz river catchment areas. The lower Gila River is also in the Basin and Range province, but its flow is supplemented by the Salt River which supplies a greater volume of water than the middle and upper Gila River watersheds.

Historical channel positions were plotted for the study reaches onto U.S. Geological Survey 7.5' quadrangles. Archival sources include 1) General Land Office cadastral survey notes and plat maps, 2) historical maps produced by the U.S. Geological Survey, Bureau of Reclamation, and Indian Irrigation Service, 3) historical aerial photography, and 4) U.S. Geological Survey 7.5' orthophotoquads. All photographs and maps were adjusted to 1:24,000 scale and plotted on the quadrangles with a zoom transfer scope. Previous channel reconstructions by Burkham (1972) and Huckleberry (1993b) were utilized to describe historical channel changes. It is clear from this investigation that all three study reaches were experiencing changes in channel form in 1912, and that these changes were driven by a shift from a period of drought to one of the wettest decades in 500 years (Meko and Graybill, 1993).

Evolution of the Gila River

The Gila River is the primary drainage for southern Arizona with a drainage area of approximately 150,000 km^2 (60,000 mi^2) that extends into western New Mexico and northern Sonora. As a major water source in the Sonoran Desert, it has been the locus of cultural activity for at least 2,000 years, but the origin of this river extends back several million years. The ancestral Gila River originated after the landscape of southern and central Arizona had been radically altered into a series of linear mountain ranges and basins approximately 8 to 15 million years ago (Damon and others, 1984). Initially drainage was closed within individual basins, however, the basins eventually filled, and regional drainage became integrated sometime between 3 and 6 million years ago (Menges and Pearthree, 1989; Morrison, 1985; Shafiquallah and others, 1980). As drainage became integrated, the Gila River and its tributaries began to incise into basin deposits forming several strath terraces in the Central Highland zone. In the more tectonically stable Basin and Range province, the Gila River primarily deposited sediment. Here there are few terraces except along the margins of the Phoenix Basin (Huckleberry, 1993a; Péwé, 1978). Radiometric dates from basalt flows intercalated with Gila River gravels indicate that the oldest Gila River landforms in the Basin and Range province are at least 3.0 million years old (Shafiquallah and others, 1980).

The modern geologic flood plain of the Gila River is incised into early Pleistocene surfaces and contains channel and overbank alluvial deposits. The channel deposits consist primarily of sands, gravels, and cobbles and are latest Pleistocene and Holocene in age based primarily on faunal evidence (Huckleberry, 1993b). The overbank deposits consist primarily of sand, silt, and clay and are generally within 3 m (9 ft) of the surface and date to the middle and late Holocene. Although a firm Holocene chronology of climatic variability has yet to be defined, it is clear that secular changes in climate characterized by changes in the intensity and seasonality of precipitation resulted in different periods of flood frequency and magnitude (Ely, 1992; Meko and Graybill, 1993; Nials and others, 1989). This undoubtedly resulted in alternating periods of channel stability and instability, and specifically, changes in channel form (e.g., braided vs. meandering) during the Holocene. Periods of increased large flood frequency are more likely to be associated with wide, braided channel conditions on the Gila River (Burkham, 1972; Huckleberry, 1993b).

Upper Gila River

The upper Gila River study reach is located in the mountainous region of east-central Arizona and divided into two study reaches: a larger reach in the Safford Valley, a northwest trending basin bounded by the Pinaleños and Gila Mountains, and a smaller reach located in a smaller, unnamed valley located between the Dripping Springs and Tortilla Mountains. This latter reach is herein referred to as the Kearny reach. The segment between the Safford Valley and Kearny reaches is covered by San Carlos Reservoir or confined by bedrock and is not part of this study. The study reaches are characterized by a flood plain of variable width inset into basin fill. The upper Gila River flood plain is widest in the upper part of the Safford Valley where it is approximately 5 km (3 mi) wide; in the lower part of the Safford Valley and in the Kearny reach, the flood plain is approximately 3 km (2 mi) wide. In general, upper Gila River flood-plain alluvium is 7-10 m thick (Culler and others, 1970).

The upper Gila River watershed extends into the Mogollon Highlands of eastern Arizona and western New Mexico; drainage basin area at the mouth of the Safford Valley is approximately 29,800 km^2 (11,500 mi^2). There are no major dams upstream from the Safford Valley, but streamflow on the Kearny reach is partially controlled by Coolidge Dam which was completed in 1928. Mean annual precipitation within the watershed ranges 20-100 cm (8-40 in) and averages approximately 36 cm (14 in). There are two periods of peak flow that are directly linked to two rainy seasons (Sellers and Hill, 1974). Summer peak flow occurs between July and October and is predominantly linked to monsoonal, convective storms. Winter peak flow occurs November through June and is supplied largely by frontal storms, snowmelt, and groundwater storage (Burkham, 1970). Segments of the upper Gila River are frequently dry in June and July (Turner, 1974).

Gaged streamflow records on the upper Gila River extend only to 1911 and provide a limited timeframe for analyzing long-term streamflow patterns. However, a recent dendrohydrological study by Meko and Graybill (1993) reconstructs mean annual streamflow for the upper Gila River for the period A.D. 1663-1985 based on statistical relationships between tree-ring width and gaged annual streamflow. The reconstructions are characterized by a series of irregularly spaced, multidecadal peaks and troughs of high and low annual streamflow. Interestingly, the 20th century contains the wettest decade (1906-1915) and the driest decade (1947-1956) within the 322 year reconstruction. Decadal scale changes in climate appear to be stochastic and related to shifts in large-scale ocean-atmospheric circulation patterns. Much of the temporal variability in annual streamflow on the upper Gila River may be linked to El Niño - Southern Oscillation climatic phenomena (Betancourt and Webb, 1992; D'Arrigo and Jacoby, 1991).

Of geomorphic significance is that as the volume of streamflow changes in response to secular climatic variability so does river channel geometry as it adjusts to accommodate changing flow regimes. Alluvial rivers adjust their hydraulic parameters (e.g., width, depth, sinuosity, hydraulic roughness, and slope) in response to changing discharge and sediment load (Leopold and Maddock, 1955). Although dryland rivers do not adjust to gradual changes in flow regime as rapidly as rivers in wetter climates (Wolman and Gerson, 1978), dryland streams do respond to low frequency, high magnitude flow events that may accompany secular climatic change (Baker, 1977, Graf, 1988). If changes in annual stream flow correspond with changes in large flood frequency, then one can expect the upper Gila River to have a channel geometry subject to dramatic changes through time at decadal time scales.

A classic study of historical channel changes on the upper Gila River was performed by Burkham (1972) as part of the U.S. Geological Survey's Phreatophyte Study near San Carlos Reservoir (Culler and others, 1970). Burkham utilized historical descriptions, survey notes, maps, and photographs to reconstruct channel width and sinuosity for a segment of the upper Gila River from 1846-1970 (Table A). To summarize, Burkham divides the chronology into three periods. From 1846 to 1904, the upper Gila River contained a relatively deep, narrow, and sinuous channel; from 1905-1917, the channel increased its width over 600 percent and became straighter, whereas from 1918-1970 the channel narrowed and increased its sinuosity (Figure B). These channel changes are clearly correlated to changing flood frequency. Large floods and above average streamflow between 1905 and 1917 resulted in the destruction of large cottonwood groves and the formation of a wide, braided channel (Olmstead, 1919). The largest floods occurred in 1891, 1905, 1906, and 1916. Of all of the hydraulic parameters sensitive to changing hydrologic conditions, channel width seems to have been most responsive to changing flow regimes (Figure B). The period 1918-1970 was a relatively dry period [culminating in the decade of 1947-1956 (Meko and Graybill, 1993)] and one with few large floods. During this period, vegetation returned to the flood plain and facilitated sedimentation (Turner, 1974). It took 50 years for the flood plain to return to conditions resembling those before 1905, although introduced exotics like tamarisk (*Tamarix* sp) precluded the return to identical pre-1905 conditions (Graf, 1988b).

No systematic study of historical channel changes exists for the Kearny reach. Cursory inspection of the General Land Office plats (Table C) indicates that the river contained a single, slightly sinuous channel in the 1870's. Photographs of the channel near Riverside reveal a relatively wide sandy channel (Lippincott, 1900: Plate 17). That there was little vegetation in the channel during this period is also suggested by the Florence (1:125,000) quadrangle surveyed in 1900 which shows a road following the course of the river downstream from Kelvin. The Ray (1:62,500) quadrangle was surveyed in 1907-08 after the 1905 floods, and it shows a wide sandy flood plain with several branching channels similar to that described for the Safford Valley reach after 1905. A large flood in September, 1926 on the San Pedro River (see Hereford and Betancourt, 1993) may have helped to maintain wide-braided conditions on this reach until 1930. However, the subsequent period of low flood frequency plus the effect of Coolidge Dam halting large floods from the upper watershed have contributed to a heavily vegetated flood plain with a single, narrow, low flow channel.

Burkham's (1972) detailed study provides a good indication of channel conditions on the upper Gila River at time of statehood, 1912. The transformation from a single-meandering channel to a wide-braided channel began in earnest in 1905 and was largely completed by 1916 (Table A). Channel characteristics presented by Burkham for the year 1914 are a good representation of channel characteristics in 1912. Moreover, the channel boundaries presented by Olmstead (1919) and reproduced by Burkham (1972: Plate 1) for the upper Gila River in 1914-15 can be considered a close approximation of 1912 channel boundaries. The 1914-15 channel boundaries may be a little wider than those of 1912, however, since there were large floods in December, 1914 and January, 1915 that resulted in bank cutting (Olmstead, 1919). It is hypothesized that wide-braided channel conditions also characterized the Kearny reach in 1912 based on historical records of widespread erosion along the upper Gila River and San Pedro River (Burkham, 1972; Hereford and Betancourt, 1993, Olmstead, 1919; Turner, 1974).

Middle Gila River

As the Gila River splits the gap between North and South Butte east of Florence, it enters the southern margins of the Phoenix Basin (Péwé, 1978) where it begins to flow over deep alluvium and lose much of its flow to infiltration. The middle Gila River study reach extends from the Ashurst-Hayden Diversion Dam to the Salt River (Figure A); most of this reach is located within the Gila River Indian Community. Due to upstream diversions for irrigation agriculture, the middle Gila River flows only during infrequent floods. An exception occurs in the lower part of this reach near the Sierra Estrella Mountains where effluent from irrigation supports a sluggish, narrow stream (Rea, 1983). Of the 150,000 km^2 (60,0000 mi^2) comprising the Gila River drainage basin, 47,400 km^2 (18,960 mi^2) lies above the Ashurst-Hayden Diversion Dam with 33,390 km^2 (13,360 mi^2) located above Coolidge Dam and most of the remaining 14,010 km^2 (5,600 mi^2) located within the San Pedro River system. There are no pristine records of annual streamflow for the middle Gila River; by the time gaging stations were established, water was already being diverted for irrigation.

Middle Gila River climate is arid and warm. July maximum temperatures at Sacaton average 41° C; January minimum temperatures at Sacaton average 1° C (Sellers and Hill, 1974). There is a slight moisture gradient from west to east; mean annual rainfall ranges from 19 cm at Maricopa to 21 cm at Sacaton and 24 cm at Florence.

Historical descriptions of the Gila River extend back to 1697 when Padre Kino and Captain Juan Manje described a channel with large cottonwoods supporting irrigation agriculture at the Pima Villages (Figure C). Subsequent European visitors passing through the area also described a stable, narrow and relatively deep channel with dense riparian galleries (Huckleberry, 1993b; Rea, 1983). Before Anglo settlement in the 1860's, the middle Gila River would periodically run dry near the Pima Villages during May and June (Rea, 1983). The early cadastral surveys (Table C) also characterize the middle Gila as having a single, narrow channel up until 1891. In 1891, the middle Gila River experienced a large flood that resulted in some channel widening. Beginning in the 1890's, streamflow on the middle Gila River was greatly reduced due to Anglo irrigation diversion, but the river was still susceptible to large flood flows. Beginning in 1905, a series of large floods struck the middle Gila River coinciding with a radical transformation in channel planform and geometry (Figure D). Similar to the upper Gila River (Burkham, 1972), the middle Gila River contained a wide, braided channel between 1905 and

1920 correlating to a period of high large flood frequency with the largest floods occuring in 1905, 1914, and 1916 (Figure C).

After construction of Coolidge Dam in 1928, the middle Gila River became somewhat hydrologically disconnected from the upper Gila River. The middle Gila River above Pima Butte seldom contained streamflow except during rare floods, and most of the floods that did pass through this reach were generated in the San Pedro River watershed (an exception is the flood of January, 1993). Below Pima Butte, effluent from irrigation and naturally shallow water tables have helped to maintain a small stream. Throughout the middle Gila River a low flow channel formed within the former wide braided channel during the 1930's, 40's and 50's forming a compound channel planform (Graf, 1988a). Only recently has the channel changed its geometry when the sustained flow of the floods of January, 1993 converted the compound channel above Pima Butte into a single, wide, braided channel.

It is clear that the upper and middle Gila Rivers share similar histories (Figure B), but there are some differences. The middle Gila River experienced two catastrophic floods in 1833 and 1868, and anecdotal evidence (see Huckleberry, 1993b) suggests that the magnitude of the 1833 and 1868 floods on the middle Gila River was greater than that of the 1905 flood, the flood responsible for dramatic channel changes on the upper and middle Gila River. Burkham (1972) mentioned no floods on the Upper Gila River during these years, and he assumed that none occurred given stable channel conditions throughout most of the 19th century. That the middle Gila River remained stable despite these large floods is contrary to disequilibrium models of arid stream behavior (Graf, 1981; Stevens and others, 1975). Applying the concept of critical discharge for sediment entrainment, catastrophic floods should result in dramatic channel changes (Graf, 1983). However, as recent floods attest, it is not the peak discharge that is as critical in channel transformations as the duration of those floods. Although the October, 1983 flood had a peak discharge of 2,800 m^3/s (100,000 ft^3/s; measured at Kelvin gage), it did not produce any long lasting changes to channel planform. In contrast, the January, 1993 flood with a peak discharge of 2,080 m^3/s (74,290 ft^3/s) resulted in the most dramatic changes in channel planform since 1905. If flood duration is a more important variable than peak discharge in channel changes, then there is a stronger basis for reconstructing prehistoric channel behavior for the Gila River based on dendrohydrological data than for other streams like the Salt River (Nials and others, 1989).

In 1912, the middle Gila River above Pima Butte contained a wide, shallow, braided, sandy channel. This is supported by several maps drafted during the period 1900-1914 by the U.S. Reclamation Service, Geological Survey, and Indian Irrigation Service (Table C), and terrestial photographs of the river (e.g., Haury, 1976: Figure 8.47). Downstream from Pima Butte, there is less domumentation pertaining to channel geometry, although resurveys of townships T. 1 S., R. 1 E., T. 1 S., R. 2 E., T. 2 S., R. 2 E., T. 2 S., R. 3 E., and T. 3 S., R. 3 E. performed 1910-12 reveal a much wider channel than that surveyed in the 1860's and 1870's.

Lower Gila River

From the confluence of the Salt River near Phoenix, the lower Gila River flows southwestward towards the Colorado River near Yuma (Figure A). Like the middle Gila River, this stretch of the Gila flows mostly over deep alluvium within the Basin and Range physiographic province. In a few places the river is confined by bedrock (e.g., near Arlington and below Painted Rock Dam), but elsewhere the river contains a wide, unconfined flood plain (generally > 3 km (2 mi)). All tributaries along this reach are ephemeral and seldom flow. The climate is arid and hot. Daily maximum temperatures average 31° C (88° F) at both Yuma and Buckeye whereas mean annual precipitation at Yuma and Buckeye is 7 cm (2.8 in) and 18 cm (7.1 in), respectively (Sellers and Hill, 1974).

Before Anglo settlement in the Phoenix Basin, streamflow on the Salt River was greater than that on the middle Gila River. Reinvigorated by the Salt River watershed (38,850 km^2 (6,600 mi^2) in area), most of the lower Gila River was perennial reaching all the way to the Colorado River (Ross, 1923). Spanish explorers during the 1700's described the native peoples living along the lower Gila River as fishermen, and large galleries of cottonwood trees lined the banks as recently as the late 1800's. Also, there were a few successful journeys by boat down the lower Gila River during the 1800's (Ross, 1923; McCroskey, 1988). However, expansion of irrigation systems within the upper watershed during the late 19th century and subsequent construction of large dams during the early 20th century greatly reduced the amount of streamflow reaching the lower Gila River. As a result, there are no pristine records of gaged streamflow for the lower Gila River. Eventually the upstream diversions combined with local groundwater pumping for agriculture converted the lower Gila River into an intermittent stream by 1920 (Brown and others, 1981; Bryan, 1923; Ross, 1923). Except for a segment near Buckeye fed by irrigation and waste water effluent from Phoenix, the lower Gila River flows only after rare, heavy rains.

Unlike the upper and middle Gila River segments, there have been no systematic measures of historic channel width, although Graf (1981) measured changes in low flow channel sinuosity for the reach upstream from Gila Bend. Historical descriptions of the lower Gila River vary somewhat which may reflect not only changes in channel configuration through time but also spatial variability in channel geometry at any one time due to local hydrological conditions. In general, the lower Gila River channel appears to have been braided in historical times. Lieutenant William Emory of the Kearny Expedition in 1846 described the lower Gila River as "about 100 yards wide, and flowing gently along a sandy bottom...". However, a rancher described the river near Powers Butte (between Buckeye and Gillespie Dam) in 1889 as having a well-defined channel with hard, sloping banks lined with cottonwood and bushes. The water was clear, was 5 or 6 feet deep, and contained many fish." (in Ross, 1923:66). The former description implies a braided, sandy stream, whereas the latter suggests a relatively, narrow, deep channel, however, the latter description may be of the main flow channel within an overall braided channel. Discrepancies in descriptions may also be enhanced by observers describing the same reach during different times of the year under different streamflow conditions.

Given that the lower Gila River flood plain is comprised mostly of sand and silt (Ross, 1923), the bank material can be easily mobilized by floods of significant magnitude and duration. This results in spatially dynamic low flow channels that shift after large floods (Graf, 1981). Early cadastral surveys plats and U.S. Geological Survey maps reveal considerable shifts in channel position near Yuma and Agua Caliente during the late 1800's and early 1900's. In a detailed study of the lower Gila River between the Salt River and Gila Bend, Graf (1981, 1988b,c) documented shifts in the low flow channel and demonstrated the effects of not only floods but also vegetation in processes of sedimentation and channel avulsion. Reaches that showed the greatest spatial instability included those behind Gillespie Dam (an area of heavy sedimentation) and other areas of dense tamarisk growth.

Given the similar chronologies of channel changes on the upper and middle Gila Rivers (Burkham, 1972; Huckleberry, 1993b), one has to ask whether or not the lower Gila River experienced similar changes. Graf's (1981, 1988b,c) study of the lower Gila River suggests that this reach did not experience dramatic changes in channel configuration near the turn of the century: "Between 1868 and 1929 the channel was braided, and the 1905 flood had no particular geomorphic significance." (Graf, 1988b:233). This stands in contrast to statements made by Ross (1923:64) who noted that the Gila River has "changed materially since it was first seen by white men". Of course, Ross was referring to the entire lower Gila River rather than the reach studied by Graf, but nonetheless there are distinct geomorphological differences in channel descriptions for the entire lower Gila River before and after 1890.

Before 1890, the lower Gila River had a distinct main flow channel within a larger braided, flood-flow channel. Every winter and spring, flow would exceed channel capacity of the main flow channel and extend into the adjacent flood channels. Dramatic changes appear to have occurred during two large floods in 1890 and 1891. A flood in February, 1890 damaged settlements and eroded terraces along the lower Gila River. Erosion was probably enhanced by a large surge in flow that entered the lower Gila River through the Hassayampa River due to the Walnut Grove Dam failure (Dobyns, 1981). The following year, another large flood passed down the lower Gila River. This flood generated the largest estimated peak discharge on the Salt River (8,400 m3/s (300,000 ft3/s)). Ross (1923:67) noted that "The disastrous floods of 1890 and 1891 did much to break down the river's confining banks, partly filled the channel with sediment, and in general interfered with the equilibrium that had been established." Although Dobyns (1981) believes that erosion on the lower Gila River began as early as 1867, it appears that major changes did not occur until after 1890 and that the floods of 1890 and 1891 were the driving force behind the change in channel configuration. During the next 25 years, a braided, sandy flood plain was probably maintained by the flux of sediment and water generated from the upper and middle Gila Rivers during the abnormally wet decade of 1905 to 1915.

The best descriptions of the lower Gila River channel near the time of statehood are offered by Ross (1923) who systematically described several segments from Buckeye to Yuma. By 1920, the segment in Buckeye Valley wandered "over a sandy flood plain between cut banks 5 to 15 feet high. The flood plain varies in width but is a mile or more in most places. The water meanders in shifting channels and does not cover more than a small part of its flood plain exept during unusually great floods." (Ross, 1923:68). (Contrast this with the rancher's 1889 description presented above.) Ross characterized the segment in the Arlington Valley as similar to that in the Buckeye Valley. Between Gillespie Dam and Gila Bend, the channel had higher banks but still maintained its wide form. At Gila Bend, a cross-section reveals a wide channel composed of silt and sand. Ross did not describe the reach from Gila Bend to Painted Rock Mountains, however where the river cuts through the Sentinel volcanic field, he described the channel as 10 to 30+ m (30 to 100+ ft) wide between low banks. Between Agua Caliente and Palomas, the channel contained banks over 10 m (30 ft) high and had shifted its position almost a mile. From Palomas to Yuma, Ross (1923:75) described the lower Gila River flood plain as "a desolate expanse of silt and sand dotted with thickets of mesquite..." and the channel as having banks 1 to 3 m (3 to 10 ft) high. These descriptions are probably applicable to channel conditions in 1912 except that at the time of statehood there was probably more water within the braided channel.

Plotting Channel Boundaries

Mapping historical channel positions is a challenging endeavor given the often arbitrary nature of channel boundaries. Whereas channel boundaries are easily defined in bedrock reaches of rivers or in entrenched or channelized alluvial rivers, they are less absolute in braided reaches where channel position frequently varies in space and time. Also, rivers in humid regions usually have easily discernable boundaries where a single channel conveys most of the flow throughout the year. However, dryland rivers are different in that the annual peak flow is considerably larger than the mean annual flow (Graf, 1988a), and thus there are commonly low and high flow channels. This latter situation certainly applies to the Gila River, especially the middle and lower reaches. Borrowing from Burkham (1972) and Minckley and Clark (1984), in this study "channel" is defined as that part of the fluvial system that conveys channelized flow and is scoured of perennial vegetation by flooding.

The earliest scaled maps that show the location of channel boundaries in Arizona are the General Land Office (now the Bureau of Land Management) plat maps. These maps were constructed when the townships were originally surveyed. The first townships along the Gila River were mapped in 1868; most others were mapped by 1900. Many of these townships were resurveyed after 1912. Because the position of the channel is only measured where it crosses township and section boundaries; the channel is sketched between section lines, and thus their mapped position is of questionable accuracy. For example, in several places the channel is plotted outside the flood plain. Subsequent maps by the U.S. Geological Survey are more accurate although lacking the detail of the larger scale General Land Office plats. Aerial photographic coverage of the river begins in the middle and late 1930's; the negatives for these photographs are housed at the National Archives in Washington D.C. In this study, 1930's aerial photography for only the upper and middle reaches of the Gila River was accessed (Tables A and C). The most recent channel boundaries presented in this study are based on orthophotoquads from 1971-72. Comments regarding the plotting of channel positions from each reach are presented below.

Upper Gila River

All of the townships crossed by the study reaches of the upper Gila River were surveyed in the 1870's (Table A) except those located within the San Carlos Apache Indian Reservation. The accuracy of the channel position on the plats is greatest in townships T. 6 S., R. 24 E., T. 6 S., R. 25 E., and T. 7 S., R. 26 E. where sections are subdivided into 1/8 units; elsewhere, channel position is estimated between section lines. During this period, the upper Gila River contained a single flow channel with more definite boundaries.

The upper Gila River was subsequently mapped by Olmstead (1919) and resurveyed by the General Land Office. After 1905, the upper Gila River consisted of a wide braided channel with several smaller branching channels. Channel boundaries mapped during this period include the entire scoured channel formed after the large floods of 1905, 1914-15, and 1916. The earliest systematic aerial photography was flown in 1934 and 1935 by the Soil Conservation Service. By 1934, mesquite and tamarisk had colonized the flood plain (Turner, 1974), and a main flow channel had become discontinuously reestablished. The latter defines the channel boundaries plotted in this study.

By 1972, agricultural fields had encroached onto the margins of the former 1914-15 flood channel mapped by Olmstead (1919). Furthermore, several reaches are confined by artificial levees resulted in rectilinear channel boundaries. Several of the photographs were taken after the flood of October, 1972 and show several freshly scoured areas. However, by and large the channel is relatively narrow and comparable to that described by Burkham (1972).

Middle Gila River

All of the original township surveys and associated plats (1868, 1869, and 1876) that cover the middle Gila River include section boundaries except townships T. 3 S., R. 4 E., T. 3 E., R. 5 E., T. 4 S., R. 5 E., T. 4 S., R. 6 E. (Table C). Thus there is good control of channel position along section lines, but inbetween section lines the accuracy is questionable. For example, the segments of the channel are plotted outside the flood plain in townships T. 1 S, R. 1 E., and T. 4 S., R. 10 E. Accurate mapping of the middle Gila River channel begins in 1904 with the U.S. Reclamation Service maps of the Gila River Indian Community (these were incorporated into the U.S. Geological Survey 15' quadrangles of the area). The 1904 maps generally show a single main flow channel with distinct banks although branching channels occur locally.

Channel boundaries on maps produced after 1905 cover a wider portion of the flood plain when the middle Gila River converted to a wide, braided channel. Maps produced in 1914 and 1928 demarcate the channel by steep banks that contained the large floods of 1905, 1914, and 1916. Hence these channel boundaries contrast from earlier boundaries in that they define the limits of flow during infrequent floods. Between these boundaries, a much smaller, low flow channel shifted laterally across the larger flood channel. Aerial photography flown in March, 1936 by the Soil Conservation Service reveals a more stable low flow channel established along most segments. Adjacent bars and islands within the flood plain became covered with phreatophytic vegetation like tamarisk and mesquite (*Prosopsis* sp) and are clearly outside the main channel. The photography shows that much of the middle Gila River is dry except for segments near Blackwater and below Pima Butte.

By 1972, a distinct compound channel configuration is established where a single, narrow low flow channel is inset into a larger flood plain with several overflow channels. Near Florence, the low flow channel was mechanically channelized. Also, many of the phreatophytes formerly present in the flood plain were absent due to groundwater withdrawal and subsequent lowered water tables (Rea, 1983). Because the low flow channel along most reaches is too small to support unregulated streamflow, it is not suitable for defining the middle Gila River channel. However, the overflow channels are difficult to distinguish on the orthophotoquads since they consist of several small distributary channels and lack vegetation along their banks. Consequently, banks on the larger flood channel are used to define the 1972 channel boundary resulting in a relatively wide channel. Locally, the 1936 and 1972 channel boundaries are identical.

Lower Gila River

Most of the first General Land Office plats that include the lower Gila River were surveyed between 1868 and 1890 except for T. 4 S., R. 8 W. (1910), T. 5 S., R. 10 W. (1914), T. 8 S., R. 19 W. (1912), and T. 8 S., R. 20 W. (1916) (Table E). Channel positions before 1890 are sketched between section lines in all of the townships except T. 8 S., R. 21 W. and T. 8 S., R. 22 W. where sections are subdivided into 1/8 units. All subsequent surveys subdivide the sections and provide better accuracy on channel position. The lower Gila River is plotted as a single channel on most of the early plats, although the channel is shown to branch along a few reaches. Plats produced after 1910 tend to show a wider flood channel with a single thread, low flow channel. Fifteen and 30 minute U.S. Geological Survey maps of the lower reach below Agua Caliente are based on surveys made in 1901-02 and 1926-27. These maps are more accurate for plotting channel position but provide little information as to channel configuration. By 1920, streamflow is largely intermittent and most of the alluvial reaches are dry (Ross, 1923).

By the time the lower Gila River is systematically photographed from the air, it is an intermittent stream and most reaches are dry (Ross, 1923). Photography for the orthophotoquads was flown in 1971 and 1972. The orthophotoquads show a distinct break in channel configuration above and below Gillespie Dam. Above the dam, the channel is characterized by a sinuous low flow channel lined with tamarisk within a larger braided flood channel (Graf, 1981, 1988b,c). Similar to the lower reach of the middle Gila River, the outer banks of the braided flood channel are used to define the channel boundaries. In many places, artificial levees encroach upon this boundary. Below Gillespie Dam, there is considerably less flood plain vegetation, and the low flow channel is also braided but contains a slightly sinuous course. This compound form extends to Wellton, but from Wellton to Yuma, the channel is largely channelized by a series of artificial levees.

Summary

The Gila River is a classic example of a dryland river that seldom seeks an equilibrium form (Graf, 1988a; Knighton, 1984; Stevens and others, 1975). Unlike rivers in humid regions that have more stable channels adjusted for more continuous streamflow with less variance in discharge, the dryland rivers are inherently more unstable and more prone to changes in channel configuration. In such unstable fluvial systems, channel configuration depends much upon the history of previous flood events. Periods of high flood frequency are likely to correlate to periods of increased channel instability. In 1912, Arizona was experiencing one of its wettest decades in several centuries (Meko and Graybill, 1993). This was also a period of increased large flood frequency (Ely, 1992), and not surprisingly, many streams within the Gila River watershed were experincing channel changes (Bahre, 1991). Beginning in 1905 on the upper and middle segments of the Gila River, the channel was experiencing tremendous channel widening due to bank cutting during periods of sustained flood flow (Burkham, 1972; Huckleberry, 1993b). In 1912, vegetation had not yet colonized the scoured flood channel, and most alluvial reaches were wide, sandy, and braided. Interestingly, the floods of January, 1993 have resulted in similar channel changes on at least the middle reach of the Gila River.

The chronology of channel dynamics on the lower Gila River are less certain, however it appears that dramatic channel transformations occurred in 1890 and 1891, approximately 15 years earlier than that for the upper and middle reaches. It appears again that two catastrophic floods were instrumental in the destruction of flood plain vegetation and causing dramatic bank erosion (Ross, 1923). Although construction of Roosevelt Dam on the Salt River limited the magnitude of flood flow reaching the lower Gila River after 1911, the lower Gila River was still experiencing excess sediment and water generated from the upper and middle Gila River reaches and possibly other tributaries during the time of statehood. Consequently, channel planform and geometry of the lower Gila River in 1912 can also be characterized as mostly shallow and braided.

Although system instability is believed to have been climatically driven on the Gila River, one cannot ignore anthropogenic mechanisms as well. At the turn of the century, the Gila River watershed was experiencing considerable vegetation change due to cattle grazing and removal of flood-plain vegetation for agricultural purposes (Bahre, 1991). Removal of grass from hillslopes accelerates runoff leading to larger peak discharges in main trunk streams, and removal of flood plain vegetation exposes banks to greater erosion. Because a rare climatic event corresponded in time to considerable landscape degradation near the turn of the century, it is not possible to separate the natural and anthropogenic causes of the channel changes on the Gila River. Obviously both processes play a role. However, a basic premise of this study is that the Gila River responds to secular climatic variability by radical changes in channel configuration, and that periods of increased, large flood frequency correlate with unstable, braided channel conditions.

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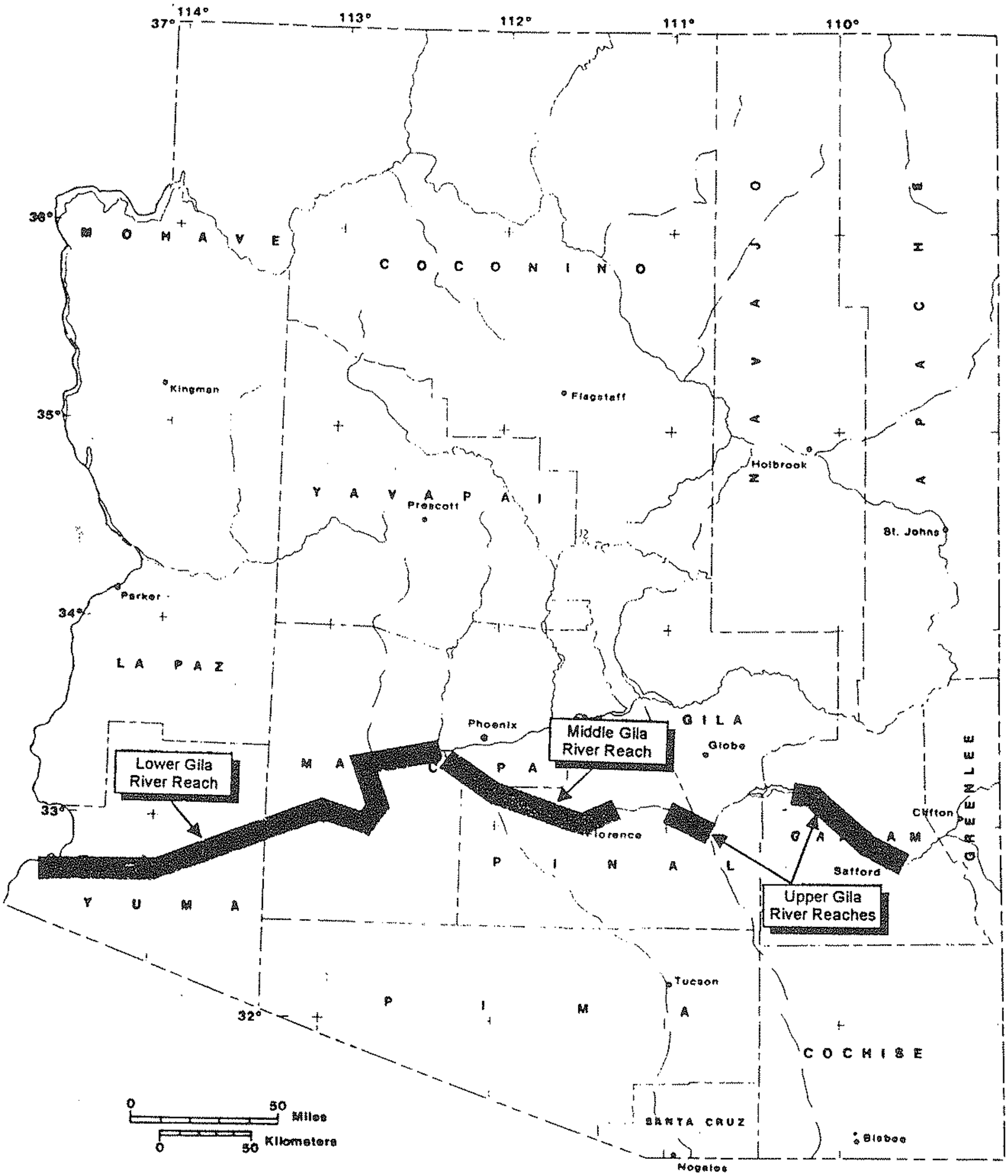
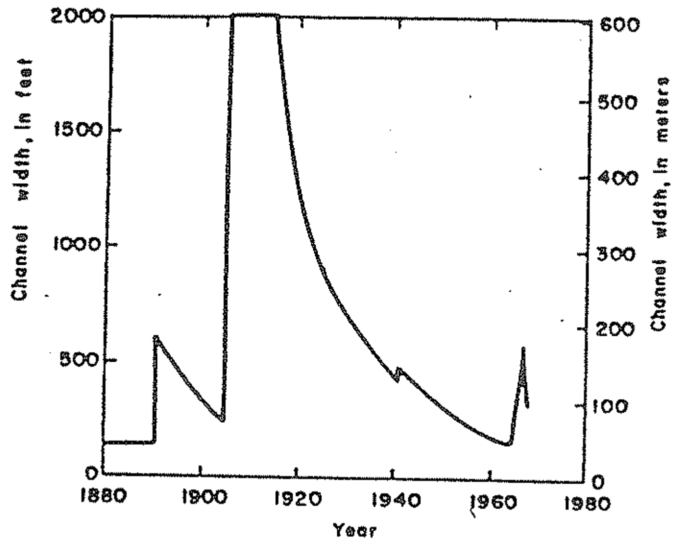


Figure A. Study reaches of the Gila River



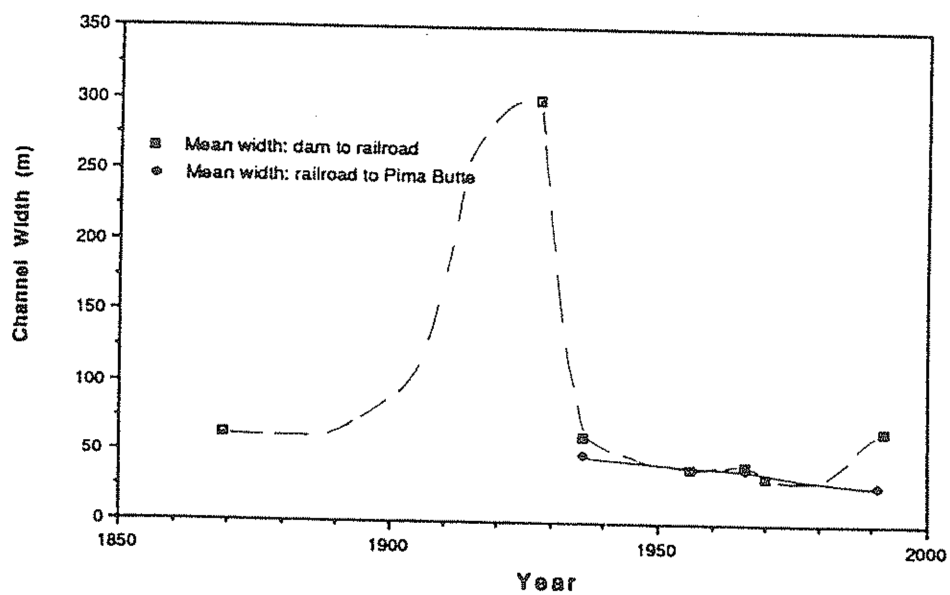


Figure 8. Changes in channel width for the upper (top) and middle (below) segments of the Gila River. Data for upper Gila River from Burkham (1972: Plate 3). Data for middle Gila River from Huckleberry, 1993: Figure 19).

AD1700

1697: Kino mentions large cottonwood groves along MGR

1763: Pfeffercorn notes that Piman fields are easily irrigated by canals implying MGR channel stability

1768-1775: Garces describes riparian vegetation along MGR

1797: Bringas comments that water can be easily diverted from MGR for irrigation and that channels and banks are covered with cottonwood and willow.

1800

1833: Winter flood recorded by Piman calendar stick; reported to have extended across Holocene flood plain

1846: Turner notes flood debris located 9-12 m above the river in canyons upstream from Florence

1868: September flood extends across Holocene flood plain and destroys 3 Pima villages.

1869: First cadastral surveys by G.L.O; MGR channel width ranges 43-82 m; dense undergrowth noted

1891: February flood estimated at 2800 cms at Florence; large trees uprooted

1900: Photographs of Gila River upstream from Florence show no mature cottonwood or willow

1900

1905: Largest recorded flood for MGR occurs in Nov.; peak discharge estimated at 5380 cms at Florence; MGR has a wide, braided channel; riparian communities destroyed

1914: December flood erodes farmland near Florence

1916: January flood estimated at 3740 cms at Kelvin

1928: Resurvey of cadastral lines; MGR channel width ranges 151-517 m; Coolidge Dam constructed

1928-present: MGR flows only during rare wet years; tamarisk invades flood plain; narrow main flow channel becomes re-established

1983: October flood estimated at 1730 cms at Florence

1993: January flood with peak discharge of 2080 cms at Kelvin

2000

Figure 6. Historical descriptions of the middle Gila River (Huckleberry, 1993: Figure 18)

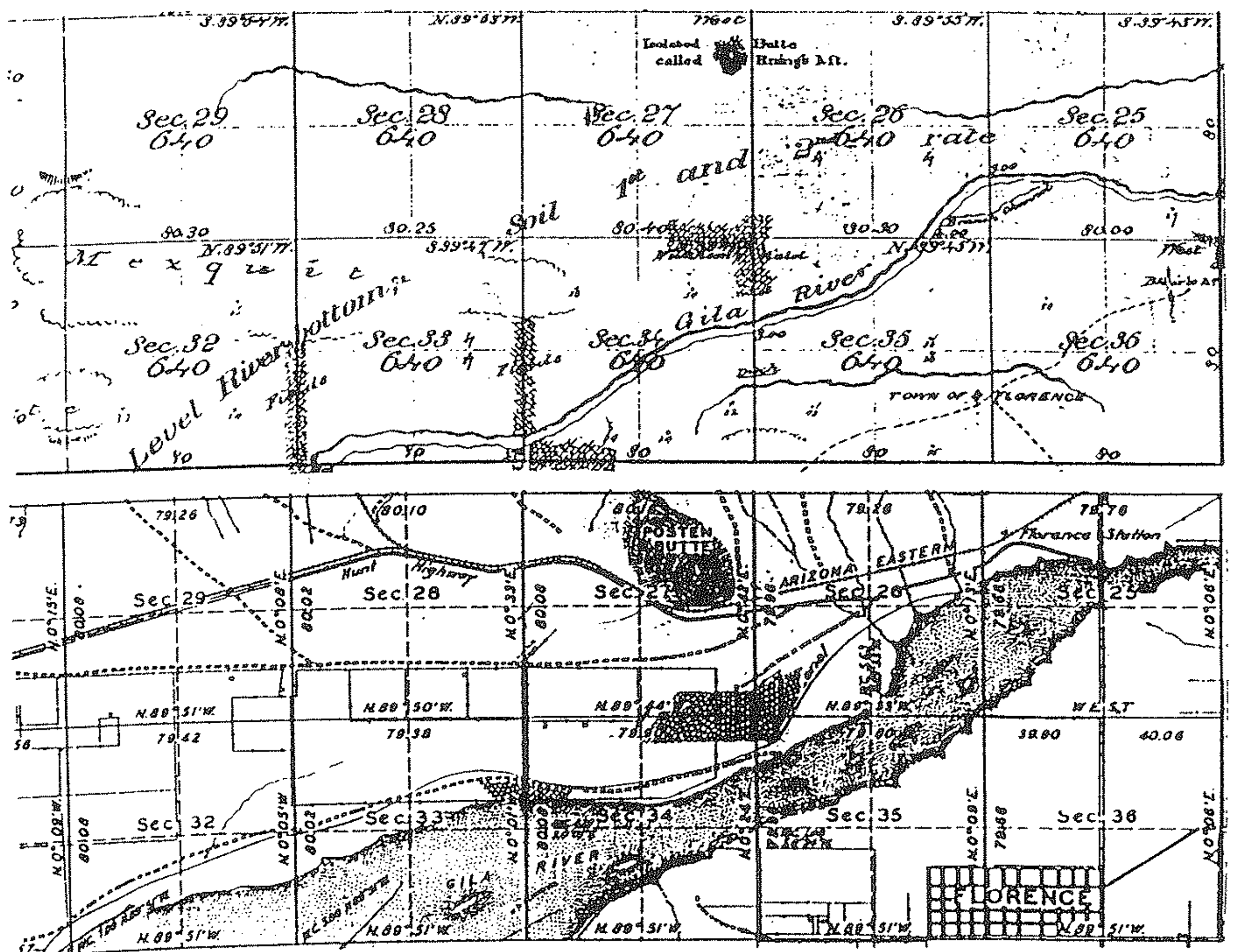


Figure D. General Land Office plats of township T. 4 S., R. 9 E. surveyed in 1869 (above) and 1928 (below). Note change in the width of the Gila River channel.

Table A. Maps and Aerial Photographs Utilized in Plotting Upper Gila River Channel.

USGS 7.5' Quadrangles (year of photography)	Orthophotoquads (year of photography)	Aerial Photography[1] (year)	Other Historical Maps[2] (year)	Cadastral Surveys (year and township)
Kearny (1962)	Kearny (1972)	1934		1879 (T4S, R14E)
Hayden (1962)	Hayden (1972)	1934		1877 (T5S, R14E) 1877 (T5S, R15E)
Winkelman (1947)	Winkelman (1972)	1934		1877 (T5S, R15E)
Dewey Flat (1959)	San Carlos Reservoir NE (1972)			
Calva (1957)	Bylas NW (1972)		1914-1915	
Bylas (1957)	Bylas NE (1972)	1935	1914-1915	
Geronimo (1957)	Bylas SE (1972)	1935, 1952	1914-1915	1875 (T4S, R23E)
Fort Thomas (1957)	Fort Thomas SW (1972)	1935, 1952	1914-1915	1875 (T4S, R23E) 1875 (T5S, R23E) 1875 (T5S, R24E)
Eden (1957)	Thatcher NW (1972)	1935, 1952	1914-1915	1875 (T5S, R24E) 1875, 1916 (T6S, R24E)
Pima (1957)	Thatcher NE (1972)	1935, 1952	1914-1915	1875, 1916 (T6S, R24E) 1875 (T6S, R25E)
Thatcher (1957)	Thatcher SE (1972)	1935, 1952	1914-1915	1875 (T6S, R25E)
Safford (1957)	Safford SW (1972)	1935, 1952	1914-1915	1875 (T6S, R25E) 1875 (T7S, R25E) 1875 (T7S, R26E)

[1] 1934 SCS photography on file at the Arizona Geological Survey; 1935 SCS photography on file at the Bureau of Land Managment, Safford; 1952 SCS photography in Gelderman, 1970)

[2] 1914-1915 channel position in Burkham, 1972:Plate 1, originally from Olmstead, 1919.

Table B. Upper Gila River Channel Characteristics (Adapted from Burkham, 1972: Table 1).

Year	Total Area ha (acres)	Length km (miles)	Average Width m (ft)	Sinuosity m/m
Subreach A: Near Solomon to Pima Bridge (See Burkham 1972: Plate 1)				
1875	116 (290)	24.54 (15.34)	48 (160)	1.20
1903	176 (441)	22.88 (14.30)	75 (250)	1.12
1914	1,192 (2,980)	20.38 (12.74)	579 (1,930)	1.00
1935	334 (836)	22.11 (13.82)	150 (500)	1.08
1957	224 (560)	23.07 (14.42)	96 (320)	1.13
1966	428 (1,070)	20.54 (12.84)	207 (690)	1.01
1967	464 (1,160)	20.64 (12.90)	222 (740)	1.01
1968	332 (830)	20.48 (12.80)	159 (530)	1.01
Subreach B: Pima Bridge to Near Geronimo (See Burkham 1972: Plate 1)				
1875	152 (380)	36.64 (22.90) [1]	41 (137)	---
1894	180 (450) [2]	11.90 (7.44) [2]	150 (500) [2]	1.12
1903	179 (448) [2]	22.2 (13.9) [2]	81 (270) [2]	1.16
1914	360 (900)	32.3 (20.2)	600 (2,000)	1.00
1935	580 (1,450)	36.1 (22.6)	159 (530)	1.12
1942	516 (1,290)	36.9 (23.1)	138 (460)	1.14
1957	236 (590)	38.5 (24.1)	60 (200)	1.19
1966	324 (810)	36.6 (22.9)	87 (290)	1.13
1967	632 (1,580)	36.8 (23.0)	171 (570)	1.13
1968	360 (900)	36.4 (22.8)	99 (330)	1.13
Subreach D: Near Bylas to Near Calva (See Burkham 1972: Plate 1)				
1914	201 (503)	9.74 (6.09)	272 (907)	1.09
1935	128 (320)	10.06 (6.29)	126 (420)	1.12
1942	90 (225)	10.50 (6.56)	84 (280)	1.17
1947	28 (70)	11.06 (6.91)	24 (80)	1.24
1954	24 (59)	11.28 (7.05)	21 (70)	1.26
1964	28 (70)	11.71 (7.32)	24 (80)	1.31
1967	49 (122)	10.88 (6.80)	45 (150)	1.22
1968	95 (238)	10.88 (6.80)	87 (290)	1.22

[1] Stream length was not measured in 1875; the length was "sketched in" by the field party.

[2] Map covered only part of reach.

Table C. Maps and Photography Utilized in Plotting the Middle Gila River Channel Positions.

USGS 7.5' Quadrangles (year of photography[1])	USGS 15' Quadrangles (year of photography or survey)	Orthophotoquads (year of photography)	Aerial Photography (year)[2]	Other Historical Maps[3] (year)	Historical Cadastral Surveys (year and township)
Florence SE (1963)		Florence SE (1972)	1936	1914	1869, 1928 (T4S, R10E)
Florence (1963, *1978*)		Florence (1972)	1936	1914	1869, 1928 (T4S, R9E) 1869, 1928 (T5S, R9E) 1869, 1928 (T5S, R8E)
Blackwater (1963, *1978*)	Sacaton (1904-1906)	Blackwater (1971)	1936	1914	1869, 1928 (T5S, R8E) 1876 (T4S, R8E) 1876 (T4S, R7E)
Sacaton (1963, *1978*)	Sacaton (1904-1906)	Sacaton (1971)	1936		1876 (T4S, R7E)
Gila Butte SE (1951, *1978*)	Gila Butte (1903-1904)	Gila Butte SE (1971)	1936		
Gila Butte (1951, *1978*)	Gila Butte (1903-1904)	Gila Butte (1971)	1936		
Gila Butte NW (1951, *1978*)	Gila Butte (1903-1904)	Gila Butte NW (1971)	1936		
Pima Butte (1951, *1967*)	Maricopa (1903-1904)	Pima Butte (1971)	1936		1876 (T3S, R3E) 1876 (T2S, R3E) 1868 (T2S, R2E)
Montezuma Peak (1951,*1967*)	Maricopa (1903-1904)	Montezuma Peak (1971)	1936		1868 (T2S, R2E)
Laveen (1951, *1973*)	Phoenix (1903-1904)	Laveen (1971)	1936		1868 (T2S, R2E) 1868 (T1S, R2E) 1868 (T1S, R1E)
Avondale SE (1954, *1971*)		Avondale SE (1971)	1936		1868 (T1S, R1E)

[1] Year of revision photography in intalics.
[2] Soil Conservation Photography on file at the Cartographic Division, National Archives, Washington D.C.
[3] Map of Florence District, U.S. Indian Irrigation Service, on file at the Bureau of Indian Affairs, Phoenix.

Table Da. Channel widths (meters) of selected cross-sections in upper reach of middle Gila River.

Township & Range	Sections	Surveyed Cross-section	Year 1869	1892	1928	1936	1954-57	1966	1969-70	1992
T4S, R10E	11&12	1	70		275	85	-	61	-	-
T4S, R10E	10&11	2	70		-	73	-	61	-	70
T4S, R10E	15&16	3	50		269	58	30	41	36	
T4S, R10E	20&21	4	57		220	43	40	45	31	30
T4S, R10E	19&30		50	140	340	-	-	-	-	-
T4S, R9E	25&30		-		151	58	34	-	-	-
T4S, R9E	25&26		60		-	58	40	31	44	
T4S, R9E	26&35	5	57		225	57	-	31		30
T4S, R9E	34&35	6	43		339	58	48	41	29	-
T4S, R9E	33&34		53		278	65	-	-	-	-
T5S, R9E	5&4	7	-		383	50	54	66	36	85
T5S, R9E	6&7		71		-	-	-	-	-	-
T5S, R9E	12&7	8	82		424	65	26	15	26	60
T5S, R8E	11&12	9	81		172	58	23	41	31	105
T5S, R8E	10&11	10	70		517	72	55	36	36	95
average			62.6		299.4	61.5	38.9	42.6	33.6	67.9
standard deviation			12.3		106.7	10.7	11.7	15.2	5.6	29.8
median			62.5		334.0	64.0	39.0	40.5	35.0	67.5

1869, 1892, and 1928 values are determined from survey notes.
1936, 1954-1957, and 1969-1970 values measured from aerial photographs.
1966 values measured from Florence SE and Florence quadrangles (1:24,000).
1992 values measured with electronic station; low flow channel.

Table Db. Channel widths (meters) of selected cross-sections in lower reach of middle Gila River.

Township &		Surveyed	Year						
Range	Sections	Cross-Section	1876	1903	1914	1928	1936	1966	1991
T5S, R8E	3&4	11				247	36	40	56
T4S, R8E	31&32	12	20				28	40	35
T4S, R8E	22&27	13					69	38	29
T4S, R6,7E	7&12	14					57	34	41
T4S, R6E	9	15					56	48	36
T4S, R6E	6	16					63		23
T3S, R5E	21	17			92		49		16
T3S, R5E	18&19	18			145		56		20
T3S, R4E	14	19		65			35		17
T3S, R4E	19&20	20		49			42		10
average							49.1	40.0	28.3
standard deviation							13.3869754	5.10	13.920808
median							48.5	43.0	33.0

1876 and 1928 values determined from survey notes.
1903 values measured from U.S. Indian Service Map (1:32,000).
1914 values measured from U.S. Indian Service Map (1:12,000).
1936 values measured from aerial photography.
1966 values measured from Blackwater and Sacaton quadrangles (1:24,000).
1991 values measured with electronic station; low flow channel.

Table E. Maps and Photography Utilized in Plotting Lower Gila River Channel Position.

USGS 7.5' Quadrangles (year of photography[1])	USGS 15' Quadrangles (year of photography or survey)	Orthophotoquads (year of photography)	Aerial Photography[2] (year)	Historical Cadastral Surveys (year and township)
Tolleson (1954, *1978*)		Tolleson (1971)		1868 (T1N, R1W)
Perryville (1954, *1978*)		Perryville (1971)		1868 (T1N, R1W) 1883 (T1N, R2W)
Avondale SW (1957, *1971*)		Avondale SW (1971)		1883 (T1S, R2W)
Buckeye (1958, *1971*)		Buckeye (1972)		1883 (T1S, R3W)
Hassayampa (1958, *1971*)		Hassayampa (1972)		1883 (T1S, R4W) 1882 (T1S, R5W)
Arlington (1960, *1981*)		Arlington SE (1972)		1882 (T1S, R5W) 1882 (T2S, R5W)
Spring Mt. (1972)		Spring Mt (1972)		1882 (T2S, R5W)
Cotton Center NW (1972)		Cotton Center NW (1972)		1882 (T3S, R5W) 1871 (T3S, R4W)
Cotton Center (1972)		Cotton Center SW (1972)		1871 (T4S, R4W) 1871 (T5S, R4W)
Gila Bend (1972)		Gila Bend NW (1972)		
Dendora Valley (1979)		Dendora Valley SE (1972)		1910 (T4S, R8W) 1914 (T5S, R8W)
Oatman Mt. (1979)		Dendora Valley SW (1972)	1953	1877 (T5S, R9W) 1877 (T5S, R10W)
Sentinel Peak (1979)		Sentinel Peak (1972)	1953	1877 (T5S, R10W)
Hyder SE (1963, *1980*)	Hyder (1927)	Hyder SE (1972)	1953	
Agua Caliente (1962, *1982*)	Aztec (1926-27)	Agua Caliente (1972)	1953	1877 (T5S, R10W) 1877 (T5S, R11W)
Aztec NW (1963, *1980*)	Aztec (1926-27)	Aztec NW (1972)		1877 (T6S, R11W) 1877 (T6S, R12W)
Horn (1962-63)	Stoval (1927)	Horn (1972)		1877 (T6S, R12W) 1877 (T6S, R13W)
Dateland (1962-62; *1980*)	Stoval (1927)	Dateland (1972)		1877 (T6S, R13W) 1877 (T7S, R13W)
Texas Hill (1963, *1980*)	Stoval (1927)	Texas Hill (1972)	1953	1877 (T6S, R13W) 1877 (T7S, R14W)
Growler (1953, *1980*)	Norton (1926)	Growler (1972)	1953	1877 (T7S, R15W) 1878 (T7S, R16W)
Roll (1953, *1980*)	Norton (1926)	Roll (1972)	1953	1878 (T7S, R16W) 1878 (T8S, R16W)
Tacna (1962, *1980*)	Mohawk (1926)	Tacna (1972)		1878 (T8S, R16W) 1878 (T8S, R17W)
Wellton Mesa (1962)	Wellton (1926)	Wellton Mesa (1972)		1878 (T8S, R17W) 1878 (T8S, R18W)

Wellton (1962)	Wellton (1926)	Wellton (1972)		1878 (T8S, R18W) 1912 (T8S, R19W)
Ligurta (1962)	Fortuna (1902-03; 1925-26)	Ligurta (1972)		1916 (T8S, R20W)
Dome (1953, *1985*)	Laguna (1902-03; 1925-26)	Dome (1972)		1890 (T8S, R21W)
Laguna Dam (1953, *1976*)	Laguna (1902-03; 1925-26)	Laguna Dam (1972)		1890 (T8S, R21W)
Fortuna (1962-62, *1976*)	Fortuna (1902-03; 1925-26)	Fortuna (1972)		1890 (T8S, R21W) 1874 (T8S, R22W)
Yuma East (1948, *1976*)	Yuma (1902-03)	Yuma East (1973)		1874 (T8S, R22W)

[1] Year of revision photography in intalics.

[2] 1953 photography on file at the Arizona Geological Survey

CHAPTER VIII

Land Use Along the Gila River

Part 1

(General overview and summary of existing land uses along the Gila River from Safford to Yuma, Arizona.)

For the purposes of this study, the 300-mile study area encompassing the Gila River and its 100-year floodplain has been divided into segments that reflect the predominant land use on uses within each segment of the reach. The land uses are shown parcel by parcel on the Gila River Base Map and include:

- Agricultural/Undeveloped
- Residential - Single Family/Mobile Homes
- Commercial
- Mineral/Mining
- Municipal Water/Wastewater Plants & Landfills
- Parks/Recreation/Open Space

1. Background

The Gila River runs almost the entire east-to-west length of Arizona, starting in Safford and ending at the confluence of the Gila and Colorado Rivers just east of Yuma. After studying the land uses within the reach and during several field trips, it was found that settlement patterns along the Gila River have been more a result of the railroad rather than of the river itself.

Starting in Safford, other major communities along the Gila include Thatcher, Winkelman, Kearny, Florence, Coolidge, Gila Bend, Wellton and Yuma. The settlement of these communities, with the exception of Yuma, corresponded directly to the construction of the railroad in the late 1870's, rather then to the presence of the Gila River. Over time, these communities became centers for agriculture as irrigation facilities were developed. This agricultural orientation still predominantly exists today.

2. Land Use Summary

For the purposes of this summary, the Gila River from Safford to Yuma has been divided into eight segments based on the predominant land use in each segment. These segments include:

1. Gila Box to eastern San Carlos Indian Reservation boundary
2. Western San Carlos Indian Reservation Boundary to Winkleman
3. Winkleman to Kelvin
4. Kelvin to Ashurst-Hayden Dam
5. Ashurst-Hayden Dam to eastern Gila River Indian Reservation boundary
6. Western Gila River Indian Reservation boundary to easter Painted Rock State Park boundary
7. Eastern Painted Rock State Park boundary to western Painted Rock State Park boundary
8. Western Painted Rock State Park boundary to Yuma

1. Gila Box to eastern San Carlos Indian Reservation Boundary

Agriculture/undeveloped is the predominant land use in this Gila River segment. Appurtenant to this agricultural land use pattern is an abundance of irrigation well sites, an extensive network of irrigation canals and some agricultural buildings and facilities.

Intermittent residential land uses also exist in this segment, such as two trailer parks just to the west of Solomon, and individual residential dwelling units in or near the villages of Solomon, Pima, Bryce, Geronimo and Fort Thomas.

Landfills constitute the only other land use in this segment of the river. According to the Arizona Department of Environmental Quality (ADEQ), there are no currently operating or closed landfills within the river's 100-year floodplain.

While there are no park/recreation areas located within this segment, approximately 23 miles of the Gila River within the Gila Box is considered suitable for inclusion in the Wild and Scenic River System in conjunction with the Arizona Desert Wilderness Act approved by the U.S. Congress in 1990.

2. Western San Carlos Indian Reservation to Winkleman

This segment of the Gila River forms the boundary between fee land to the north and the San Carlos Indian Reservation to the south and is totally undeveloped. With a terrain characterized by steep mountain cliffs and sandy vegetated river bottom land, this segment of the Gila River possesses a high degree of riparian and wildlife habitat value. A 7.5 mile portion of this segment is considered to be partially suitable for inclusion in the Wild and Scenic River System.

3. Winkleman to Kelvin

Several small communities dot this segment of the Gila River which depend on the mining industry for their livelihoods. Winkleman Flats, located in the eastern portion of the town of Winkleman lies within the 100-year flood plain and experienced extensive damage by the flooding of the Gila River in the spring of 1993.

There are, however, individual residential dwelling units situated within the flood plain between Winkleman and Hayden, in Kearney, and in the small unincoporated area of Riverside.

Between the towns of Winkleman and Hayden and within the 100-year flood plain is a large tailings pond associated with the ASARCO pit and deep copper mining operation. While located within the flood plain, the high dirt walls surrounding the pond prevent any pollutants from entering the Gila River watercourse.

Other uses located within the flood plain in this segment of the Gila River include the Hayden Golf Club in Winkleman, an underground gas transmission line in the vicinity of the confluence of the San Pedro and Gila Rivers, and a sewage disposal pond in Kearney.

Finally, according to the ADEQ, there is a closed landfill located at the southeastern edge of the Hayden Country Club that was once operated by the Town of Hayden. This closed landfill is situated within the Gila River's 100-year flood plain.

4. Kelvin to Ashurst-Hayden Dam

For the most part inaccessible except by rail, this Gila River segment is very similar to segment 2 in that the streambed is almost totally undeveloped. The only development along this segment is the A-Diamond Ranch with two barns and the settlement of Cochran, with two individual dwelling units, both within the 100-year floodplain.

This lack of development, coupled with steep mountain slopes and dense native and salt cedar vegetation, make this segment very valuable as a riparian and wildlife habitat.

5. Ashurst-Hayden Dam to eastern Gila River Indian Reservation boundary

This segment of the Gila River widens to as much as one mile at some points downstream of the Ashurst-Hayden Dam, which was constructed for irrigation water diversion. The Florence-Casa Grande Canal carries these irrigation waters to the many agricultural fields that lie both within and just outside of the 100-year flood plain. Because of their proximity to the Florence State prison, some of these fields lie within State Prison Ranches No. 1 and 2.

Other land uses within this segment include individual residential units to the north and west of the City of Florence, a sewage disposal pond northwest of Florence, and two gravel pits, one east of Florence and one to the northwest of the village of Adamsville. There are also two closed landfills that are located within the river's 100-year flood plain, both of which were operated by the City of Coolidge.

6. Western Gila River Indian Reservation Boundary to eastern Gila Bend Indian Reservation Boundary

Beginning at the confluence with the Salt River, this Gila River segment is predominantly agricultural with its antecedents of well sites and irrigation canals. In fact, one water impoundment structure, Gillespie Dam, was constructed not for flood control but for the purpose of diverting water into the Arlington and Gila Bend Canals that provide irrigation water to the numerous ranches in the area, most notable the Poloma Ranch. Because of this heavy emphasis on farming, there appear to be many agricultural structures such as barns and outbuildings that lie within the 100-year floodplain, primarily in the area south of Buckeye.

In the area of the confluence of the Gila, Salt and Agua Fria Rivers, just south of the City of Avondale, possibly as many as one hundred agricultural buildings lie within the 100-year floodplain. These buildings are situated in the vicinity of 115th Avenue and Southern Avenue. Other concentrations of residential dwelling units in the floodplain exist south of Buckeye in the village of Allenville and in the Arlington Valley. Adjacent to these residential units is the Arlington School, also situated within the 100-year floodplain.

Other land uses in this segment, that lie within the flood plain, include portions of the Phoenix International Raceway parking lot; the Estrella Mountain Regional Park and Sierra Estrella Golf Course; wastewater treatment plants and sewage disposal ponds west of Buckeye and north of Gila Bend; several gravel pits; two landing strips west of Gila Bend; four natural gas pipelines (three in vicinity of Gillespie Dam); and the Liberty Cemetery of Tuthill and Lower River Roads.

In addition, there is a closed landfill once operated by the Town of Buckeye located within the river's 100-year floodplain at Miller Road and the Gila River.

7. Eastern Painted Rock State Park boundary to western Painted Rock State Park boundary

The boundaries of this segment encompass Painted Rock Reservoir and approximately 2,500 acres below Painted Rock Dam that was once leased by Arizona State Parks. Owned by the U.S. Bureau of Land Management, the primary land use within this segment has been recreational in nature. With Arizona State Parks providing facilities for fishing, boating and other passive recreation opportunities. However, the recreational value of this segment is currently questionable due to the DDT infiltration into the watercourse from surrounding agricultural uses. At the time of this study, the park was closed and Arizona State Parks did not renew its lease due to this environmental problem.

8. Western Painted Rock State Park boundary to Yuma

Beginning in the area known as Dendora Valley and ending at the confluence of the Gila River with the Colorado River at Yuma, the predominant land use in this segment is agricultural or undeveloped. Another land use characteristic of this segment, because of its agricultural orientation, are the great number of roadways and canals that were constructed to access and to serve the many fields under cultivation that lie within the floodplain. This land use pattern is extremely defined in the area administered by the Mohawk-Wellton Irrigation and Drainage District.

Also prevalent within the flood plain throughout this segment, are scattered residential units and agricultural buildings, specifically, north of Dateland, near Texas Hill, near the Colfred Floodway, north of Tacna, Roll and Wellton, and east of Yuma. In addition, three other uses that lie within the floodplain in this segment are a landing strip near Tacna, the Mohawk Valley School near the village of Roll, and a closed landfill located 2.8 miles north of Wellton.

Part 2

(Discussion of land uses, ownership, acreages and environmental concerns with appendix and table references.)

Land ownership, land use and environmental concerns along the study reach of the Gila River between Safford and the confluence with the Colorado River at Yuma will be discussed in this part of the chapter. Information gathered for reference and study include:

- Land Ownership
- Land Use and Existing Improvements
- Vegetation and Wildlife
- Environmental Concerns

The discussion in the second part of this chapter is limited to current land ownership, existing land uses and improvements and environmental concerns within the floodplain boundaries along the study reach. Some reference, however, is made of the Gila River before and after the time of Statehood (February 14, 1912) for historical perspective in summarizing vegetation and wildlife.

1. Information Sources

The sources of information for the land ownership were the county assessor records at the Maricopa County Assessor's Office (Maricopa County), the county assessor records at the Arizona Department of Revenue (Yuma, Gila and Graham Counties), the Pinal County Assessor's Office (for Pinal County), the State Land Department leasing database and the Bureau of Land Management's land ownership records. Sources for land use information were the County Flood Control Offices in Yuma, Maricopa, Pinal and Graham Counties (to identify existing sand and gravel operations on the study reach), U.S. Department of the Interior, Fish and Wildlife Service, Arizona Game and Fish Department, Arizona Parks Department, Arizona Department of Environmental Quality and the Arizona State Mine Inspector for other land use information.

2. Methodology

Data was obtained from Maricopa and Pinal County Assessors records, Arizona Department of Revenue assessors records, for Yuma, Gila and Graham Counties, the State Land Department and Bureau of Land Management records, to ascertain land ownership; local, State and Federal agencies were contacted to obtain land use data. This data was used to construct a Geographical Information System (GIS) for the Gila River study reach. The GIS can be used to assign information, such as land use, land ownership, vegetation, wildlife and geologic/hydrologic characteristics and other information to specific land parcels or reaches of a river. The Gila River GIS developed for this study was partially adopted from the Flood Control District of Maricopa County (FCDMC) GIS, and combined with the data described above.

A portion of land ownership information for the Gila River GIS was received from FCDMC as ARC/INFO export files, and was converted into a GIS coverage after removing parcel polygons for Salt River areas. Land Use information was also obtained from local, State and Federal agencies (described above). Land use codes in the GIS were based on standard state of Arizona property use codes obtained from the Arizona Department of Revenue, and were recorded and entered with ownership information using ARC/INFO file.

Plots of GIS information for the Gila River, including land owned by Arizona Game and Fish, U.S. Bureau of Land Management, Indian Reservations, Arizona State Trust Land, privately held lands and other (unspecified) owners are provided in Appendix I. These GIS plots also include:

- Land Ownership
- Land Use
- Main Channel Alignment
- Floodplain Limits

3. Land Use and Ownership

Land Ownership was obtained from the Arizona Department of Revenue assessor records (for Yuma, Gila and Graham Counties), Maricopa County assessor records, Pinal County assessor records, State Land Department leasing records, Bureau of Land Management ownership records and from FCDMC Metroscan file for that portion of the Gila River from the Salt River confluence to Gillespie Dam. A summary of gila River land ownership and land use information based on these data sources are shown in the following tables. The largest percentage of land held, between the confluence of the Gila and Colorado Rivers and Safford is private, followed by the Bureau of Land Management, three indian reservations (San Carlos, Gila and the tiny Gila Bend Indian Reservation north of the Town of Gila Bend), Arizona Department of Game and Fish and State Trust lands managed by the Arizona State Land Department.

Gila River Land Ownership	
Owner	**Acres**
Private	243,772
Bureau of Land Management	105,480
Gila River Indian Reservation	5,289
San Carlos Indian Reservation	7,358
Gila Bend Indian Reservation	9,694
Game and Fish Department	1,898
Arizona State Trust Lands	30,135
Other	151,365
Total	**554,992**

Gila River Land Use	
Land Use	**Acres**
Vacant Land	80,577
Residential-single family	1,830
Residential-multiple family	20
Hotel-motel-resorts	0
Condominiums	0
Commercial property	1,096
Industrial Property	149
Farm/ranch property	149,665
Public utilities	168
Natural resources	1,270
Special use property	5,657
General service use	170,182
Other	144,378
Total	**554,992**

4. Agriculture

Agriculture is the primary land use along the Gila River from the confluence at the Colorado River, through three Indian Reservations; the Gila Bend Indian Reservation, north of the Town of Gila Bend, the Gila Indian Reservation, south of Phoenix and the San Carlos Indian Reservation, northeast of Hayden (see General Location Map in Appendix A) to the terminus of the study reach at Solomon. Examples of crops to be found along the study reach include: cotton and lettuce, alfalfa hay, winter grains (such as wheat and barley), milo/sorghum and assorted vegetable crops (such as beets, broccoli, onions and cabbage). In the Safford area, Graham County, cotton, wheat and feed grains are found. Cotton, wheat and barley, and feed grains/alfalfa may be found on the San Carlos Indian Reservation, in the Florence area, and on the Gila Indian Reservation. West of Phoenix, along the Gila River to the Gillespie Dam, cotton, milo, alfalfa, winter grains (wheat and barley), and some vegetable crops are grown. Along the lower Gila River from Gillespie Dam to the Yuma area, cotton, wheat, alfalfa, a variety of vegetables (especially lettuce) and citrus are found. Plots of agricultural use are provided on the land use maps in Appendix J.

5. Wildlife Habitat

The Arizona Game and Fish Department (AGFD) own 1,898 acres of land on the lower reach of the Gila River (from the Salt River confluence to Roll, Arizona). The biggest percentage lies along the study reach between the Salt River confluence and Gillespie Dam. The balance is dotted along the study reach from Gillespie Dam to an area near Roll (see land ownership maps in Appendix I. AGFD use their land for wildlife habitat, waterfowl, sand and gravel leasing, flood control and right of way leasing. At the time of this study, AGFD was in the draft stage of preparing management plans for their properties. AGFD recently acquired "Quigley Pond" downstream from Texas Hill. AGFD had six (6) parcels in the vicinity of Texas Hill; three (3) were exchanged with the Bureau of Land Management for "Quigley Pond". Another plan for 1991-1995 is the Robbins Butte wildlife area near Robbins Butte, NE¼, Section 28, T1S, R4W (Dove nesting, waterfowl, wildlife habitat) Reference Robbins Butte Wildlife Area Management Plan 1991-1995, Federal Aid Project W-85-17-30, November 1990 (see land use maps in Appendix J). Additional information on wildlife habitat planning by AGFD will be provided to the State Land Department in the near future.

Contacts with the United States Department of Interior, Fish and Wildlife Service, revealed that they have no wildlife refuges along the Gila River study reach.

6. Recreation

No specific sites have been identified along the Gila River study reach as recreational areas to accommodate activities such as boating, fishing and swimming; although, throughout the years people have individually engaged in these activities whenever conditions on the river have been favorable to do so. Even so, the State of Arizona recognizes that its water courses are a potential valuable resource for outdoor recreation. To this end, the state developed a comprehensive plan to assure the protection, enhancement, and enjoyment of the state's native resources -- The Statewide Outdoor Comprehensive Recreation Plan (SCORP). SCORP was prepared by Arizona State Parks and financed in part through a comprehensive planning assistance grant from the United States Department of Interior, National Park Service, under the provisions of the Land and Water Conservation Fund Act of 1965 (LWCF; Public Law 88-578)[1].

The Arizona State Parks Board (ASPB) is responsible for administering the LWCF program in Arizona and preparing its Statewide Comprehensive Outdoor Recreation

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[1] Arizona Statewide Comprehensive Outdoor Recreation Plan. Rose Mofford, Governor, Arizona State Parks, 1989

Plan[2].

Arizona's waterways are becoming increasingly important as recreational resources. Arizonans and visitors alike have come to view these waters as refreshing and revitalizing contrasts to urban and desert landscapes. In ever-growing numbers, people are pursuing water-related activities such as boating, tubing, hunting, fishing, hiking and swimming. Rivers and streams also provide desirable opportunities for more passive pursuits including picnicking, nature study, and general sightseeing[3].

In response to growing and changing demands in the state, the Arizona State parks Board initiated a major update of the Arizona State Comprehensive Outdoor Recreation Plan in 1987. Recognizing the importance of waterways to the state's overall outdoor recreation program, State Parks elected to focus a substantial portion of its efforts on a recreational and environmental evaluation of streams and wetlands. The Arizona rivers, Streams and Wetlands Study is the result of this initiative[4].

The study's fundamental conclusion is that Arizona's rivers, streams and wetlands can provide a wide variety of high quality outdoor recreation experiences for both residents and visitors[5]. The Gila River is mentioned in this report, along with the Salt, Verde and Little Colorado Rivers, for its growing popularity in whitewater boating, though no specific reach is identified. Notation was made that "in its native condition, Arizona's landscape was not as parched as what we experience today. Little more than a century ago, rivers and streams flowed year round in nearly every area of the state. The Santa Cruz River in Tucson, the Salt River in Phoenix, and the Gila River in Safford were, at one time, all perennial streams."[6]

It is estimated that only five to ten percent of Arizona's original native riparian habitat remains today. As a result, riparian communities now comprise only a very small portion of the total southwestern landscape, between 0.1 and 0.5 percent. Riparian

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[2] Arizona Statewide Comprehensive Outdoor Recreation Plan, Rose Mofford, Governor, Arizona State Parks, 1989

[3] Arizona Rivers, Streams and Wetlands Study, Chapter 2, pages 82-84; Arizona Statewide Comprehensive Outdoor Recreation Plan, Rose Mofford, Governor, Arizona State Parks, 1989

[4] Arizona Rivers, Streams and Wetlands Study, Chapter 2, pages 32-84; Arizona Statewide Comprehensive Outdoor Recreation Plan, Rose Mofford, Governor, Arizona State Parks, 1989

[5] Arizona Rivers, Streams and Wetlands Study, Chapter 2, pages 82-84; Arizona Statewide Comprehensive Outdoor Recreation Plan, Rose Mofford, Governor, Arizona State Parks, 1989

[6] Arizona Rivers, Streams and Wetlands Study, Chapter 2, pages 82-84; Arizona Statewide Comprehensive Outdoor Recreation Plan, Rose Mofford, Governor, Arizona State Parks, 1989

areas are now Arizona's most threatened natural communities[7]. Fishing and hunting are not the only recreational activities to suffer from degradation of stream resources. Without adequate flow, boating is impossible; without healthy vegetation, campers lose shade and scenic quality suffers. Clearly, there is a relationship between environmental quality and diversity of recreational opportunities; a relationship that must be taken into account in planning for future stream and wetland recreation[8].

7. Other Uses

Numerous other activities and uses are currently present on the Gila River study reach. These include dam and flood control structures, flood control and drainage districts, commercial activities such as sand and gravel mining, roads, bridges and railroads. A summary of these uses follows:

Dam structures:

Four dam structures have identified along the study reach:

1. Coolidge Dam: located in the SW¼ Section 17, T3S, R18E; latitude 33°-10'-10", longitude 110°-31'-50"; drainage area 12886 square miles; completed October 25, 1928, regulating flow since November 15, 1928; current estimated usable capacity is 866,600 to 1,073,600 acre-feet between elevations 2382.63 ft. (sill of lowest outlet gate) and 2510.4 ft. (revised, crest of spillway); maximum recorded storage 1,090,000 acre-feet, 26 February to 6 March 1980; no dead storage; stores water for irrigation of 100,000 acre San Carlos Project and for power development dependent on irrigation demands.

2. Ashurst-Hayden Dam: located in the SW¼NW¼ Section 8, T4S, R11E; latitude 33°-14'-50"; drainage area 18,305 square miles; operational since July 1923; 10 miles northeast of Florence, Pinal County; diversions for Florence-Casa Grande irrigation canal; flow partially regulated by storage in San Carlos Reservoir; four sluice gates in dam with tip of opening 6.5 feet below crest of dam.

3. Gillespie Dam: located in the SE¼NE¼ Section 28, T2S, R5W; latitude 36°-13'-45", longitude 112°-46'-00"; eight (8) miles downstream from Hassayampa River, approximately six (6) miles south of Arlington, Maricopa County; drainage area 49,650 square miles; diversions for Gila Bend Canal and

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[7] Arizona Rivers, Streams and Wetlands Study, Chapter 2, pages 82-84; Arizona Statewide Comprehensive Outdoor Plan, Rose Mofford, Governor, Arizona State Parks, 1989

[8] Arizona Rivers, Streams and Wetlands Study, Chapter 2, pages 82-84; Arizona Statewide Comprehensive Outdoor Recreation Plan, Rose Mofford, Governor, 1989

Enterprise Canal; operational since August 1921; maximum recorded discharge, this location, 178,000 cfs, 16 February 1980; maximum estimated discharge for this location (outside of period of record) was 250,000 cfs, February 1891; average discharge of river above diversions at dam for 56 year period of record, 391 cfs.

4. Painted Rock Dam: located in the SE¼ Section 18, T4S, R7W; latitude 33°-04'-30", longitude 113°-00'-50"; 19 miles northeast of Sentinel, Maricopa County; drainage area 50,910 square miles; operational since October 1959; no diversions for irrigation at this location; many diversions above station for irrigation; flow above dam regulated by many reservoirs, the largest of which is Painted Rock Reservoir, estimated capacity 2,492,000 acre-feet; maximum recorded discharge, this location, 9,190 cfs, 3 May 1983.

Major reservoirs on tributaries to the Gila River that have impacts on flow include:

Salt River: combined capacity of reservoirs is estimated at 1,755,000 acre-feet.

Verde River: combined capacity of Bartlett and Horseshoe Reservoirs is estimated at 317,700 acre-feet.

Agua Fria River: capacity of Lake Pleasant is estimated at 157,600 acre-feet.

See the land use maps in Appendix J for approximate locations of these features.

Irrigation/Flood Control Districts

Irrigation and drainage districts, flood control districts and agriculture water companies identified along the study reach between the confluence of the Gila and Colorado Rivers at Yuma and Safford include:

- Yuma Irrigation District - Yuma County
- Wellton-Mohawk Irrigation and Drainage District - Yuma County
- Arlington Canal Company - Maricopa County
- Woolsey Flood Protection District - Maricopa County
- Buckeye Water Conservation and Drainage District - Maricopa County
- Florence Flood Control District - Pinal County
- San Carlos Irrigation and Drainage District - Pinal County
- Gila Valley Irrigation District - Graham County
- Safford Valley Consolidated Canal System - Graham County

Commercial Activities

The land use maps in Appendix J show locations for commercial or industrial uses. Contacts with the floodplain offices of the counties where the Gila River was studied indicates that there are fifteen (15) sand and gravel mining operations presently operating under permit on the Gila River. These are shown in the table below.

Gila River Study Reach Active Sand and Gravel Operations Maricopa County				
OPERATOR	PERMIT STATUS	SEC	TWP	RNG
Edward Kelton Const	Approved	5	1S	2W
George Bell/Mesa Materials	Approved	1	1S	1W
Joseph Urban Family Trust	Approved	34	1N	1W
Randy Harper	Approved	36	1N	1W
Pioneer Landscaping Materials	Approved	7	1S	2W
Sanner Contracting	Approved	34	1N	1W
Andrew Jackson	Approved	15	1S	3W
Gravel Resources	Approved	15	1S	3W
Andrew Jackson	Approved	19	1S	3W
Gravel Resources	Approved	24	1S	4W
Andrew Jackson	Approved	14	1S	3W
Gravel Resources	Approved	14	1S	3W
Western Rock and Sand	Approved	Gila Bend		
Harper Sand and Rock	Approved	36	1N	1E
Pinal County				
Tanner Sand and Gravel Co	Approved	Maricopa Road		

Contact with the Arizona Department of Environmental Quality revealed that there are no operational landfills along the study reach of the Gila River. Five closed landfills have been identified and are listed in the table below.

Landfills along the Gila River Study Reach (closed)						
FACILITY	TYPE	COUNTY	TYPES ACCEPTED	OPERATOR'S NAME	DIRECTION	SEC TWP RNG
Wellton	CSWLF	Yuma	Rubbish ? Asbestos ? Septage ? MSW ? LW ?	Yuma County 2703 Ave B Yuma 85364	2.8 miles north of Wellton on Ave B	19 8S 18W SENENE
Buckeye	CSWLF	Maricopa	Rubbish Y Asbestos N Septage N MSW Y LW N	Tn of Buckeye 715 Monroe Buckeye 85326	at Miller Rd and the Gila River	? 1S 3W
Coolidge #1	CSWLF	Pinal	Rubbish Y Asbestos N Septage N MSW Y LW N	Cty of Coolidge PO Box 398 Coolidge 85228	.6 miles north of AZ 287 on Nafiger Rd	12 5S 8E NWNWSW
Coolidge #2	CSWLF	Pinal	Rubbish Y Asbestos N Septage N MSW Y LW N	Cty of Coolidge PO Box 398 Coolidge 85228	1 mile north of AZ 287 on Christenson Rd	12 5S 8E SWNWNW
Hayden #2	CSWLF	Gila	Rubbish Y Asbestos ? Septage ? MSW Y LW ?	Tn of Hayden 520 Velasco Ave Hayden 85235	adjacent to the southeast edge of Country Club	23 5S 15E

Municipal and residential land use locations along the Gila River study reach, identified in county assessor records, are provided on the land use maps in Appendix J. During the storm events from January to early March 1993, some residential homes in Winkleman were inundated by flood waters of the Gila River. Since that event, FEMA has settled with the homeowners who lost their homes. These people have relocated and the Winkleman Flats area is closed to residential use.

Environmental

Biotic Communities[9] (vegetation and wildlife)

Historically, the Gila River has supported a variety of riparian ecosystems that continue to change over time. These changes have occurred, and will continue to occur as a result of land uses that locate along the river from Safford to Yuma.

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[9] Ohmart, Robert D., 1979, Past and Present Biotic Communities of the Lower Colorado River Mainstem and Selected Tributaries, Volume V.

Prior to Arizona Statehood in 1912, native Americans utilized floodplain lands along the Gila River for inundation agriculture and eventually small scale irrigation agriculture, primarily around the communities of Safford and Thatcher. This combined inundation/irrigation farming practice was continued by Anglo settlers that entered the region in the late 19th and early 20th centuries.

This ever expanding agricultural land use trend along the Gila River's entire reach began having profound effects on the river's diverse biotic communities. As agricultural use expanded, the native mesquite vegetation that lived along the river were removed in favor of agriculture. Cattle ranching also had a negative impact on biotic communities, as river banks were cleared so that cattle could directly access the river. These agricultural/cattle grazing activities led to an increase in erosion and sediment run-off.

Perhaps no other action changed the river's biotic communities as much as the introduction of the salt cedar in approximately 1915 in the Safford area. Once the salt cedar was established, native plants were almost completed excluded. The salt cedar's ecological adaptiveness has led to its proliferation not only along the Gila River, but in other riparian areas throughout the southwestern United States.

Finally, the River's biotic communities were further impacted by the construction of irrigation impoundment dams over a span of some 40 years. These dams include Gillespie Dam (1921), Coolidge and Ashurst-Hayden Dams (1928) and the Painted Rock Dam (1959). The construction of these dams has artificially changed the river's ecosystems in areas that became flooded after the dam was built, and in areas downstream of the dams that receive less than the historical flows prior to dam construction.

Based on this historical perspective, the following narrative will discuss, very generally, the current state of the Gila River's biotic communities. The that purpose, the Gila River has been divided into the Upper Gila River from Safford to Avondale, and the Lower Gila River from Avondale to Yuma.

As mentioned previously, the vegetation in both the Upper Gila and the Lower Gila regions consisted largely of cottonwoods and willows until land clearing at the introduction of the salt cedar. Today, while some concentrations of cottonwoods and willows still exist, the predominant land cover is salt cedar. There also exists various species of mesquite, as well as other more desert oriented vegetation such as saguaro cacti, dessert broom and brittlebush. In the more riparian areas at the river's edge and within the streambed itself, there are a variety of cattails and both native and non-native grasses.

Changes in wildlife populations are much more difficult to gauge because quantitative data on changing wildlife patterns are almost nonexistent. Since generating this quantitative data is beyond the scope of this study, what can be detailed is what wildlife populations do exist in both the upper and lower Gila River reaches.

Bird populations in both the upper and lower Gila River regions include songbirds (wrens, swallows, warblers, tanagers, finches and sparrows), game-birds (dove, Gambel quail), resident birds (owls, sandpipers, killdeers and roadrunners), as well as migratory birds (sandhill cranes and bald eagles). Currently, 14 species of migratory, or resident, birds in the Gila River region have been placed on the Federal endangered species list, including the bald eagle, the peregrine falcon and the Yuma clapper rail.

Mammal populations of the Gila River region include a variety of bats, squirrels, chipmunks and jackrabbit. Also present within the river's reach are porcupines, coyotes, badgers, skunks, foxes and gophers. Threatened and endangered mammals include the Yuma Mountain Lion, Sonoran Pronghorn and the Desert Bighorn Sheep.

Also inhabiting the Gila River study area are a number of amphibians and reptiles which include several species of rattlesnakes, such as the sidewinder and Mohave rattlesnakes, in addition to many varieties of non-poisonous snakes. Amphibians include frogs, lizards and toads, all of which seek out the river for its riparian habitat. Threatened and endangered reptiles that may inhabit the study area include the desert tortoise and the gila monster.

Environmental Concerns[10]

As mentioned previously in the land use summary of this report, approximately five closed landfills exist within the Gila River study area. These landfills are historic in nature and were predominantly localized in use. They can present both groundwater and air quality problems and, depending on the type of refuse in each landfill and its relative location to the floodplain, each of these closed landfill sites should be the subject of further study prior to converting these sites to public lands.

Water quality, both surface and subsurface, is another environmental concern for the Gila River. To address this concern, ADEQ utilizes a number of Fixed Station Network (FSN) monitoring stations along the Gila River between Safford and Yuma. These stations, which were established by the United States Geologic Service (USGS) for monitoring river levels and quantities of flows, are used by ADEQ and a variety of other public/private entities to monitor water quality of the river. The results of this monitoring has revealed that certain segments of the river have a variety of pollution problems that are directly related to nearby or adjacent land uses. These pollutants are generated by forming activities, mining operations and other municipal/industrial uses located along the Gila River and its many tributaries.

[10] Arizona Department of Environmental Quality, 1992, Arizona Water Quality Assessment.

One of the most notable surface water pollution situations along the Gila River has been the high levels of DDT in the area of the Painted Rock Dam. Arizona State Parks leased approximately 2,600 acres of land bellow Painted Rock Dam for many years as a state park; however, due to the DDT problem, gave up that lease in 1990. Signs have been erected warning that fish taken from the Gila River in this area should not be consumed. This serious situation still exists at the time of this study.

With respect to groundwater quality, ADEQ also monitors groundwater contamination on a statewide basis. Similar to surface water contamination, groundwater contamination is closely related to land use. In the Gila River study area, underground aquifer tests have revealed a higher than normal amount of total dissolved solids (TDS), so much higher in fact that water pumped from many wells along the river contain TDS in the range of 3,000-10,000 mg/L of water. This level, according to ADEQ, can have a detrimental effect on irrigated crops. Agriculture and mining are both major contributors to high levels of TDS.

Various flood control projects have been proposed and some implemented over the years to reduce flooding along the Gila River study reach. Already mentioned in the Land Use and Ownership Section of this chapter, the Florence Flood Control District located northeast of Florence along the Gila River provides flood protection to district members; the Woolsey Flood Protection District, the boundaries of which extend from Gillespie Dam along the Gila River to Gila Bend and east from the river approximately 13 miles at its widest, provides flood protection to farms, crop land, State Trust land and federal land (BLM). Flood protection work to control flooding within the Wellton-Mohawk Irrigation and Drainage District was implemented in the eighties. Much of this work has had an impact on the river environment. The Final Environmental Impact Statement for Clearing of Phreatophytic Vegetation from the Salt and Gila Rivers from Ninety-first Avenue to Gillespie Dam, Maricopa County, Arizona, Department of the Interior, U.S. Fish and Wildlife Service, Region 2, November 1981, prepared by Flood Control District of Maricopa County discusses the impact of such a proposed action to reduce flooding along the rivers. Examples of these impacts cited include; soil erosion, increased capacity of the channel, removal of mature salt cedar, habitat loss, temporary degradation of existing fisheries; existing prehistoric sites would require clearing and existing land use along the reach identified for construction would be impacted by land exchanges with the federal government or other compensation or temporary loss of use; air quality degradation (temporary) could also occur. Recommended mitigation measures include the following actions:

- Confine open burning activities to periods when the wind is from the east - with respect to activities on the reach of the Salt and Gila Rivers cited above.
- Implement dust control measures during construction activities near populated areas.
- Develop wildlife habitats within AGFD lands to replace loss of habitat.

- Consult with the Arizona State Historic Preservation Officer and the Arizona Advisory Council on Historic Preservation to ascertain future requirements for addressing cultural resources that may be affected.

On any reach of the Gila River that the Arizona Navigable Streams Adjudication Commission determines to be navigable the environmental issues impacting that reach at the time of determining the public trust values have to be taken into account in accordance with A.R.S. § 37-1123.

DATA SOURCES / LAND USE AND ENVIRONMENTAL SUMMARY

- U.S.G.S. 7.5 min topographic maps
- TRW Assessor Records/Maps (ownership/land use)
- field surveys
- Arizona Division of Emergency Management (aerials)
- Arizona State Parks
- Arizona Game and Fish Department
- Arizona Rock Products Association (Roy Steigol 254-8465)
- Arizona Department of Environmental Quality
- Arizona State Land Department, GIS

Published Data Sources

Arizona Department of Environmental Quality, Arizona Water Quality Assessment, 1992

Arizona Department of Environmental Quality, Directory of Arizona Municipal Solid Waste Landfills (MSWLF), Rubbish Landfills (RLF) and Private Solid Waste Landfills (PSWLF), March 1993

Ohmout, Robert D., Past and Present Biotic Communities of the Lower Colorado River Mainstem and Selected Tributaries, Vol. V, 1979

Trimble, Marshall, Arizona: A Cavalcade of History, 1989

U.S. Bureau of Land Management, Lower Gila South Resource Management Plan and Environmental Impact Statement, Phoenix District, Arizona, 1985

U.S. Bureau of Land Management, Wild and Scenic River Suitability Assessments, Arizona, 1993

U.S. Fish and Wildlife Service, Final Environmental Impact Statement: Clearing of Phreatophytic Vegetation from the Salt and Gila Rivers: 91st Avenue to Gillespie Dam, Maricopa County, Arizona, 1981

CHAPTER IX

Technical Report: GIS for Gila River

March 9, 1995

A. Land Ownership and Use

The land ownership GIS for the Gila River was digitized from assessor maps using the ALRIS AZTRS coverage as the base map (see Section C). The percentage of private land within the 100-year floodplain (based on Table 1) is 44.0%.

The 100-year floodplain was chosen as the study area limits. All parcels entirely or partially within this floodplain limit were digitized and coded.

The land ownership GIS also contains the land use data for all private parcels and some public parcels within the floodplain. The values used were based on State of Arizona property use codes, and the classifications created, are shown in Appendix B of this chapter.

B. 100-Year Floodplain

The 100-year floodplain was digitized from lines drafted onto USGS 7.5' topographic quadrangle maps. These maps were used as a guide to determine which parcels were to be digitized into the land ownership/use GIS. The 100-year floodplain used, was copied from FEMA flood insurance rate maps.

TABLE 1: Ownership and Land Use Summary for Land within 100-Year Floodplain of the Gila River.

Breakdown by Land Owner

Owner	**Acres**
Private	243,772
State	30,135
Bureau of Land Management	105,480
Gila Bend Indian Reservation	9,694
Gila River Indian Reservation	5,289
San Carlos Indian Reservation	7,358
Arizona Game and Fish Department	1,898
Other	151,365
Total	**554,992**

Breakdown by Land Use

Land Use	**Acres**
Vacant Land	80,577
Residential - Single Family	1,830
Residential - Multiple Family	20
Hotel - Motel - Resorts	0
Condominiums	0
Commercial Property	1,096
Industrial Property	149
Farm/Ranch Property	149,665
Public Utilities	168
Natural Resources	1,270
Special Use Property	5,657
General Service Use	170,182
Other	144,378
Total	**554,992**

C. Methodology

1. Land Ownership

Pertinent tiles from ALRIS's AZTRS coverage were copied and appended to create the base for the parcels coverage. Four new items -- BOOK, MAP, PARCEL, and OWN_CODE -- were added (see Appendix A of this chapter).

Registration tics for digitizing were created by adding and snapping a tic to the coordinates of each section corner stored in the AZTRS coverage. Tics for half-section, quarter-section, or smaller maps, were created by manually digitizing them from the section maps. For detail maps lacking sufficient reference points, tics were placed at strategic points corresponding to the outline of the mapped area.

Arcs for parcel polygons were digitized from assessor plats. Parcels which fell entirely or partially within the floodplain as delineated on the FEMA map sheets were digitized.

A parcel dataset for the portion of the Gila River, from the confluence with the Salt River downstream to Gillespie Dam, was received from Maricopa County Flood Control District. This dataset was not used because it was found to be incompatible with the ALRIS coordinates existing in the other datasets. Since the total number of parcels involved in this area was relatively small, it was decided simply to digitize them from the assessor maps.

In most cases, assessor maps were considered the final authority in matters of boundary and ownership, although ASLD ownership maps were also consulted in cases of agency administered lands (ASLD & BLM).

Once all the arcs were digitized, the topology was built and the parcel boundaries were rechecked against the original maps. Polygon labels were then created and attributes assigned and checked for consistency.

The ownership relate file was created in INFO, by entering owner data from "TRW" microfiche copies of county assessor ownership records, obtained from the Appraisal Section of ASLD.

Once the ownership relate file was completed, parcel polygons were checked to make sure that each parcel was coded and could relate to a record in the ownership relate file. See Appendix C of this chapter for the list of ownership codes.

2. Land Use

Assessor land use codes (State of Arizona Property Use Codes) were recorded and entered at the same time as name and address of owners. Appendix B of the chapter, lists these land use codes and shows how they are divided into general land use categories.

3. 100-Year Floodplain

Tic marks for digitizing were the 7.5 minute quadrangle map corner tics copied from the QUADS coverage. Then the floodplain boundary lines were digitized, edgematched, and the topology was built. Polygon labels were then created and attributes assigned and checked. All source maps are stored in the Drainage and Engineering Section of ASLD.

4. Date Storage

All data (see Appendix D of this chapter) is available from, and stored on, the SUN computer system at ASLD. All this data is in the form of Arc/Info coverages or related INFO files. Copies of all original sources, including assessor maps and field notes, are also stored in the Drainage and Engineering Section of ASLD.

Appendix A: Data Formats

PARCELS COVER PAT FILE

PARCELS.PAT ITEMS

AREA	12 F
PERIMETER	12 F
PARCELS#	5 B
PARCELS-ID	5 B
TOWNSHIP	4 C
RANGE	4 C
SECTION	2 C
COUNTY	2 I
BOOK	3 C
MAP	3 C
PARCEL	4 C
** REDEFINED ITEMS **	
TR	8 C
TRS	10 C
OWN_CODE	12 C

NOTES: Items AREA through SECTION are identical to the corresponding items in ALRIS's AZTRS coverage.

OWN_CODE = COUNTY+BOOK+MAP+PARCEL

Appendix A: Data Formats (continued)

OWNERSHIP/LAND USE DATA RELATE FILE

OWNDATA ITEMS

PROP_ADD	78	C	
OWNER	2	I	
OWN_NAME	40	C	
ADDRESS1	40	C	
ADDRESS2	40	C	
ADDRESS3	40	C	
ADDRESS4	40	C	
STATUS_DAT	10	D	
LC#	2	C	
IC#	2	C	
LCIC_DESC	30	C	
ACRES	9	N	
IMP_VAL	9	I	
LAND_VAL	9	I	
TOT_VAL	11	I	
LEGAL1	78	C	
LEGAL2	78	C	
LEGAL3	78	C	
LEGAL4	78	C	
LEGAL5	78	C	
OTH_CODE	80	C	
OTH_USE	80	C	
COUNTY	2	I	
BOOK	3	C	
MAP	3	C	
PARCEL	4	C	
** REDEFINED ITEMS **			
OWN_CODE	12	C	
LCIC#	4	C	[State landuse code]
PARCEL-N	4	I	
BOOK-N	3	I	
MAP-N	3	I	
OWN_ADD	200	C	

Appendix B: Land Use Categories and Codes

VACANT PROPERTY

0000 Vacant Land

RESIDENTIAL PROPERTY

0100 Single Family
0200 NOT USED
0300 Multiple Residential
0400 Hotel
0500 Motel
0600 Resorts
0700 Condominiums
0800 Mobile Home
0900 Miscellaneous and Salvage

COMMERCIAL PROPERTY

1000 Miscellaneous Commercial
1100 Store, Grocery
1200 Store, with Office or Apartment
1300 Department Store
1400 Shopping Center
1500 Office Building
1600 Bank/Credit Union
1700 Service Station
1800 Automotive Sales and Service
1900 Nursing Homes etc.
2000 Restaurant and/or Bar
2100 Hospital, Medical Buildings
2200 Race Tracks, Private Airstrips
2300 Cemeteries and Mortuaries
2400 Golf Courses
2500 Amusement Facilities, Theaters, Bowling Alleys, Skating Rinks
2600 Parking Garages
2700 Club, Lodge or Fraternal Organization
2800 Partial Complete Structures - Under Construction
2900 Private School or Day Care Center

INDUSTRIAL PROPERTY

3000 Industrial Park
3100 Manufacturing of Durable and Non-Durable Products except foods
3200 Manufacturing of Food and Kindled Products
3300 NOT USED
3400 Lumbering, Saw Mills and Planning Mills
3500 Cotton Gins and Compresses
3600 Mining, Quarring and Processing
3700 Warehousing, Storage, and Truck Terminals
3800 NOT USED
3900 NOT USED

Appendix B: Land Use Categories and Codes (continued)

FARM/RANCH PROPERTY

4000 Plant Nurseries, Greenhouses, Hydroponic Greenhouses
4100 Field Crops - Hay, Cotton, Grain, etc.
4200 Vineyards
4300 Other Crop Trees - Mature Trees
4400 Citurs Crop Trees - Mature Trees
4500 High Density Agricultural
4600 Immature Crops - Vineyards, Trees, Not-Trees, etc.
4700 Grazing - Ranch Property
4800 Pasture Land
4900 Fallow Land

UTILITY PROPERTY

5000 NOT USED
5100 Railroad Operating Machinery
5200 Telephone and Telegraph Operating Property
5300 Pipeline Operating Property
5400 Gas and Electric Utility Operating Property
5500 Water Utility Operating Property
5600 Microwave Service
5700 Municipal Utilities - Electric, Water
5800 Airline Flight Property
5900 Private Car Companies

NATURAL RESOURCES

6000 NOT USED
6100 Producing Mines
6200 Railroad Property
6300 Oil and Gas Geothermal Resource Interests
6400 Electric and Gas Companies Environmental Protection Facilities
6500 Electric and Gas - Under Construction
6600 Non-Producing Mine Property
6700 NOT USED
6800 Mineral Rights Only
6900 Standing Timber
7000 NOT USED
7100 NOT USED
7200 NOT USED
7300 NOT USED
7400 NOT USED
7500 NOT USED
7600 NOT USED
7700 NOT USED
7800 NOT USED
7900 NOT USED
8000 NOT USED
8100 NOT USED
8200 NOT USED
8300 NOT USED
8400 NOT USED

Appendix B: Land Use Categories and Codes (continued)

SPECIAL USE PROPERTY

8500 NOT USED
8600 Miscellaneous Commercial or Industrial Improvements on subdivided or unsubdivided acreage
8700 Improved Residential Site on more than 5 acres of land
8800 Limited Use (Well Sites, Tower Sites, Private Roads, etc.)
8900 NOT USED

GENERAL SERVICE USE PROPERTY

9000 NOT USED
9100 NOT USED
9200 Religious and Charitable
9300 NOT USED
9400 Federal Government
9500 State Government
9600 County Government
9700 Municipal Government
9800 Indian Lands
9900 NOT USED

END OF CODES

Appendix C: Land Ownership Codes

01 ____	Private Owners
02 ____	State Land
03 ____	Bureau of Land Management
04 - 17	NOT USED - Other
18 ----	Gila River Indian Reservation
19 - 28	NOT USED - Other
29 ____	San Carlos Indian Reservation
30 - 33	NOT USED - Other
34 ____	Gila Bend Indian Reservation
35 - 70	NOT USED - Other
71 ____	Arizona Game & Fish Department
72 - 99	NOT USED - Other

Appendix D: Data Inventory

Land Ownership/Use GIS (names correspond to ALRIS LAND tiles):

YUMAW, YUMAE, DATEW, DATEE, LHORNE,
GILAW, PHXSW, PHXSE, MESAW, MESAE,
CASAW, CASAE, GLOBEW, GLOBEE, MAMW,
CLIFW, SAFFW

Relate File: OWNDATA

One Hundred Year Floodplain: FLOOD

Chapter X

Summary

The Gila River has been a reliable source of water for a large portion of central Arizona for more than a millenium. Documented uses of the river include water supply for irrigation, recreational and commercial boating, fishing and recreation. At times it has served as a barrier to transportation from north to south. This report has documented continuous use of the Gila River from the time of the Hohokam, through the period around statehood and up to the modern era.

The Gila River has a long record of prehistoric use and occupation. The native American Hohokam civilization in central Arizona was dependent on water diverted from the Gila River to support their agricultural economy (A.D. 550-1450); the Mogollon civilization occupied the upper Gila reaches (A.D. 100-1200); and the Patayan civilization occupied portions of the Gila from west of Gila Bend to east of the Buckeye Hills (A.D. 300-1450). Primary uses of the river were for water for agriculture and fish for protein; river cobbles were a source of tools and building materials. Types of agriculture which were practiced included irrigation, floodwater and dry farming.

Geologic and hydrologic data provide specific evidence of the natural condition of the Gila River only since the mid-1800's, although portions of the river were described as consisting of a stable, narrow and relatively deep channel as early as the late 1600's by Father Kino and others. This type of channel was probably typical prior to construction of the Roosevelt and San Carlos dams in the early 1900's; the river has become more broad and shallow since construction of the dams. Prior to construction of Roosevelt and San Carlos dams the river was apparently perennial to the confluence with the Colorado River. Due to changes in climate characterized by changes in intensity and seasonality of precipitation, the Gila has likely alternated between periods of channel stability and instability and specifically in form (e.g., braided vs meandering). Periods of high seasonal flow probably occurred during late summer and mid-to-late winter, with low flows occurring during May and June. U.S.G.S. records indicate that annual flood discharges in excess of 20,000 cfs were not uncommon from Safford to Yuma, with maximum recorded or estimated discharges of 150,000 to 200,000.

Early explorers of the Gila River probably found the river in much the same condition as the earlier Patayan, Hohokam and Mogollon residents. The stream's flow was perennial though variable with the seasons and included fish populations, beaver and other small game in a well developed riparian habitat. Early Anglo residents floated boats, canoes, logs, rafts and ferries through the study area, and although use of the river was largely dependent on higher seasonal flows, boats were apparently on the river at all times of the year. Boat traffic apparently occurred as recently as 1908 and ferries were on the river around Phoenix as late as 1905. Travel seems to have been down-river or across the river, but not up-river. Travel on the river was frequently interrupted due to hazards such as sand bars or snags. Use of the river's water for irrigation seems to have had a higher priority than use as a means of transportation, with numerous canals constructed beginning in the late 1800's from above Safford to Gila Bend. Residents along the river used the river for recreation and fishing, although to lessening degrees with the passage of time and the construction of the upstream dams.

By Statehood, an extensive series of irrigation diversions in combination with the construction of Salt River reservoirs had largely reduced flows in the Gila downstream of the Salt River confluence. In 1929, San Carlos reservoir on the Gila above the town of Winkelman further reduced flows in the river, with modern day flows largely dependent on local runoff or large storm events which are not fully contained by the reservoirs. Flows upstream of San Carlos reservoir continue to be perennial. Recreational boating continues upstream of San Carlos on a regular basis, while downstream recreational boating opportunities are largely dependent on response of the river to transient flows. Since 1912, the Gila River has been characterized by a normally dry channel downstream of San Carlos reservoir except during periods of sustained high flows in excess of reservoir and diversion capacities.

Under House Bill 2589, the Arizona Legislature defined navigability criteria to be used by the Arizona Navigable Stream Adjudication Commission when considering evidence on specific streams. For the Gila River, the following data described in this report relate to the State's navigability criteria:

- **Commercial Trade and Travel.** As of the time of statehood, the Gila River was susceptible to limited forms of commercial trade and travel. The hydrologic record shows that there was sufficient water in the river that would allow use of shallow water boats during regularly occurring portions of the year.

- **Flow Regime.** As of the time of statehood, the hydrologic record shows that the Gila River flowed at times other that in direct response to precipitation. Specifically, sustained high flow periods generally occurred in winter and spring that were not directly related to precipitation events. Even during the driest portions of the year, some reaches remained perennial despite extensive diversion of the normal flow into irrigation canals.

- **Sustained Trade and Travel Upstream and Downstream.** There was no evidence that sustained trade and travel ever occurred on the Gila River, nor is there evidence that trade or travel in the upstream direction ever occurred. However, the hydraulic rating curves indicate that some types of boat traffic <u>could</u> have occurred both upstream and downstream, though upstream travel would have been difficult.

- **Profitable Commercial Enterprise.** There was no historical evidence identified for this study that any profitable commercial enterprises were conducted using the Gila River for trade and travel as of the time of statehood. However, this is historical evidence that profitable commercial enterprises were conducted barely seven years prior to statehood.

- **Types of Vessels.** The historical record indicates that canoes, flat boats, rafts, ferries and floating logs were the only vessels to be used on the Gila River. Historical records of use of any type of boats diminished by the time of statehood. The hydraulic rating rating curves prepared for the study reach indicate that large boats could not have been used during the low flow conditions which occurred in 1912; while during high flow conditions, high velocities and river conditions may have made use of large powered boats hazardous. Canoes and other maneuverable low-draft boats could have been used with some difficulty during low-flow conditions in the perennial reaches in 1912.

- **Diversions.** Irrigation diversions removed large portions of flow from the Gila River as of 1912.

- **Recreational Boating.** Many of the historical accounts of boating on the Gila River were for recreational or non-commercial purposes.

- **Regular Flotation of Logs.** Logs or other material could not have been floated through the entire Gila River as of the time of statehood throughout the entire year. However, logs or other material probably could have been floated regularly (annually) during the season of high flow as of 1912.

- **Impediments to Navigation.** There were several irrigation diversion structures in 1912 that would be considered impediments to navigation. Many of these structures were present during the time when recorded accounts of boating on the Gila River occurred, although most of the boating accounts occurred downstream of the irrigation diversions and thus were not impeded by the diversions. These structures apparently were not impediments to small portable watercraft.

- **Customary Modes of Transportation.** The customary mode of transportation in the region near the Gila River was not by boat. By 1912, alternatives to boat travel included foot, horse, mule train, wagon, train, bus and automobile.

- **Rivers and Harbors Act of 1899.** The Gila River is not one of the streams listed under the Rivers and Harbors Act of 1899, however the Gila River confluences with the Colorado River at Yuma. The Colorado River is one of the streams listed under the Rivers and Harbors Act of 1899.

The Gila River could have and did support some types of boating during the period prior to statehood. By 1912, use of boats on the river had declined but was still possible in some reaches during portions of some years, especially upstream of the San Carlos reservoir; a condition which persists today. Finally, at the confluence of the Gila River with the Colorado River at Yuma the Colorado River and, therefore the Gila River, is navigable for an undetermined length of the Gila River upstream of the confluence due to backwater effects with the Colorado River. The extent of this navigable backwater must be determined at a future time.

CHAPTER XI

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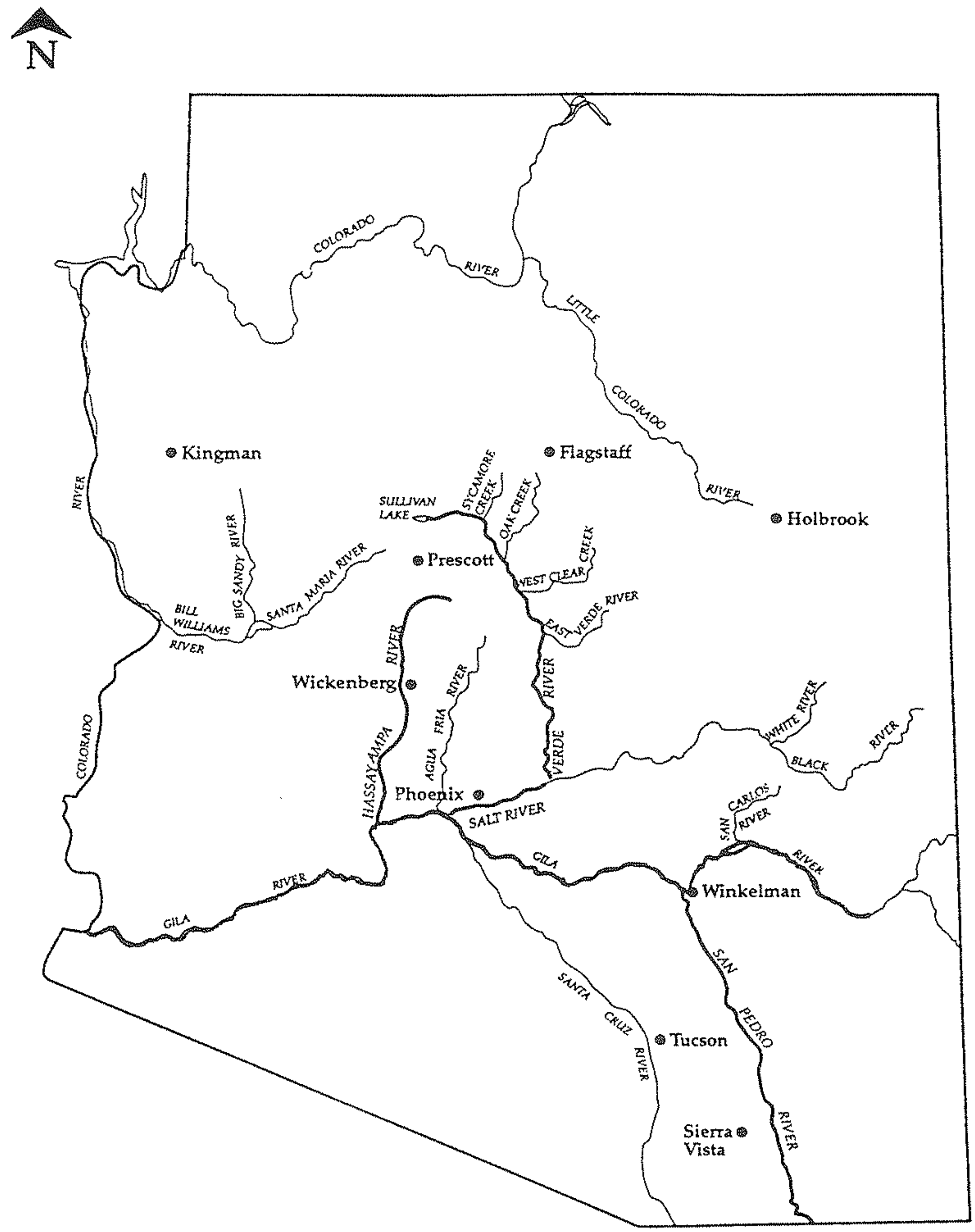
Appendix A

General Location Map



General Location Map for Arizona Stream Navigability Studies

Appendix B

Contact Letter/Information Request

Arizona
State Land Department

1616 WEST ADAMS
PHOENIX, ARIZONA 85007

FIFE SYMINGTON
GOVERNOR

M.J. HASSELL
STATE LAND COMMISSIONER

April 30, 1993

Dale Steele, Librarian
1700 West Washington
Phoenix, AZ 85007

Subject: Gila River Navigability Study

Dear Sir or Madam:

In June 1992 the Arizona State Land Department was charged by the Arizona Legislature under House Bill 2594 with gathering information and performing studies to assist the Arizona Navigable Stream Adjudication Commission in its duties related to determining the navigability of Arizona's watercourses at the time of Statehood and thereby resolving clouded titles. The information which is gathered from various persons and agencies will include the history, archaeology, hydrology, hydraulics, geomorphology, ownership and use of the underlying lands within and along the study rivers.

The Department and its consultants are currently performing such a navigability study along the Gila River (see the attached general study area map) and is seeking sources of relevant information. Specifically, we are seeking to identify sources of the following types of information:

1. Historical and archaeological records of activity within or along the Gila River which would indicate that the river was utilized for navigation, wildlife activity, recreation, commercial activity, transportation of goods or persons, drainage, etc.

2. Hydrologic, hydraulic and geomorphologic records of stream flow, floodplain limits, flow characteristics, changes in channel location, etc.

3. Title ownership (most recent lists), property tax records, and use of underlying lands.

We are seeking to acquire and/or review these types of information in whatever medium is available but, if possible, would prefer the following formats:

1. GIS (Geographic Information Systems) coverages, preferably in a UNIX system.

2. Database information, preferably on Reflex, Paradox or, UNIX ARC/INFO.

3. Maps, photographs, audio, video, audio-visual, graphic aids, slides, etc.

4. Studies, reports, articles, books or other written (or computerized) records; published or unpublished.

5. Oral or recorded history of activities along and on the river from senior citizens and others.

6. Expert witnesses.

7. "Hard copies" of information.

Finally, we are seeking to identify contact persons within your agency who could assist us in identifying and reviewing these types and sources of information. Would you please review and complete the enclosed questionnaire and return it to us? A postage-paid envelope is included for your convenience. When we have received your response we will be in contact to follow up.

Your assistance in this matter is greatly appreciated. If you have any questions or require any additional information, please contact our office (602-542-2677).

Sincerely,

Clyde E.

Clyde Anderson
Project Manager
Drainage and Engineering Section

CA:dds

Enclosures

GILA RIVER NAVIGABILITY STUDY RESOURCE QUESTIONNAIRE

Name of Agency ______________________________
Address __________________________________
Telephone Number ____________________________
Name of contact person _________________________

We are in possession of the following types of information or can direct you to persons or agencies who are in possession of such information.

1. Historical and archaeological records of activity within or along the Gila River which would indicate that the river was used for navigation, transporting goods or persons, wildlife activity, recreation, commercial activity, drainage, etc. Yes __ No __

2. Hydrologic, hydraulic and geomorphologic records of stream flow, floodplain limits, flow characteristics, changes in channel location, etc. Yes __ No __

3. Title ownership (most recent lists), property tax records, and use of underlying lands. Yes __ No __

4. GIS (Geographic Information Systems) coverages, preferably in a UNIX system. Yes __ No __

5. Database information, preferably Reflex, Paradox or UNIX ARC/INFO. Yes __ No __

6. Maps, photographs, audio, video, audio-visual, graphic aids, slides, etc. Yes __ No __

7. Studies, reports, articles, books or other written (or computerized) records; either published or unpublished. Yes __ No __

8. Oral or recorded history of activities along and/or on the river from senior citizens and others. Yes __ No __
9. Expert Witnesses. Yes __ No __

10. Other information. Yes __ No __

Please return this form as soon as possible to:

Arizona State Land Department
Drainage and Engineering Section
1616 West Adams
Phoenix, Arizona 85007
ATTN: Clyde Anderson
Phone: 602-542-2677
Fax: 602-542-2590

Appendix C

Contact/Mailing List

Gila River Navigability Study

Agencies/persons contacted for literature search & information request

Agency contacted	Telephone Number	Primary Contact Person	Position
Agua Fria—New River Natural Resource Conservation District	379–3058	Jon Hall	
Arizona Department of Transportation/Hwys/Location Sec	255–7711	John Louis	
Arizona Department of Transportation/PAGTPD; GIS	628–5313	Jim Altenstadter	
Arizona Game and Fish Department	789–3607	Eric Swanson	
Arizona Game and Fish Department, GIS	789–3000	Brian Vrooman	
Arizona Historical Society Museum	782–1841	Carol Brooks	Curator
Arizona Historical Society Museum (Central Division)	929–0292		
Arizona Mining and Mineral Museum	255–3791		
Arizona Railway Museum	821–1108		
Arizona State Capitol Library	542–3701	Dale Steele	
Arizona State Capitol Museum	542–4581	c/o Dale Steele	
Arizona State Museum	621–6302		
Arizona State Museum	621–6281	John Madsen	
Arizona State University Map Collection; Hayden Library	965–3582		
Arizona State University Map Collection; Hayden Library	965–3582	Edward Oetting	Head, Archives/Manuscripts Collection
Buckeye Valley Historical & Archaeological Museum	386–4333	Michael Sullivan	
Buckeye Valley Historical & Archaeological Museum	386–4333		
Casa Grande Valley Historical Society Museum	836–2223	Michelle Dickey	Director
Chandler Museum	786–2842		
Chandler Museum	786–2842	Al Wiatr	
City of Yuma	343–8639	Phil gourley	
City of Yuma Development Services	343–8692	David M. Campbell	Director
Coolidge Historical Museum	723–7186		
Coolidge Historical Museum	723–7186		
Corps of Engineers, U.S. Army	640–2003	Paul LeBrun	
Department of Interior, Bureau of Land Management	650–0526	Jim Hutchinson	
Department of Interior, Bureau of Reclamation	343–8100	Earl Burnett	
Desert Botanical Garden	941–1225		
Environmental Quality, Department of	207–4416	Wayne Hood, III	
Game and Fish Department	942–3000	Eric Swanson	
Gila Bend Museum	683–2002		
Gila Bend Museum	683–2002	John Laird	
Gila County Engineer	425–3231, x313	Robert Byall	
Gila County Planning and Zoning	425–3231, x372	C. Roberto Bigando, Jr.	
Gila County Recorder	425–3231, x232	Linda Haught Ortega	
Gila River Arts & Crafts Center & Heritage Park	963–3981		
Gila River Indian Community	562–3301	Cecil Antone	
Graham County Engineer	428–0410	James Moser	
Graham County Historical Society Museum	428–1531	Mara Archibald	
Graham County Recorder	428–3560	Greg Innes	

Gila River Navigability Study

Agencies/persons contacted for literature search & information request

Agency contacted	Telephone Number	Primary Contact Person	Position
Heard Museum	252–8840	Mario Nick Klimiades	
Heard Museum	252–8840		
Laguna Natural Resource Conservation District	726–5562	Bobbie Stevenson	
Maricopa Association of Governments	254–6308	Leslie Dornfeld	
Maricopa County Assessor, Records Department	506–3266	Bill Kennedy	
Maricopa County Planning Development	506–3951	Richard Turner	
Maricopa County, Flood Control District of	506–1501	John Svechovsky	
McFarland Historical State Park	868–5216		
McFarland Historical State Park	868–5216	Katie Montano	
Park of the Canals	644–2230		
Arizona State Parks Board	542–2146	Judy Krauthamer	
Phoenix Museum of History		Bill Soderman	Community Relations
Pinal County Historical Society Museum	868–4382		
Pinal County Historical Society Museum	868–4382		
Pinal County Planning and Development	868–6442	Phil E. Hogue	
Pinal County Recorder	868–6391	Katie Felix	
Pinal County, Flood Control District of	868–6501	Tom Nichols	
Quechan Indian Museum	572–0213	Fritz Brown	
Quechan Indian Museum	572–0661		
Salt River Project	236–6025	David Varela	
Tempe Historical Museum	305–5100		
Tolleson Public Library	936–7111	Sheryl Pieper, Director	
University Library, Special Collections Department	621–4300	Peter Steere	
University of Arizona Library, Central Reference Department		Ms. Atifa Rawan	Arizona Documents Librarian
University of Arizona Library, Special Collections Department		Lou Hieb	Head of Department
University of Arizona Map Collection	621–2596	Charlene Baldwin	
University of Arizona, Advanced Resource Technology; GIS	621–2489	Robert MacArthur	
U.S.D.A. Farmers Home Administration	726–4707	Robert Lanford	
U.S.D.A. Soil Conservation Service	280–8838	Dwight Curtiss	
Water Resources, Department of	542–1541	Terri Miller/David Creighton	
Wellton–Mohawk Fine Arts & Historical Museum	785–3333		
Wellton–Mohawk Fine Arts & Historical Museum	785–3333		
Yuma County Development Services Director	329–2300	Harold Aldrich	
Yuma County Library District	782–1871	Diane Stratton	
Yuma County Recorder	329–2061	Susan Hightower Marler	
Yuma Crossing Quartermaster Depot Historic Site	329–0404		
Yuma Crossing Quartermaster Depot Historic Site	329–0404		

Appendix D

Oral Histories

MINISTER: Well the 24th of July's important, and when you were a boy, do you remember the pageants? Could you describe a little more of it?

PACE: Oh, yes. Some would dress like Indians. They would shoot off powder on the anvil. Boom! And we'd ride horses. I remember we wanted to go to a 24th of July celebration at Eden. That's fifteen miles. We just saddled up in the morning and went to the celebration and came back that evening.

MINISTER: Were there speeches that were made, plays?

PACE: Yes, and we had an old man here for a long time who had pushed the handcart across the plains. How on earth could they do it? There were so many, many lost. Six thousand people, I think. He would get out and parade. Now they take the family, put them in old style clothes, and push handcarts.

Oh, I don't know, but our association with the young people was different than I think it is now. Of course, I don't know how it is now, but we had to entertain ourselves with what we had. We had no radios. We had no TV's. It developed us in a lot of ways. I remember taking the team and wagon and going out to the reservoir to go swimming for Easter. We would have hayrack rides. The dancing was upstairs in timber over the doors and windows to pay for tearing it down. This was a tizwin party. Tizwin is made from corn. I saw some of it, but I never drank it. This is one of the tanks, went up in the nineties. That horse stable was built in 1872, if I'm not mistaken. To tell you the truth the lumber that came out of that building was the finest lumber I've ever seen. This was one of the big twelve by twelve tanks, Swedish steel. When a trucker came down after it, he got on the truck and said, "Oh, take it off."

MINISTER: How old was that town, San Carlos?

PACE: Started in the seventies. This was the jail. Seven or eight prisoners in there when I went down. This was the school house. There were about a thousand tons of sandstone in that building. The corners of that were perfect, and the water table was perfect.

Everybody that had ever shot any dynamite was the best dynamite man on earth. They knew all about it. I sent a picture of the building to the powder company, and they said put black powder under it, and it ought to raise the building. The foundation is there. I will bet them they can't raise it that way. I had the building half drilled for shooting before the first man came that knew what he was doing. He'd been in demolition for the Utah Copper Company. He said, "Well, lot of big valves and pipes and one thing or another. "What's taking on here?" "Oh, you bought a water system. This is an irrigation system." There wasn't anything you could do about it, because they had no business selling it, and they had you on the hip. So we wound it up in about eight months. Mostly the buildings went to individuals who came and took their own building down. We took some of them down, salvaged the pipeline that was put in before the turn of the century, and a cast iron pipeline. We cleaned it up and sold it to the local utility company. It was heavier than what they were buying. We sold it within ten percent of what their new pipe would cost. After all those years, it was really better pipe, heavier pipe, and we cleaned it up in better shape than when new. Had I been an experienced wrecker I would have held on and run into the depression. See, this was right before the stock market crash.

We bought different things there. Here's a tepee with tizwin drinkers.* This is an old agency building and different. These are the houses they pulled off, and these were the big buildings. This is a shop building. We went in and shot the corners of these buildings, then put a cable through them and over the wall. Had a big truck, and we'd take a run and pull the walls over. I think this building had enough

*Reference to photos during this topic

English teacher at the high school. They went to Tucson where she taught school and put him through the U of A, a very, very fine person.

MINISTER: Right okay. Well, [audio interruption] our interview with this San Carlos story, you were in . . . would you describe the kind of business you were in for us and what you did there in San Carlos?

PACE: I was trying to make a living selling hay and grain, alfalfa seed, whatever came along. I bought the mohair clip one year. Mohair was quite an industry in those times. For your information, mohair is from the goat, and it brought in a hundred thousand dollars to Graham County a year. I bought the clip one time. A friend of mine told me about San Carlos Indian Agency being for sale. I went down and looked around and bought it. No one could identify what all they were selling me. So I just went off to one side and said, "For everything at San Carlos." Likewise, I signed a contract to take San Carlos out in 60 days which couldn't be done. Likewise, I had to level the walls, and to level the walls could mean a lot of different things. So when they came in and hauled off a bunch of buildings, I said, "Hey, there, what's taking on?" They said, "Why you didn't buy these. Had no business selling them to you." They came in and hauled off a took on on the freight road. I remember one of them telling me that they got down to the Gila River, and it was flooding, and they couldn't get across. They tapped a fifty gallon barrel of whiskey they had on the wagons. When they tap a barrel of whiskey, you raise up a hoop, drive a horseshoe nail in, and draw what you want, then let the hoop back down again. He said that when they got to Globe they had it all arranged. They grunted and groaned and set this barrel down in the warehouse empty. They drank that whole barrel of whiskey.

*End of
e 1,
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Nearly all of it was farming and cattle. Supplemented on the freight road.* They'd go in by Munk's Ranch to Wilcox. I think of so many of those happenings on the road. They started issuing shoes to the Indians. The Indians didn't want those shoes. They were good shoes. So they started selling them to the freighters. The agency put on guards at the line to search the wagons for them. I remember one fellow who knocked the top of the water barrel out and nailed these shoes to a board and put them in the water barrel, then put the top back on to it. That's the way he went around the Indian Service guard with those shoes. Oh, that was a rough time, and they had some fights there with the Indians at Black Point and different places. It wasn't any too healthy. Of course, quite why Solomonville, Safford,and Thatcher are so close together. How did that come about?

PACE: Well, young lady, they were horse and buggy days. When the cement road came in from Thatcher to Safford, we noticed the competition out of the Safford stores more. Pavement didn't do us any good. We had three miles. It was five miles between Safford and Solomonville. The automobile has changed it around. When you got in a horse and buggy, three miles was a nice little drive.

MINISTER: Can you tell us what the occupation of most of these people was?

PACE: Well, all right, the people came in from Utah and other places, Alabama and one place or another. They settled at Pima first, then came up to Central, and then they settled across the river. They made most of their clothes. I remember one aunt made the gloves, one aunt made the hats, and they lived on what they grew. They all got so tired . . . the old timers tell me about how tired they'd get of sweet potatoes.

They had to have a little money to pay their homestead entrance, their hardware; so they went on the freight road. They freighted from Wilcox to Globe. And there is where you get your real stories about what

MINISTER: Okay, so The Big Six and then your mother's table was sort of the center of the community and the travelers...

PACE: Well, we ran a transfer business. See at that time the traveling salesmen would come with their samples in big trunks. They didn't know how to reduce it like they do now. They would come to the sample room at the hotel, open up, and the merchants would go there and buy from them. Later, when I got into it, we would go to Safford, and they'd set up there and sell to us and the other merchants. We had teams and hacks and would haul the drummers when they opened up in Pima and Thatcher. That was the way things were done earlier.

MINISTER: Well the closest city was Tucson and if it hadn't been for the big cities, how would they have gotten their goods and things?

PACE: Well the funny thing of it is that Denver was our jobbing point. I remember Star Chewing Tobacco came in in wooden boxes. I remember them coming out of Denver. When we first started trading with John Deere, their headquarters were in Denver. I remember the Capital horseshoe nails came from Denver, and I don't know where the groceries came from. They had

CONTENTS

INTRODUCTION

Donald Clyde Pace was born in Nutioso, Apache County on January 21, 1896, the year his family moved to the Gila Valley area where Pace has lived ever since. His father, William Wilson Pace, a Representative and a Senator in the both the Territorial and the State Legislatures, was one of the founders of The Big Six, Thatcher's general merchandise store. Pace graduated from the Gila Academy, worked in The Big Six, served in the First World War, and worked for a time in Phoenix in the feed business. He continued his education whenever the opportunity arose, studying at the Lamson Business College in Phoenix, the University of Arizona, and Stanford University.

Pace managed his own wrecking and salvage business, traveling from coast to coast to find buyers, always on the lookout for useful discarded items, and hauling freight to take advantage of empty trucks on return runs. Among his notable projects, he bought the town of San Carlos for $506 and wrecked it to make way for the San Carlos Dam waters. Pace is fascinated with salvaging from the engineering point of view, but he also holds high regard for the value of castoff items and worked tirelessly to find a place for his inanimate "orphans."

Pace has given much time and effort to salvaging people, too, playing an essential role in the Civilian Conservation Corps' projects in the Gila Valley, and he was a key figure in American Red Cross efforts to meet the needs of persons stranded in the Gila Valley during the Great Depression. Don Pace is an active supporter of the Democratic Party and the Arizona Historical Society, having served the Society as President.

Don Pace's life is centered in and defined by the Gila Valley's history and his Morman heritage. The community is small enough to be encompassed in the memory of individuals, and Don Pace is an authority on the Gila Valley folk and their story. He brought all of that authority to his interview which was taken in his home office in Safford on May 6, 1982. The narrator edited his verbatim draft, eliminating repetitions and changing some of his speech to written style.

FSU

ARIZONA ORAL HISTORY PROJECT

an interview with

DONALD CLYDE PACE

by Kristina Minister, Ph.D.

May 6, 1982

sponsored by

The First Interstate Bank of Arizona

a building down at Pima, six miles away. The most desirable orchestra was a Mexican orchestra from Solomonville, fifteen miles away. They'd start from Solomonville right after noon to get to Pima in time to play for the dance. When my brother was putting on a dance at Pima, he would pay the orchestra and pay for the hall. What he had left would be his loss or profit. About the time the orchestra got ready to leave town, members were subpoened on a coroner's jury, and had to stay in Solomonville. My brother went to the school and got a little orchestra. 'Course when he changed the orchestra, he owed an apology. He got this old boy up on a chair to give an apology, and he said, "The Mexicans got caught on the jury. This is the best we could do." The second orchestra packed up their bags, and he had an awful time holding them on the job. We wanted to waltz, two-step, and schottische. They had to quit schottishing because it was upstairs, and they got afraid of the building.

They'd hook up the buggy, and if it was cold, we'd put on the side pieces, go down and back by horse or team. I don't think they ever took the hayrack quite that far. That's quite a long ways in horse and buggy days.

We rode the flume. The flume ran from the sawmill down to the foot of the mountain. They would saw the timber on the mountain and then put in this flume. In ten minutes, twelve minutes it was down there in about that many miles. Oh, it would really go! Sometimes jump out of the flume. We'd go up and pick a place that wasn't too steep or too far up. We'd walk up, and then ride it back. The girls would put on overalls, and that was something different in those days. They didn't dress like they do now.

I remember when we were in high school, which was a Church school, one of the girls went downtown in bloomers, stockings up to the bloomers, and a jacket. The president of the school gave her all kinds of fits for going downtown dressed like that. How things have changed!

MINISTER: Tell us the story about the blacksmith, just before he was ready to pass on. What was his name?

PACE: James Ellsworth. This will lead on to something else. Old man Ellsworth, the blacksmith, was part of the Browning Machinegun Company in Ogden or Logan. I'm not sure which; I think it was Ogden. He pulled out and went to Moab, Utah, and then into Snowflake with Jesse Smith when they settled there. Jesse Smith's wagon broke a tire. He took out the forge, welded the tire, and set it out there on the highway. He went into New Mexico and then he came down here in

AS 1

ARIZONA ORAL HISTORY PROJECT

an interview with

RALPH W. BILBY, Sr.

by Kristina Minister, Ph.D.

March 17, 1982

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The First Interstate Bank of Arizona

INTRODUCTION

Born on September 15, 1891, in Concho, Apache County, Ralph W. Bilby, Sr. attended the one room school there before his family moved by wagon down to the Gila Valley in the Safford-Thatcher-Solomonville area. After he graduated from the Gila Academy he married Marguerite Mansfield and shortly carried out a promise made to her: that he would attend the law school at the University of Arizona. Traveling by horseback to Tucson, (with Mrs. Bilby following by train) he took the teacher's examination and taught school one year before entering the law school and working odd jobs on the side. He passed the bar examination before earning his law degree, and he has practiced law at Tucson ever since. But Graham County continued to figure in Bilby's life, because early in his career he was called there as a special prosecutor in the notable Blackburn versus Arizona case which he describes in detail in the present interview.

Bilby is a member of the American College of Trial Lawyers. He is a vigorous supporter of the University of Arizona and its College of Law, serving as president of their alumni associations. He has been Chairman of the Pima County Republican Party and has attended three Republican National Conventions.

The interview was held on the afternoon of March 17, 1982, at the law offices of Bilby, Shoenhair, Warnock, and Dolph in Tucson. The narrator was very serious about his interview and evidently had engaged in thoughtful preparation since our preliminary meeting. Only once did he indicate that he required a question from me. Mr. Bilby was highly aware of the potential audience for his oral history, and before beginning the tribute to his family and Arizona, he rose to his feet to deliver the speech in formal style. The narrator made a number of precise alterations to the verbatim transcript, being especially concerned with accuracy of fact.

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I imagine it was a pine tree, a small pine tree--trimmed the branches off, took the big end of the pole, and put it . . . tied it to the front axle of the wagon, and carried it back to the hind wheel . . . where the wheel had been shattered, and tied the axle and the pole together, so that the axle was resting on the pole, and we just dragged the pole along the ground. We went on in to Pleasant Valley hoping and praying that there would be a spare wheel around there somewhere.

We got there and sure enough. We got the wheel, and it fit our wagon. I remember how elated I was.

I remember we talked to old Mrs. Tewksbury who was the mother of one of the families involved in that war I told you about. Stayed there a night or so, went back, and our flour was safe. We reloaded it and completed our job. But that was quite an experience for me as a youngster.

MINISTER: Yes.

BILBY: We . . . my father left that country because it was so difficult to eke out an existence there. The season is much shorter there than in the lower, warmer parts of the State. And the crops that could be grown are limited. So he decided to move down to the area around Safford; it's called the Gila Valley. And in order to move, we had to use our teams and wagons. That was the only means of transportation. We took two wagons and two teams. Took some spare horses that we had and some cattle. And I, as a little boy, not quite nine years of age, had . . . was assigned the job of helping to drive the cattle and the horses.

We went out through Springerville up on the mountain at a place called Alpine and then to Nutrioso. And then to get to the Blue River--we had to go down a rather steep mountain. My sister was driving. My sister, Harriet, was driving one of the teams. My father was worried for fear she couldn't brake the wagon, hold the brake tight enough to keep it from running away with her and running right over the horses. There was a steep incline. He again improvised. He cut a pine tree again. Took the tip end of it, tied it to the wagon so that the brushes . . . branches would be pulling against it. And she got down the hill that way.

We went right down the Blue River into Clifton. We must have crossed that river a hundred times. It was not a big stream. It'd be knee deep for the horses. Of course, we traveled slowly with the cattle and the wagons. I don't know how long it took, but it must have taken ten days to two weeks to move . . . . one county to the next one.

I remember we got down to Solomonville--or right near Solomonville where the Gila River comes into the Gila Valley there--on the first day of June, 1900. I was born in*'91, so you see I would not have been nine years old. It wasn't yet September. I must have been quite a sight. I had lost my hat; it had blown off in the river, and I was wearing a red bandana handkerchief around my head, and was riding a little bay horse. And was sunburned to a crisp!

*September, 1891

In any event, my father had been there before and had arranged to buy a piece of property. We went to this property and settled there. This was another farm, but it was much more hospitable country, as far as the climate was concerned. I remember my father planted a large orchard; raised alfalfa, grain.

I remember our farm was right along . . . running along side of the railroad track. There was a railroad running from Globe to Bowie where it connected to the Southern Pacific Railroad. An intriguing thing to me was to see that train go by and to see the Indians that used to ride the outside of the train. In order to build this railroad, they had to cross the Indian, Apache Indian Reservation, or part of it. And to induce the Indians to

"This is Carol Brooks and today is the first of March, 1990.
Today I'm interviewing Laura Killman who moved to Wellton area in 1919, and we're going to find out about her life and the life of the town of Wellton also.

"Laura, tell us about where you were born and when, and about your family."

Laura: "Well, I was born in Yuma Valley on 11th St. and County C, in a tent under a mesquite tree, in 1913. And my Daddy helped build the Laguna Dam. He had teams and he took his teams and wagons and helped haul the cement and everything up there when they were building the Laguna Dam, and then --uh, Mother came to Yuma in 1903 and Daddy came in 1904, and Mother was going to Crane School at the time that they met. And, 'course Daddy was farming in the valley and working with his teams, hauling, --- the government took all of Daddy's hay. He had a hay farm and the government took all of his hay for the teams at the Laguna Dam. And Mama was going to Crane School and Daddy sang in the choir, and the first time Mama went to church and heard Daddy singin' she said, 'That's my man if I never get him.' And she finally got him. And they were married seven years before I arrived on the scene. And then, in the meantime, my Granddad, my mother's father had quite a garden and orchard down on First Street, right close to Joe Henry Park. I can't go down and find where it was, but it was right near Joe Henry Park--east of it, I believe, and Daddy had---Grandpa, Mama's Dad, had quite an orchard. He raised lots of fruits and vegetables, and at that time the prison was still there. So my Mom had a little team of mules and once a week she would go up and load up a lot of watermelons and cantaloupes and all kinds of vegetables, and the fruit off'n the fruit trees and things and go up to the prison and Mrs. Ingram was the warden's wife. Mrs. Ingram. Anyway they would open the gate and let Mama come in with the little wagon and they would let the prisoners out, one at a time and they would buy the melons and the fruit and so on, but---by the way, these prisoners were allowed to make all kinds of jewelry. They made some beautiful pins and things out of mother-of-pearl that was furnished them, and then, as they sold them, they got to keep a small amount of the money. Of course, the prison got the rest of it. But they had their own money, and if they wanted to come out and buy a watermelon or a cantaloupe, they was allowed to come out, one at a time, and pick what they wanted off of Mama's little wagon and that was part of Mama's helpin' out when they were first getting married and then she would, what was left she always gave it to Mrs. Ingram--what she hadn't sold, she would give the rest of the fruit and stuff to Mrs. Ingram.

"And then, Mama helped with the farmin' and everything and then, when I finally arrived, why, they was a-growin' some kind of fancy cotton that came--they got the seed from South America and my Dad help put in that first crop in the Yuma Valley and they hand-picked every boll of it that they wanted for special seed again, to use for their next crop, and they wouldn't let 'em go through and pick it all until these guys went through and picked the certain sized boll, so many locks to each boll, and certain size and all of that stuff, and they saved that --- I can't remember the name of that cotton. It was something special that they worked on again later for -- but I still can't remember that special name it had, but Dad and Anderson Cypert---was a farmer next door---he eventually bought our *place when we moved to the Hot Springs. And my Daddy had one of the first three threshing machines that they ever put out---that came to Yuma Valley. And so Daddy could go to the door and call everybody by name all over the whole valley 'cause he helped with the threshing. And before they got the Laguna Dam finished, they irrigated by an old--what they called the Ludie canal, and it was all gravity flow, and where it came out of the Colorado---at that time, the Colorado, there was no dams up the country and there was nothing to settle it, and that water was so thick you could practically cut it with a knife. It was just red gooey mud and it would plug up their canal, so they had an old dredge thing of some kind there, and each farmer had to put in so many days a week keeping that mud away from the heading, there, so that they could get the water in to the farmers to irrigate, and someplace I've got a real good picture of that gang, some of them standing on that old job. If I can find it, you can have it for your notebook."*

Carol: "Oh, we'd love to have it."

Laura: "But that was the Ludie Canal. He was the engineer that engineered that first old gravity flow project in the Yuma Valley, as far as I know, and my Daddy was one of the farmers that used to go and help take care of it and farm there. And then, my Grand-dad got, he was down with uh--this was several years later. In the meantime my Dad went to Camp Verde and did some canal work up there--contract work, and we moved up and back with teams and wagons, and then when we came back from there, which was in 1916, I believe, and Grandpa, (that's my Dad's father) had psiatic rheumatism or that's what they called it. And some old man came and stayed and, well he camped just here and there. He didn't have any money but he had a team of little mules and a little hack and Grandpa, of course, had this garden and everything and there was lots of grass around the fence rows, and Grandpa told this old man that, if he wanted to let the little mules pick the grass around the fence rows, of course, and keep 'em tied as long as he did the thing, why it was fine with him. Which, the old man, his name was, I believe, Henry Forest. And, as I said, Grandpa was getting down to where he was really---he couldn't get around, period, and this old man stayed around for a couple of months and he told my Dad and my uncle, a younger brother of Dad's, he said, 'You know,' he said, 'out near Wellton,' he said, 'I've got a homestead out there that I believe would help your Dad if you could get him out there.' He said, 'It's a little hill across the river from Wellton, a little red hill out in the valley and uh, well, Dad and Uncle Raleigh decided that it was worth a try so they put a little mattress in the back of this little wagon, and they loaded Grandpa in there and they headed for Wellton and crossed the river, at that time the old man just called it the 'Hot Springs.' And he said, 'There isn't anything there,' he said, 'but the old pole house.' He had built---to prove up on it this old man had had to build a cabin, so he had made a house out of cottonwood poles and---mud, and so Dad and my uncle brought Grandpa out there and they stayed at this little cabin and it was probably, oh----three, four hundred yards down to the river bank, and down at the river bank, then, where the main Gila River hit, it came in and hit the side of this little mountain and it kept, there was a big hole of water there all the time, because there was no dams up the river and the water, the river ran all the time. We had to cross the ferry at Dome to get out here. There was no bridge at Antelope Mountain. So Dad and Uncle Raleigh put Grandpa down there in that hot mud. That was the only thing that they *could do; there was no well or anything and they would just dig a trench down in that hot mud and they would put Grandpa---they would haul him down there in the little wagon and they would put in that hot mud. And in two weeks time Grandpa was walking."*

Carol: "Well, I'll be!"

Laura: "And that's how come the Worthington boys bought the Radium Hot Springs. In 1919 we moved out here in this area. And our closest neighbor was four miles, and that was the cattle ranch. That was the Chappell boys. At one time Jim Chappell was the very famous sheriff in our area. But anyway, that was how come the Worthingtons to buy the Hot Springs.

"Well, when we came out there, of course, there was nothing up the valley. It didn't exist----no railroad or anything in the Mohawk Valley. So, the first year, the school season of September of 1919 and 1920, they made me stay in town and live with my Grandmother. And that didn't work very good because I couldn't have my horse. So the next year, then, Daddy said, 'O.K., young lady, if you want to ride to school, you'll just have to ride to school.' So I rode from the Hot Springs, which was eight miles across to Wellton School, and down at our museum, we've got a picture up in the corner, of ten little kids and a little 12 x 14 building up on a hill over here, back of the golf course. That's where the school was at when I went to school the first time. Well, instead of having it, in the meantime they were working on a new building in Wellton. But they didn't have it ready for school in September, so we had to go to school out there until the first of the year and then we kids all walked and carried our books and went down, for the first of the year, then to what was your old library building. That was just the one big building with the little ante room on each side. That was the only thing. One teacher taught all eight grades in that one big room, and I can see 'em yet; we kids all took up a collection and bought Lincoln's and Washington's pictures, and we had one on each corner, looking west. There was one on each side of that building up there. I don't know what they ever done with those two big pictures, but oh, we kids were so proud of those pictures---one was Washington and the other'n was Lincoln. And I have one of the old clocks---the first clock that they had. It's in the museum down there---at that building. And I think there was---it's disappeared---from the Museum or else it is put away and it's been put away 'til I can't find it. We had a picture of all of us kids that day when we went down there; I think there's about 17 of us and we have a picture standing by the side of the door of the new school, but I cannot find it. I've just got to go down there and dig some more, because---we've got the old one, up on the corner. There was ten kids up there, and then that year the school had improved and then 'course the railroad is what kept Wellton going----was the section houses and all of the kids and uh, so, by the time we got---I think there's 17 or 18 kids in this other picture, and of course I'm right in the middle. I've just got to get hold of that picture again, so we can keep the two of them together, but I don't know what's happened to it. It's got my name across the back of it in big letters. And the teacher---the first teacher's name that we had, her name was Hattie Skidmore. And in this diary now, this man talks about that one day that the teacher was sick, Mrs. Skidmore was sick and he had two kids that they didn't go to school that day because Mrs.

Skidmore was sick. I probably rode right beside the man's house comin' to school every morning, but I cannot place that gentleman.

Carol: "Now let's back up a little bit and you tell us your father's name and his parents' names and where his parents were from."

Laura: "Dad's father was James Monroe Worthington, ---J.M., that's right, and they were from Texas. And Dad's name was Joseph Harvey Worthington, and, course, he was born in Texas, I don't know what town, but he was born and raised in Texas and he worked on the X.I.T. Ranch before he came out here. That was one of the big cattle ranches back then.

Carol: "Do you know how long he worked on that?"

Laura: "No, I don't. And another thing I do know, though, that my Daddy and a friend of his, they used to run--help--they worked all over the area, back in Texas and New Mexico, and they would make the cattle drives through to Kansas City and they also would come over into New Mexico, and the old gentlemen, Price, I don't know what his first name is that found and put---went into the first time the Carlsbad Caverns---my Daddy and his buddy tied their lariat ropes together and let that man down in there the first time he ever went into the Carlsbad Caverns."

Carol: "Now what was your father's mother's name?"

Laura: "Ibby Belle Allen."

Carol: "How do you spell her first name?"

Laura: (Laughs---long pause) "Ibby Belle, is all I know."

Carol: "Okay. What about your mother's family? What was her name and what were her parents' names?"

Laura: "George L. Ricks was my grandfather on my mother's side and they moved out here from Texas. Grandpa was working for a big sheep company. He took care of all the windmills that uh, in Texas, and then, Grandpa was allowed to run 1,000 head of sheep for his taking care of the windmills, and a small salary, I don't know. It wasn't much, but anyway that was my Mom's first job. Her and her older brother had to take care of the sheep, and do you remember the little picture in the paper that Bob Worley put of the picture when we moved out? She had put sheep on the cake and that's when I said, 'Oh, no, my Daddy was a cattle man,' and so Louise run home and made up some color and she put horns on these sheep and she put spots on 'em and --- it was cute and she got the biggest kick out of it, but, anyway Mama was out of a sheep family. Of course, by that time, I guess the sheep men and the cattle men had got to where they didn't fight so much, but anyhow, that was how come the families got together when they came out here. And Grandpa Ricks traded a piece of property in Texas for a piece of property out here, <u>sight unseen</u> and when he got out here the biggest part of it was in the Colorado River. So they lived down on the river bank and farmed part of it and the rest of it was in, I don't know, what, eventually I think the Bureau finally bought it from him or something, but anyway, that was how come the Rickses to come out here. And

Granddad's father fought in the Civil War and I have an old rifle that Grandpa's father fought in the war with and Great Granddad traded a section of land for that gun. Either guns were awfully high or land wasn't worth much, I don't know. Anyway, it's an old cap 'n' ball rifle. And that was the Ricks family."

Carol: "Did your parents or grandparents ever tell you what they thought about this area when they first moved out here?"

Laura: "I guess they liked it. They all stayed here 'til they passed away."

Carol: "Let's go back to: you were talking about the Laguna Dam. How long did your father work on that?"

Laura: "Oh, it must have been three or four years. And in the meantime while they were working on that, they began putting the siphon under the river."

Carol: "Was he involved in that?"

Laura: "Well, anything that had to have cement hauled---Daddy would---but it was closer to town, see there was no railroad up there so they could get their cement from in town there, off'n the railroad; by that time they had the railroad through there. And, uh, I think eventually they finally put a track up to Laguna Dam after they had the biggest part of it put in, but it was later on and that water was so thick and muddy that they had to keep those "slush gates" they called 'em where they could open it up ever so often to flush the mud down and then that---oh, you just don't realize how thick that old red water was that came here from Grand Canyon."

Carol: "Where did your mother do her shopping in town, when she was in Yuma?"

Laura: "Harry Brownstetter had a big department store on Main Street. There was three stores and fourteen saloons, my Daddy said, when he came here. And Sanguinetti's, E. F. Sanguinetti owned a store on one corner, and Mr. Brownstetter had a store up a little further and across the street was Harry Goldsmith's. And Mother sold butter to Mr. Brownstetter. And when we left and moved out here, he had to have that cow. He bought that cow, and Mama said he had to have it, and I don't know who took care of it, but I remember that he bought that cow, and 'course, we had several and Daddy tied the one to the back of the wagon and that was my job to ride the pony and make the calves all would keep up with that cow that was tied to the back of the wagon. And we were three days moving out here. It was a long, rough road."

Carol: "What are your earliest memories of Yuma?"

Laura: "Oh, the Southern Pacific Depot. Over at the end of Madison, where the bridge went across, and the ferry, I believe was probably down just a little from it, but anyway, I never will, I always loved to go in, if we could go down to see that, 'cause it was so pretty, they had pretty green trees all around it and a little lawn, and oh, and a big cafe, old Charlie

Sam, a chinaman, had a cafe in the Southern Pacific Depot, and upstairs you could rent rooms. And back in one corner, our doc--I guess our only doctor, Dr. Ketchersides, (his name's on my birth certificate,) anyway, that was ---oh that was, I thought---in the museum down there is--I've got a little vase about that big around and about this high and it's got a picture, hand painted picture on it, of that depot. It's beautiful. I always thought that was the prettiest place in Yuma."

Carol: "And who hand painted the picture?"

Laura: "I don't know. Somebody gave it to Mother, and it's just a little vase. Oh, it's only about this high, and the bottom of it's about that big around, but across this one side it's got this picture of the old depot where the bridge went across, and the bridge at that time still, opened up to let the boats through."

Carol: "Mmm--hmm, a swing span."

Laura: "Mmm--hmm."

Carol: "Now, when your family moved out to the Wellton area, where did your parents shop out here? Was there someplace to buy supplies?"

Laura: "No, we had to go to town. We had to go to Yuma for most of our groceries. We bought groceries once a month in Yuma. And Daddy would either go down to Mr. Sanguinetti's and then, eventually there was a Safeway moved in up on Fourth Avenue and Eighth Street, as near as I remember. That was the first Safeway that I can remember. And we used to go down there and Daddy would buy groceries by the case, and flour and sugar and everything by the hundred-pound sacks, and beans."

Carol: "How long did it take you to get into town?"

Laura: "We'd go in one day and get our groceries bought that evening and stay all night with Grandmother--two grandmothers, Grandma Ricks and Grandma Worthington lived there and we could stay all night with them and then we would come back home the next day---and if we hurried, we could make it before dark. The road was rough---deep ruts, and we crossed the ferry at Dome---a little Mexican by the name of Juan Nunez poled the ferry across---he had one arm off right here, and he would put the pole under his arm and then pole the ferry back and forth across, and my Daddy said the first year that we were out here, it cost him $250.00 in ferry crossings. Every time we crossed, it was $2.50. And we had to ship our feed out on the car---box car, to Dome. Oh, Dome was a nice town. It had a nice store there, we bought lots of stuff there, and the post office, and a big freight depot and the Castle Dome Mine brought their ore down and loaded it on the flat cars there, and Dome was a good-sized little town. And we would go from the Springs down with the team and wagon and load our hay off of the box cars and that was the way we had our feed for our cows and our team and, 'course, my saddle horse."

Carol: "Do you have any idea of how many people lived in Dome at that time?"

Laura: "Well, there was some Indians. Just on the West side of Dome, there was a big Indian village there; there was lots of Indians there, and they made their living across over back of McPhaul Bridge, someplace in that area, placer mining."

Carol: "Do you know what kind of Indians they were?"

Laura: "Don't have any idea---whether it was Cocopah and Quechan mixed or what, but they was just--and then some of them worked for the railroad--some of the Indians, but the rest of them went over there and placer mined. But Dome was, of course a railroad, too. They had the section-- buildings, and everything, there were lots of---oh, there must have been ----- 150 people."

Carol: "Do you have any idea of how many Indians were living there?"

Laura: "No, I can't---I would say maybe half of them, because there were Mexicans and Indians that did most of the railroad work. And the school, right this side of Dome, I can show you right where it was at, on a little hump out there, and Mrs. Proebstel, it's in that diary, that lived right straight North of town down here, was their teacher."

Carol: "Oh, she's still alive, huh?"

Laura: "No."

Carol: "No? That's too bad."

Laura: "No, her and Uncle Ike are dead. And, uh, she got snake bit one time. He took her down in the field to do some garden work or something and a snake bit her on the calf of the leg and he had left, and so she laid there 'til noon before he came back after her, and she almost lost her leg, but he brought her over to my Mom's at the Hot Springs and Mama soaked her in that hot water and that hot mud and stuff and within two weeks' time that had healed up and she had a great big hole there where that leg had almost deteriorated, but, uh, she had that big scar there but---she walked with a limp after that, but---everybody called her 'Aunt Molly.'"

Carol: "Do you remember what the houses that the Indians lived in looked like?"

Laura: "Oh, they were all stick and mud houses. Just poles and adobe mud."

Carol: "Mmm-- hmm. And they had their families living there?"

Laura: "Mmm--hmm. There were several other teachers there, but I didn't, I mean, I didn't have anything to do with the school except that I just knew that Aunt Molly Proebstel, we called her, taught school down there for several years."

Carol: "When your family was at Radium Hot Springs, did they ever operate it as a resort?"

Laura: "Oh, yes! Yes.!"

Carol: "Oh, tell me about that."

Laura: "Well, Daddy put up six little buildings there and that was the way we got started. We had an old hand pump that pumped water and he built some tubs out of cement, and people would come out there that were crippled up, and we would put 'em in there and pump this---there was no cool water anywhere; we had to pump water up in the tank and let it cool overnight and then we would put the cool water in the tub and then pump this hot water in there to get it where they could stand it, and then after they got in it, then we could get it as hot as we wanted. And it would kill pain just <u>instantly.</u> They would be hurting so that you couldn't hardly touch 'em and you'd put 'em in that hot water and within a few minutes time there would be no pain whatever."

Carol: "In addition to that, did they also go down and get in the mud?"

Laura: "Mmm--hmm." We charged 50 cents for a bath, and hand pumped the water, but the mud was free. They'd go down there an lay in the mud all they wanted to." (Laughs.)

Carol: "Now did some of them actually live out there for periods of time?"

Laura: "Oh, yes, we generally recommended 21 days. If it didn't do anything for you in 21 days, why it wasn't going to do you any good."

Carol: "How long did your parents operate that?"

Laura: "Oh, I guess----(long pause)---think sold that in ----'54, '55, somethin'--I don't know---I've got the papers at home. Mother and Daddy got to where they couldn't---we didn't have any electricity or anything, and we always had to either pump water with the hand pump, or finally, then some of the guys helped Dad get an old Dodge engine and they fixed a pump on that you'd go down and crank this old Dodge engine and it would pump water up in the tank, and also into the bath tubs for that hot water."

Carol: "How did people find out about the Springs."

Laura: "Just word of mouth. Somebody'd come there and it would help 'em and they'd go tell somebody else and we had people there from all over the world. There was one old---two Frenchmen that came from New York State and one of 'em was just solid eczema and the other one was paralized on one side. He couldn't use his one lame leg. He just barely could drag his---it took him a half an hour to walk down to the bath house and, uh, they stayed a year, and when they left they were both out there in the field, workin' in the hay and they said an old Indian back there on the river, someplace in New York State---they met this old Indian some place and he told them that, if they would come to Yuma and come up the river from Yuma, he didn't know how many miles, and you'll find this spot, and he said, "You stay there ---you stay there one year, and it sure---it cleaned that old boy off that had eczema, and within two weeks' time, he was just cleaned off just slick as could be---and the brother that was paralized, he would take his watch and put it in his teeth (to wind it) and when he left he was *out in the field buckin' bales just---oh that water is wonderful---I know what it'll do, it was just the idea that I didn't have the money to take care of Mama and Daddy and pay the water assessment charges, which I couldn't get money to put the land in, and the farm was just----costin' me $1900 a year for water, to the District, and I couldn't farm it so all I could do was sell it, and then I brought Mother and Daddy over here and took care of them 'til they passed away."*

Carol: "What was the last year that it was operated as a resort?"

Laura: "It must have been the middle ----- fifties----I don't know. Karen---the other girl---she wanted some information off of some of this stuff and I brought these death certificates, hoping that she would---I thought she was the lady that was coming out, and I was gonna let her look at these and see if she could get some information that she wanted off of it, but anyway---I'll get in town sometime and hunt her up."

----"Laura, we could make copies, if you wouldn't mind, and---"

Laura: "You could, I guess." (-------? Not very clearly audible)- "Because she wanted this bunch of stuff on the family tree and I'm no good at fixin' out all that stuff, so I was gonna let her work off of these---I thought maybe the death certificates would help her out some, so that's the reason I've got all this stuff together and I was gonna have---"

Carol: "You talked about the cabins that your father built out there. Who was responsible for feeding these people? Who was responsible for cleaning up the cabins?"

Laura: "My mother cooked for all of 'em that didn't wanna cook----each one of the cabins had a little stove in it and a bed, and they could do their own cookin' if they wanted to, or it they had somebody to take care of them. And I have got some pretty good pictures of the old place with the cabins and things, and then, later, when old man C. W. Tainter built the power line---he bought some property over in the valley, and they got the wells going there and he farmed part of---I guess, 160 acres, or I don't know the exact amount, but, anyway, he built two big houses. He built a "bunk house" he called it, 'cause he hired quite a few men, and they --- the old house that Grandmother Lattie bought and moved up on the corner, right down the road ---across the road and down there to where you go down to Wert Grover's, and anyway, where that big house burnt on the corner there, that was one of the houses that was moved from the old Tainter place, and Daddy bought the other one and we moved it down to the Springs, and your Aunt Hanna lived in it here in Wellton for----that's the old house that we had over at the Springs. Umm-hmm. I helped Daddy and them move that old house. My Daddy used to move houses on the side, when we had --- of course, there weren't many people come in those days and you had to do what you could, and my Daddy was a house mover as well as a land leveller, and when I was little, my Daddy would tie a rope around my hand and I would crawl under the house with this little rope tied to the end of a chain, and when I got through, they would get hold of the rope and pull the chain through, and then they pulled the timbers through with the horses---and I was the gopher. I crawled under the houses and everybody said, 'Well, weren't you afraid?' I wasn't afraid of snakes and gophers and scorpions *and things like that. They didn't make any difference, but it was so much easier. Men couldn't get under there."*

Carol: "Was there ever anything under the houses, when you got under there?"

Laura: "Not that I can remember. Maybe a skunk or two, and they'd take off the other way. (Laughs.) They don't bother you if you leave them alone."

Carol: "Now, when your mother did the cooking, was there a separate place that everybody ate, or ---"

Laura: "Yes, we had a place called the Cook's camp, and Mama raised lots of chickens and we had hogs and the cattle and everything; we did our own butchering. And by that time, there was a few homesteaders beginning to get started up in the Mohawk Valley again, and there was an old fellow up there by the name of Louis Macy. Now, I don't know how he spelled it, but he's also in the diary. This guy had gone over to Louis Macy's to borrow the chain blocks to work on So-and-so's car. But, anyway, this Mr. Macy had a hand-dug well to water, which was probably 18, --- 15 to 18 feet, but it wasn't far to water. And he told my Dad, if he wanted to try and put in a little patch of hay and feed for our stock so that we wouldn't have to haul it clear from Yuma yet, why that he would go ahead and help him get that well fixed, and he bought a little old Chevy motor and a six-inch pump, a centrifugal pump, and o'course, I doubt that you know anything about pumps, but anyway, a centrifugal pump will push a long ways, but it won't lift. You've got to have 'em sittin' right practically in the water, to get 'em to pick up the water. They just don't have that much power, but after it's picked up, why then it'll push it a heck of a ways. So anyway, this old man put that little old Chevy motor down there, and my Daddy irrigated this little piece of alfalfa out there, and then they got the bright idea that they were going to put in some cotton, and as far as I know, it's the first cotton ever raised in the Roll valley, and we had ten or twelve acres of cotton, and I helped Daddy irrigate that cotton. I could <u>run</u> down to the end and tell him when that row was out, and he'd turn it off and put it on the next row of cotton, and I never will forget it, because when Daddy got through, we had to haul it, by the way, down to Dome, across the ferry with the team and into Yuma to the gin. But, anyway, when we got it all harvested, Daddy gave me fifty dollars for helpin' him with the cotton. And I thought that was really somep'n. But as far as I know, that was the first cotton in the Roll valley."

Carol: "What kind of problems did people out here face as they started growing crops?"

Laura: "Well, when they commenced puttin' in the dams up above, then they dried us up completely."

Carol: "What did the farmers do then?"

Laura: "That irrigation project in those days was the Wellton-Mohawk Municipal Water Conservation District." (Ed. note: It was the Mohawk Municipal Water Conservation District.--The "M.M.W.C.D.")*

Carol: "When did they start that?"

Laura: "Oh, it must have been in the middle twenties because by that time the railroad was coming through. They had got the railroad through, and the wells then, they began, as the river dried up, the dams up above dried the river up and the railroad was---yeah--that was the middle twenties that they had, because in '33, we bought the --- well, they call it the Gatlin place now, but anyway, it was down close to---back of Mrs. Ming's old place---the old Gatlin place, there that was the first place that Floyd and I bought, then we farmed a little while up there, and then we turned around and sold it to whoever Mr. Gatlin was workin' for."

Carol: "You mentioned Mrs. Ming. Is she related to the Mings in Yuma?"

Laura: "Yessum. A. B. Ming and Mrs. Ming---he was the County Assessor, and they helped my Daddy get the first school in the Roll Valley. He was the Assessor and the School Superintendent was Mrs. Spaulding. (Sp?) And they didn't have any money. The county didn't have any money. So they told my Dad that, well, Daddy, in the meantime, I was riding to Wellton to school, horseback, so, to keep me from having to ride so far, my Daddy went to Phoenix and bought a school section, which, every so far, if you look on the old maps, is a school section, every so many miles, and Daddy went to Phoenix and bought this school section and then personally built this little house that we were going to live in when we were getting ready. In the meantime, we still had kinfolks that were taking care of the Springs for us, and so we were going to move up there and farm. They had finally got one well down on the corner of our property. And so, the Mings said that if, well, Ming and the Supervisors, as I said, he was the Assessor. And, I forgot what Mrs. Ming did. She did--she had a job up at the courthouse, too. I don't remember what it was."

Carol: "Was this his wife?"

Laura: "Mmm-hmm. And Mrs. Spaulding was the Superintendent, and she told Dad if he built a house, they would furnish the teacher and the books and the desks. And that was how we got the Ming school started. And there was 17 little Mexican kids up in the upper end of the valley that weren't going to school, and I had a little cousin that lived down on the corner from the Springs where we did, and I was the only one going to school and I was riding to Wellton. So there was 19 kids and that's how come Daddy wanted to fix the first school.

And then, the wells--for several years we had good water, in the wells, and the farmers began moving in, and the No. 1 well was right straight east of Roll one mile, about a mile---right in front of Shirley Murdock's house. And it was No. 1 well. And Shirley Murdock's grandfather, Grandpa Linden owned that property at that time, and there--that was the begin---and Jack Roll came in, then, with the railroad. He told 'em he would give 'em property for the siding if they would name the siding after him, and that was the starting of Roll Store and Roll post office. My Daddy bought the first box and money order that Mrs. Roll sold at the Roll post office."

Carol: "Do you know how the Rolls happened to come to this part of the country?"

Laura: "No, I don't. And when Wayne Wright came here---he was one of the old pioneers. Him and the Batleys. And when Wayne came here, he didn't know where his property was. He came to the Springs and my Daddy had helped the county and the district---at that time, the water district was getting started, and Daddy had helped them survey it all, and Mama cooked for all the surveyors. And so Wayne came down--him and his uncle, and they stayed at the Springs and he told, he had a map of his property but he didn't know where it was, so, soon as he showed Daddy the map and on one corner there was a little detail dealie there, and it says, 'wild horse trap.' And, course there was lots of wild horses in those days. And so, the guys, every so often there was people that wanted horses, or the cattle men, used this wild horse trap to catch their animals. And Wayne said that, on his map, showed that, on his property, someplace down there, was this wild horse trap. And Daddy said, 'Oh, sure, I'll show you right where that's at.' And so he took him the next morning and drove up there and showed him where his corners were and the old horse trap and everything, and showed him how to put down the well. In those days, everybody, most of 'em, used two-inch pipe and a 'sand point' they call it, and a hand pump---a 'pitcher pump' or hand pump. And so Daddy helped him and his Uncle Roy(Ed. note: Dr. Roy Wright was Wayne's father) put their little well down, and showed him where his corners were, and that's how come Wayne Wright got started in the valley. I don't know how come that Grandpa Wright had bought the property. Wayne was still just a kid goin' to college, and when he got out of college, well then, Grandpa Wright sends him down to start farmin' and he didn't know any---all he knowed was book farmin' and that isn't like actual experience, you know. So Wayne had some problems getting started with his farm, but he did fine and there's still several of the boys left over there."

Carol: "Can you describe this wild horse trap?"

Laura: "Well, it was just a small corral--it had to be very strong, because when you get a bunch of these crazy wild horses into it, they'd all pile into it and try to tear it down and it had long wings on it. The little corral maybe wasn't very big, maybe wasn't half as big as this room, but they had these long wings out here and they'd get after them horses out there and run 'em into these wings and then they'd crowd 'em and before they realized what had happened they had run into this little corral and then they would fasten the gate on 'em right quick and then they would go in and catch either cattle or horses or whatever they wanted out of these---there was several of those old wild horse traps around the country because the cattlemen used to use them, too, to help round up their cows."

Carol: "That's interesting. I'd never heard of them before."

Laura: "You hadn't?"

Carol: "No."

Laura: "And another thing that was interesting, the railroad was responsible for tearin' it all down, our Butterfield Stage buildings; they were every so-many-miles apart. And, course there was teams kept at each place and they ran those horses as hard as they could run from one place to the other. There was one right at the foot of the Antelope Mountain there, right on this Northwest corner. It was in beautiful shape; the roof was still on it an all, and the cattlemen then, still had, that was when we first moved out here and they run the cattle in the country over there, because the floods every spring---there was no dams or anything and the floods every spring would cover the valley and then it would cover, grow---all kinds of green feeds and weeds and stuff that the cattle and the wild horses and things ate on, 'course the cattlemen didn't like the horses, but anyway, the cattlemen would all go together. There was the Bakers and Nortons and Higueras and the Chappells and oh, I can't remember them all the cattlemen, but they'd all get together and go up the valleys and work their cattle, every so often, well, every fall and every spring. And they had 'line shacks' they call 'em where there was always supplies. So they'd go and work all day here and then they'd go over to this line shack for the night, and they got to goin' to the line shack at night and there wouldn't be any supplies there. They were disappearin'. Well, then somebody had to go thirty--forty miles to try and pick up supplies and things, which was hard to do. And they finally caught 'em and they was three Mexicans, and they hung 'em in that building at the end of Antelope Mountain, and there was three ropes still hangin' there when we moved out here. I wanted one but my Daddy wouldn't get it for me. But the railroad company tore that one down when they came through. The Butterfield, uh, Filibuster is the one that we named after our deal down here by Gus Svenssen's, but I don't remember what the name of that one was, but anyway, it was a beautiful building and it was in real good shape and Joe Allen's house is almost on top of the graveyard, 'cause I remember when the graves were all still marked."

Carol: "Who was buried there?"

Laura: "I don't know if it was those three guys or if it was people coming through, or what, but there was several graves out there, right straight west of the---it's right near Joe Allen's house, there."

Carol: "Do you remember what kind of markers were on the graves?"

Laura: "Just wooden crosses."

Carol: "Did they have any names still visible?"

Laura: "I don't remember. And I think there was one group though, maybe, there was four that had a little wooden frame, maybe, put around it. I don't remember; I didn't get up that far very often. That was about four miles up from the Springs. After they began workin' on the bridge, then I used to run up there and shimmy up a big cottonwood tree and watch,-------I was always fascinated by heavy equipment. Anything in the way of equipment, I liked to watch, and I'd crawl up this big cottonwood tree, and, by the way, our river, in those days was, before they dried it up, was great big, huge cottonwood trees. Just----oh, they were beautiful. And we didn't have any salt cedars. They all came down after they put the dams in and we had pretty white sandy banks and everything, and the river---oh, it was so nice. I used to run up there and I had a great big white bulldog *and he would go with me and he'd sit there at the bottom of the tree while I was up the tree watchin' the guys work on the equipment and stuff. Just let somebody come anywhere's near if they wanted to get in trouble. He was my protector."*

Carol: "You said you watched them building the bridge. Which bridge was that?"

Laura: "The Antelope bridge, I mean, the railroad bridge."

Carol: "I see. Tell me something about that. How long did it take them, and what were they doing?"

Laura: "Well, I don't know---I don't remember how long it took them. I know it was quite a while, because they had to put those big pilings in for those piers. They had to move a lot of sand and stuff to put those big piers in that holds the railroad bridge. And the river still ran a couple of times enough that it would---they had a little spur line across down, just below the big bridge that they was workin' on and they would haul some of their equipment across it, and the river washed it down one time---washed it out and they had to rebuild it and all that stuff, but that must have been in----they began working on that in '24, I think is when they started workin' on that railroad bridge."

Carol: "How did your family deal with the heat out in this country?"

Laura: "We just had little cabins and the whole side of the building---we just had screen wire on it, and at night, you would go a raise those flaps, we called them, and that let the breeze come through, and if it was too unbearably hot why then you could wet a sheet and put over you, or whatever. But all of the cabins had those flaps on them."

Carol: "Do you remember, as a child, being aware of the weather, and it bothering you?"

Laura: Hunh unh. (Negative.) I don't think it was as hot then. Well, it was, too. Because, in 1917, I heard my Daddy say that he had to---on the Fourth of July he was baling hay someplace in the Yuma Valley, and at that time this old horse walked in a circle, a ring, and pulled this log, was hitched to it --- and he would step over this plunger, it pushed the hay down, but this hay was pushed down by a man's leg. There was a man stood there and, as this plunger went back, then---it was hand-fed---the old baler was hand fed and this man shoved the hay down with his foot and then jerked it up right quick and as the old horse came around, that pushed this deal. And one of his buddies got his leg hung in this thing on the Fourth of July, and Daddy was at some kind of a church picnic or something and some of the guys came rushing over there to get my Dad to get this man out of this baler. They had to unbolt it to get him out. And oh, a week or so later somebody said, 'What was you doin' the Fourth of July, Harvey?' and Daddy said, 'Balin' hay.' And they said, 'Do you know how hot it was that day?' And Daddy said, 'No.' And he said, 'It was 125.' That's what it registered that day, but nobody thought anything about it, I mean---and my Mama cut and twisted the wire by hand for that baler. She cooked for the crews and the bought the wire in great big rolls, and she would pull off so many---it had to be measured just like your wire is now---I guess they still use it. They use so much string and stuff now, I don't know what they use on the balers but in those days Mama cut the wire by hand and then twisted the loop on it to get it ready for the baler."

(Editor's note: The interviewer suggests a break at this time, while Jeannie Coulter goes after a new video tape, so the conversation changes.)

Someone says: "Laura, I think it's <u>wonderful</u> what you remember."

Laura: "Yeah, but I can't remember dates."

Carol: "Oh! I think she does a <u>wonderful</u> job."

(?) "Stuff you remember---there's stuff like the wild horse corrals and stuff like that, that we never even dreamed existed."

Laura: "I can take you right now and show you where there's one of the old traps up there, but it's pretty well deteriorated. The guy that had it, it's way down at the end of the big mountain down there. And these horses would slide down this steep bank to get water out of this water hole. And so, a bunch of the, oh, the Cole boys, they're on that list I gave you, the Cole boys and some of 'em come up from the valley, if there was a special horse in this certain herd or something that they wanted, why, they would build these traps or whatever and then, in the meantime they went down there and they fenced off this canyon that was real deep, and the horses slid down this steep bank to get down to the water, so they go down and they take a bunch of poles and in the meantime, somewhere, they got a hold of a bunch of the old wire that they used to put---that went from here to the Betty Lee Mine. It was great big old slick wire. We've still got a piece or two of it at the museum. You just wouldn't believe how big that wire is, but anyway, these boys had got some of it and they built this trap in this canyon up there and then there was a palo verde tree off to one side, and they fixed the gate so that, when these horses slid down this bank to get water----course, they put the fence down a ways, away from the bank where these horses slid down their trail, and these guys would hide under this palo verde tree at night, and when the ponies would slide down this bank in there, why then they had this gate that they could jerk a cable and it would pull the gate to on 'em and they couldn't get back up that trail and they would catch whichever pony they wanted or how many ponies they wanted and then they'd turn them loose. And there's still---the last time I was up there, there was still some of it showin'. A beautiful water hole.

"Oh, but I love the country up there. I was such a nut. I didn't have anything else to do. Daddy ordered a boy and got a girl and he made a tomboy out of me. And when I was eight years old he bought my shotgun and a case of shells. 'Now,' he said, 'It's up to you to keep us in meat.' And I killed rabbits and ducks and geese and quail, whatever was eatable."

Carol: "What happened to the shotgun. Do you still have it?"

Laura: "I still have it."

Carol: "<u>That's wonderful!</u>"

Laura: "And when I went to buy that shotgun was Imperial Hardware down on the corner right next to the Brownstetter's. Mr. Sanguinetti was north on that corner and right where the First National Bank is at, downtown, or that bank building downtown----right straight across the road now, on Second there---was Imperial Hardware. That was 'I.V.' they called it. And, so, my Daddy took me in there----a little tiker like this you know, to buy a shotgun, and here come all the men. 'Course they were gonna follow along and see what that little girl wanted in the way of a shotgun, and they all kept sayin': 'Oh, you need a .410. You need a .410.' 'Aaahh,' I said, 'I don't want one o' them little old pop guns.' So I got me a full-choke single-barrel .20 gauge, and I could kill just as much game as any of the rest of 'em could with that little shot gun. And right today, it is a good-shootin' little gun. It would kick the tar out of you sometimes if you didn't keep it <u>clean,</u> but I sure did, oh, I had more fun with that e gun."

Carol: "Well, Laura, when did they put the road over Telegraph Pass, because, you're talkin' about, when you first came here, you took the road over to Dome and then around the mountain, right?"

Laura: "Umn-hmm."

Carol: "Do you remember when they began the road over Telegraph Pass?"

Laura: "No, I sure don't. When they put the first paved road, but the first road we had was gravel---a little ol' bitty narrow, two-way---"

(?): "It went around the South end of the mountain?"

Laura: "No, the first one through the mountain."

(?): "Oh, through the mountain."

Laura: "Mmm-hmm."

Carol: "The Telegraph Pass road was originally gravel?"

Laura: "Umn-hmm. Yeah, I'll take you down there and show you where it made curves around some of those steep hills, and then during, oh, let's see, it must have been----because in the forties, during the war, when they began pulling those long dealies with the airplane wings on them, remember those trucks---what did they call those trucks? They were real long trucks and they couldn't get around the corners if there was anybody comin'. They would have to----those little corners were so short. I can show you one of 'em--you can look right down on top of it the main road now---two or three of 'em over there where that went. The old gravel ones. And let's see, let me---it was in the forties, but I can't say whether it was before Floyd came out of the Navy or right after he came out."

Carol: "Well, Laura, do you remember when the stage coach came through? When you were a kid, was the stage coach still coming through?"

Laura: "No. If it was, it was a private job."

Carol: "Then the stage never went over Telegraph Pass, right? They always went around."

Laura: "Mmm-hmm."

Carol: "Then, the stage would have to cross on the ferry then, on the river, wouldn't they?"

Laura: "No. Now that's where that one guy here, years ago, used to claim he had the stage building?"

Carol: "Yeah?"

Laura: "Okay, he's just as crazy as a loon because why would that stage go over there and then turn around and come back? No way. That did not. It went from Ligurta right around down by the granite spur and around to Dome and then right on in to Yuma. It did not go across over to that thing. That was an old farm house, and that old guy claimed that it was a stage building and it was not."

Carol: "Oh, okay. That's interesting."

Laura: (Laughs.) "Why would the stage go out of the way three or four miles and then have to come back and cross the ferry again? No way."

Carol: "One of the things that you mentioned a while ago was the Betty Lee Mine and the wire that used to run down there."

Laura: "Mmm-hmm. That's southeast of Wellton, here and there was quite a ---there was a heck of a big mine there. And there's shafts and things--- it's dangerous to go out there even yet, and go in those tunnels and things, because you'll be going along in there and 'course it's dark and then you just all of a sudden you drop staight off, and you can drop a rock down there and you just---there's been an awful lot of work done there and the ore was hauled in and loaded on to the railroad and shipped to El Paso, Texas."

Carol: "What kind of ore were they bringing out?"

Laura: "Gold and silver. Copper. Gold, copper, and silver. Mostly copper. But there was some gold and silver."

Carol: "Did people from the Wellton area work down at the mine?"

Laura: "Well, they just had a regular village out there. At one time they had a school, and a bar, and a regular little village out there. The first time I was out there the bar was still standing and there was all kinds of bottles and things and we found a lot of those little sample whiskey bottles and things back of this old bar out at the Betty Lee Mine, in the Copper Mountains."

Carol: "Do you know when it was going full blast?"

Laura: "No. It must have been about the time they was gettin' the railroad going through here, or something, I don't know. They were still----had a watchman out there for years until they finally put the gunnery range in and then they wouldn't even let 'em keep a watchman out there."

Carol: "Well, what was the wire for?"

Laura: "Telephone."

Carol: "Mmmm-hmmm. Did it just run along the ground?"

Laura: "No. They had little cottonwood poles. For a long time we had some of those poles layin' around, but I think they've all-----and everybody in the country had one of those wires for a clothes line. (Laughs.) But there's quite a good piece of it that Mr. Wooley brought in, down at the museum---of that wire, great big old heavy galvanized wire."

Carol: "Well, tell us something about your teenage years and what you did, and then into your early twenties."

Laura: "Well---------nothin'---------special-----trappin'. And when I graduated out of the eighth grade, up on the corner, at the old Ming school, this Mr. Tainter was putting in his property down below, a couple or three miles there, between the Springs and the school and he had a bunch of Mexicans there, grubbing stumps---I mean, you didn't go in with a bull-dozer and push 'em out like you do now---you got in there with choppin' axe and shovel and you dug 'em out and cut the roots off and then pulled 'em out and hauled 'em off with trucks. And I helped by drivin' a truck for a dollar and a half an hour. And I didn't---I'm a drop out; I never did go to high school, so that's what I was doin' 'til I finally got married and he didn't---Mr. Tainter didn't like it a bit when I quit, 'cause he said I took good care of his trucks and he needed me. But that' all right, I didn't---I couldn't go to school because I wasn't goin' to stay in Yuma and go to high school. And I got this job and I went to work down there on the ranch--and then we helped Mother and Daddy take care of the Springs for several years and Floyd worked for the irrigation district up there---him and Jack Naquin dug all the, with the drag-line, dug all the drain ditches in the Mohawk Valley and my husband was the grease monkey. And Jack Naquin, Jimmy J.'s Dad, was the operator."

Carol: "How did you meet your husband?"

Laura: "At school. When they came through with the railroad dealie, it they didn't have the other school built yet and the kids all came down to the Ming School."

Carol: "What was your husband like?"

Laura: "Well, they was---all them Killman boys were tall----big, husky. One of the school teachers over there had a crush on him, and the kids would come home and the teacher---I don't remember her name, I'm sure Floyd Harvey probably could tell you-------but anyway, he would say: 'Miss So-and So said---My Daddy's the best-looking guy in the country.' You know, the *kids thought that was really somethin'. But anyway---a lot of the things-- ---I guess there's not too many of 'em left any more."*

Carol: "How long had your husband's family been in this part of the country?"

Laura: "They come in '24, with the railroad. When they come through, building that railroad dike---and that's why I say, they had the trucks and hauled the food and supplies to 'em and that's when they came through with them in the early part of '24."

Carol: "Where were they from?"

Laura: "Oklahoma and Texas."

Carol: "And what decided them to stay here?"

Laura: "I don't have any idea. McLain was a full-blood Indian. He was Cherokee Indian. That's Berta Woodhouse's Dad. And he started farming---- no, he was workin' for Mr. Andres. But anyway, after they finished the railroad here, right here on the corner, why there wasn't any more of that trucking work to be done, and so, he went to work for Mr. Andres, and then finally bought a little place down in the house that they were----I don't know who he bought that place from. But anyway, and then he was farming Mrs. Ming's place and then when the Mings, or when June quit farmin' it, why Billie Dee's Daddy, I'm sure was the next one that farmed it."

Carol: "Billie Dee?"

Laura: (Referring to Jeannie Coulter) "She looks so much like her Mama, I can't help but call her Billie Dee. She sure looks like her Mama. Oh, we used to have so much fun. Do you remember all those big trees? And still, I think some of those big tamarack trees are around the old place there. We'd go over there on the weekends and the kids would get out there ---the boys, John and George and Floyd Harvey and Luther and---they'd get out there with .22's and shoot birds out of the trees and your Mama would cook a batch for us or whatever, and then we'd all eat."

Carol: "What was Christmas like when you were a kid? What did your family do for Christmas?"

Laura: "Eat, mostly. I generally got a new saddle or a new saddle blanket or a new scabbard for my gun, or somethin' and ---somebody said somethin" like---oh, oh, oh, yeah, when they had all the, when I had all the kids from the school---that came to the library, I mean, the museum one day and they had specially asked for me to come and talk -- it was in the paper and things---and some of the little girls or, I don't know, some of the kids wanted to know what I played with. And somebody said, 'Doll?.'---Naahh! I had two, all right, but they were fancy ones and they were put away. All I done---I had a good dog and my gun and fishin' and all that stuff and we made all these things by hand---no power. And we did all kinds of woodwork. I made pistol grips and paper knives and letter openers and paper weights and gun handles----all out of ironwood."

Carol: "That was some work."

Laura: "I mean! When you go out and drag one in and saw it off by hand---by the time you get through with it, you'll know you have done something. This thing's about 55 years old, I think."

Jeannie: "About how old?"

Laura: "About 55 years old, ---yeah, 'cause we were too, we didn't have anything else to do and when there wasn't too much goin' on we would do this ironwood work. And we killed rattlesnakes and we would take and skin the snakes and save the hides and make belts and we'd cook the meat off the bones and take the bones and make necklaces and we'd average over $25 apiece for the rattlesnakes."

Carol: "Did you ever do any trapping?"

Laura: "Oh, yes. Yeah, we had a trap line in the winter time."

Carol: "What were you trapping?"

Laura: "Coyotes and bobcats and fox and rabbits, sometimes a skunk would get in there."

Carol: "What would you do then?"

Laura: "Well, you just had to take it out and we always save it---if it got caught in the trap, why, we didn't destroy it. We went ahead and saved the hide but it wasn't as nice to work with as the bobcats and coyotes and foxes---two different kinds; the gray fox and the swift fox. And we sent---shipped---there were big fur companies then, all over, and they would send us advertisements like you get in the paper from stores and things now, why every month we would get an ad from Somethin' and Stephens Company and Sears and Roebucks and, I forgot, there was one more---full fur companies---and which ever paid the most for the fur---they had their prices and we would pack up all the---you had to know how to skin 'em, just so-so and put 'em on boards and dry 'em and we would pack 'em all up in burlap bags and send 'em up to the store and mail 'em in, and then in two or three weeks or a month later, we'd get our little check back and that was our spendin' money. Mama and I had our trap fund."

Carol: "Were there many foxes in the area?"

Laura: "Oh, yeah! The gray fox and the swift fox---just a little kit fox, they call 'em."

Carol: "Are there many of them left now?"

Laura: "I don't think so. You don't see 'em any more. One morning I went to the upper end of the trap line and here was this little tiny---I thought a baby skunk in the trap, and 'course I had great big coyote traps; there was big coyotes then. You'd come across them and set 'em and---but the trap was big enough and this little guy's leg was small enough that it hadn't hurt him, but it just held him; it was above the joint and he *wasn't injured in any way. and he was a little fella; he was only about that high. And I got me a stick and monkeyed with him and he wouldn't bite at it nor anything, and I thought, 'Well, if you're not goin' to fight, why I won't hurt you.' And I kept monkeyin' with him and, finally, I put my gloves on and reached down---- 'course, they've only got a certain amount of scent----and the big skunks the same way. I took him and he had de-scented himself---he had already, when he first got caught, he had pulled the dirt all up around him and he'd done, 'course he'd been caught---I don't know how many hours, but he wasn't injured, and so I picked him up and he couldn't stink any more; he didn't have any more scent to throw. So I picked him up, I took him out of the trap and picked him up and got to monkeyin' with him and I stuck him in my pocket and got on my horse and took him home, and I kept him for years in a big cage out in back, and come to find out he wasn't a skunk at all; he was a civet cat. That's the little guys that carry rabies. But he was a very nice little fella, because I had helped him and got him out and then he never did offer to bite or anything. And I was told later that the civet cats carry more rabies germs than any other kind of a polecat or anything, but we kept him for years and we called him 'Stompie.' And we had banty chickens and they lay little tiny round eggs, you know, and that's what we fed him was those chicken eggs and he would roll up in a little wad around that egg and hold it with his hind feet and his front feet and then he would kick his bottom ones until he could finally---it was more fun, that was the funny part, was watchin' him break those eggs so he could suck the eggs. And we had him, oh, I don't know how many years, until there got to be a hole in the cage or somethin' and he got out.*

"And I had a little old bob-tailed coyote that I had caught and she was crippled and every time that she would dig out, sometimes, and I had about three different times that she got away and the next time I'd start trappin' in the fall,----yeah, we'd always start trappin' in November,---why it wouldn't be long 'til I'd run along another place that had caught her someplace along the line. Her little body was only about that long and she had a little screw tail just like a bulldog. But she was tall. She had long legs and a regular, full-sized head and she was such an odd-ball thing that the first time I caught her I thought, 'Well, gee whiz, I don't know--her fur wasn't---you know, she wasn't full size and it wouldn't be a good hide or anything, and it was such a freak'--I thought, 'well I'll just take her in.' So I got me a stick and put it in her mouth----I got her down and put the stick in her mouth, and then I took a string and tied it there so she couldn't bite me, and then I tied her legs together and hung her over the saddle horn and took her on home and----I've got some good pictures of her someplace, too, and---oh, I had her, I guess, for about ten years. And every once in a while, we had her in a cage out back, and every once in a while she'd dig out and it'd be just a little while 'til we'd catch her in the trap line again, 'cause she couldn't run fast enough to catch her food or anything. She couldn't resist traps; she'd come back into the traps again.

"The little old black horse that I run the trap line with, he knew all those things---he knew where every trap was at. When I'd go set my traps----the next day, he'd go right back to 'em just as straight as an----and if it was bothered, if it was disturbed, he could tell us. And if if wasn't disturbed, there wasn't nothin' in it,---you know. And I always had a drag

on my traps; I never tied 'em solid. If you put a little drag, an iron rod or somethin' on 'em, why then, they don't stop and chew their leg off. If you tie 'em solid, lots of times they'll chew their foot off and get away. But, anyway, he could hear 'em when they'd be off at a distance, and he'd go just as straight to 'em just like a hound, and that old horse was really smart. And he was good with snakes. You couldn't get anywheres near a rattle snake as long as it was alive. But I could kill that snake and wrap it around his neck. He had that much faith in me. And I killed lots of em, too, what I mean.

Crazy thing, I've often wondered, it's a wonder I didn't get killed I was ridin' down the river bottom in the deep sand, no sound at all, in the horse's tracks. And in those days it was a real pretty sandy river bottom, and there was a real steep bank here and an old cottonwood tree had fell off there and right down at the lower edge of it was a huge rattlesnake. Oh, a big sucker---he was rolled up that big around, coiled up, and I didn't see him until I was passin' him. Oh, I wasn't that far from him, ridin' on the horse in that sand, you know, and it didn't make any noise. And if I remember right it must have been about the time of year that they are blind----they can't see too good. And so I rode on by and I tied my horse to the tree down below, and I goes and I get me a----I didn't have my gun that day, and I got a hold of a limb---a pretty good sized one, and popped it off, and when it splintered off it was real sharp, and it's a wonder I didn't get hurt, but I didn't. I slipped back up there and got right over that old boy's head and I shoved that stick, right quick, through that snake's head, you know, he couldn't---it was cold---one morning. And his body, he whipped it all around my legs---and 'course I had to hold him then, 'cause I had it shoved in the ground and, as I say, --------I was always doin' somethin'. And after he finally quit fightin' and wigglin' I pulled it out and put him over my shoulder and got on my horse and his tail touched the ground. That's how big he was. And I took him home and---oh there was always a bunch of people sittin' around the bath house down there, and I guess they didn't know quite what to make of it. And they was right, 'cause I was always doin' somethin."

Carol: "What did your mother think about your doing this kind of thing?"

Laura: "She was just as bad as I was. That's the reason I wasn't afraid of many things. I wasn't afraid of nothin'."

Carol: "Your parents sound like they were unusual people. They sure did a lot."

Laura: "Yeah, and very independent. I didn't ask nobody to do nothin' for me that I could do for myself. I didn't have no brothers 'n' sisters to help me and I learned to do for myself in ways that a lot of people wouldn't believe, 'cause you figure out sump'n."

Carol: "Do you remember having a special childhood friend---a girlfriend or---?"

Laura: "Well---There never was anybody lived that close----now, I used to come to Wellton when I was goin' to school over here. The depot agent's daughter, her name was Dorothy and their name was Spivey. He was the depot agent for the Southern Pacific Company----and that was the prettiest place in town---in Wellton, because they had it ---it was a big two-story building. They lived upstairs with the stairs down the side of the building. I can still see that, and they kept a nice lawn around the building and they had some nice big cottonwood trees and things there, and in the bottom part was the ticket office and across the railroad track on the other side was the freight depot. Oh, we did a lot of business in those day, 'cause everything had to go and come by train, and the trains stopped and picked people up all the time---twice--three times a day. There was a lot of passenger trains, and one even stopped one time and let me off over there on the corner, right up the road from Wayne Wright's place, from Batley's where the road went over---and I lived in Roll, right there by the rock house. It stopped right there by the rock house and I walked home.---- While Floyd was in the Navy. I had went home with John, or I went back with John, you remember? But, anyway, John was home on leave and it was hard to get a ticket, especially in the big towns and when we would go to L.A. or some of the bigger places, and so John said, 'Well, you're my sis. Just come on.' So he took me through with him clear to Seattle and I got to go see Floyd while he was in the Navy and then when I came home, they let me off right there at that crossing. I was thinkin' about that the other night."

Carol: "Now that brings a question to my mind. When your guests came to visit the Hot Springs, how did they get to your place? I mean, if they came by the train, then how did they get out there?"

Laura: "They would have to call ahead of time--er 'call'--they had to write, because we didn't have any telephones, so they would write to Roll, to the Hot Springs and then Daddy could meet them up there, or else they would meet 'em over here at Wellton."

Carol: "When did you guys first have a truck or a car?"

Laura: "I guess in '13, about the time I was born Daddy got one of the first little Fords that came to Yuma."

Carol: "What effect did the depression have on this area out here?"

Laura: "I don't remember. All I know was you just had to try and grow as much as you could and take care of what you had, I mean, as I said, we went in once a month and bought groceries and Dad would buy three of those big hundred-pound cakes of ice and bring 'em home and we had a box in the ground and he would put those---(chuckle)---that brings to mind---scared me to death one day. I was helpin' Dad with those big ice tongs---you know what the ice tongs looked like?---okay. Daddy and I were unloading three of those blocks of ice, so we had hooked on to this one 300-pound chunk and was carrying the---well he had backed in as close as he could to this ice box thing in the ground and we---he had one side and me the other and I was---oh, thirteen, somethin' like that, a good-sized girl, and stout---I always have been stout, and I don't know why, but I had the ice pick in this hand---we'd been doin' somethin' with the ice pick and I had the ice pick in this hand and Dad and I was carrying this chunk of ice, and when we got over to where we was gonna put it in the ground, I put my hand up here agin a post or somethin' so I could brace myself to help lift that up *there, and Dad got overbalanced and throwed his hand up there and stuck that ice pick through his hand, right there. I TELL YOU, it liked to scared me to death. Daddy just grabbed it and jerked it out and we went ahead and put the ice up and he went down to the hot water and soaked his hand in that hot water and it didn't even swell up. But I tell you that's one thing that I'll never forget is the way Daddy throwed his hand up there again that dealie and that ice pick went clear through his hand. But he was a good sport about it. 'Course it wasn't --- it was neither one of us' fault, it was just careless of me that I hadn't put the ice pick down, I guess, but, anyway, I sure never will forget that little incident.*

"But that hot water---we was talkin' about that hot water over there, that water is wonderful OH, it was good for arthritis, it was good for ----if you had this old icky feelin' like you had the flu comin' on, you know, and that nasty taste in your mouth---you could go down there and take a couple of those baths and I mean, it'd stop. And this family in the Yuma Valley had a little girl about two years old or something like that and back in those days we had what they called 'desert sores' and WHY, I don't know, but they would just break out with those sores---just one solid sore, the kids would just get covered with them and this baby they had to keep her wrapped in a wet sheet---I mean, she couldn't stand to have any clothes on or anything, and they brought her out there and give her three baths and she peeled off that hot water just cured them things up in three days' time and she was just slicked off, clean as anything---never even had a scar on her face where she had those great big old sores and things. And boils, carbuncles and things like that---he would just take 'em down there and put 'em in that hot water---and blood poisoning, they brought a guy out there one time that had stepped on a nail or something and he had black marks almost to his knees and they took him down there and soaked his leg in the hot water.

-- AT THIS POINT THE TAPE ENDS --

COLVIN FARMS
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VERNA RAE COLVIN
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SEPTEMBER 7, 1993

W. DEMPSEY HELMS
ARIZONA STATE LAND DEPARTMENT
1616 WEST ADAMS
PHOENIX, ARIZONA 85007

DEAR MR. HELMS,

THIS LETTER IS TO PROTEST THE STATE OF ARIZONA CALLING THE UPPER GILA RIVER BETWEEN SAN JOSE AND FT THOMAS, ALL WITHIN GRAHAM COUNTY, A NAVIGABLE RIVER. AS A HISTORIAN, I HAVE WRITTEN A BOOK ABOUT THE AREA AND HAVE WORKED ON SEVERAL OTHER HISTORICAL BOOKS. I HAVE READ MANY, MANY HISTORIES THAT HAD BEEN WRITTEN BY OUR EARLY SETTLERS WHO ONCE LIVED IN THE VALLEY AND NEVER ONCE IN ALL OF THESE HISTORIES HAVE I FOUND ANY MENTION OF USING THE GILA RIVER FOR NAVIGATION.

CROSSING THE GILA RIVER WHEN IT WAS IN FLOOD STAGE WAS THE ONLY TIME THAT I EVER HEARD OF A BOAT OR RAFT BEING USED AND THESE WERE USED BY INDIVIDUALS FOR THEIR OWN USE-NEVER FOR THE PUBLIC. MOST OF THE SETTLERS WHO CROSSED THE RIVER DURING FLOODS USED THEIR HORSES OR SWAM THE RIVER. WHEN THE BRYCE/PIMA BRIDGE WAS BUILT IN 1915, THEY WERE ABLE TO CROSS WITH THEIR CARS.

NOT ONLY THE STATE OF ARIZONA BUT THE U.S. GOVERNMENT IS TRYING TO TAKE CONTROL OF THE GILA RIVER IN OUR AREA. BOTH ARE USING THE TERM NAVIGABLE RIVER TO PUSH THEIR CASE. ENVIRONMENTAL GROUPS SEEM TO BE THE MOVERS IN THIS TAKEOVER OF PRIVATE PROPERTY FOR THEIR DIFFERENT PROJECTS FROM ENDANGERED SPECIES TO WETLANDS.

BUT A NAVIGABLE RIVER IN OUR AREA NEVER EXISTED. THE EARLY SETTLERS FROM ABOUT 1876 ON SETTLED ON THE UPPER GILA RIVER UNDER THE HOMESTEAD ACT OF THE U. S. GOVERNMENT. THE SETTLERS HAD TO LIVE ON THEIR LAND AND GET WATER TO RAISE CROPS BEFORE THEY COULD RECEIVE A DEED TO THE LAND. THIS HOMESTEAD ACT MADE A FEDERAL GOVERNMENT AGREEMENT BETWEEN THE SETTLERS AND THE GOVERNMENT LONG BEFORE ARIZONA BECAME A STATE. THIS FEDERAL AGREEMENT HAS STOOD THE TEST OF TIME UNTIL THE PRESENT WHEN THE STATE OF ARIZONA DECIDED TO TRY AND TAKE THE DEEDED LAND WITHOUT PAYING FOR IT. THE FLOOD PLAIN OF THE GILA RIVER IN OUR AREA TAKES IN A LOT OF DEEDED AND DECREED PRIVATE PROPERTY ON WHICH THE OWNERS HAVING BEEN PAYING PROPERTY TAXES ON OVER THE MANY YEARS SINCE IT WAS HOMESTEADED.

IF THE STATE OF ARIZONA AND/OR THE FEDERAL GOVERNMENT FEELS THAT IT IS IN THE INTEREST OF THE PUBLIC THEN THEY SHOULD PAY FOR THE LAND WHICH THEY CLAIM . AND IF THEY FEEL THAT THE PROPERTY SHOULD HAVE BEEN THEIRS SINCE 1912, THEN THE PROPERTY TAXES SHOULD BE REFUNDED WITH INTEREST.

WHEN THE SETTLERS FIRST GOT WATER FROM THE GILA RIVER IN THE 1800'S, THEY BUILT DIVERSION DAMS. THESE DAMS DIVERTED THE WATER FROM THE RIVER TO CANALS USED TO WATER THEIR FIELDS. THESE DAMS PUT BARRIERS ON THE RIVER FROM SAN JOSE TO FT THOMAS FOR ANY RIVER TRAFFIC TRYING TO NAVIGATE THE GILA RIVER IN OUR AREA. THE TRANSPORT WOULD BE STOPPED ABOUT EVERY TWO MILES AND HAVE TO UNLOAD GOODS AND PASSINGERS WHEN IT CAME TO A DIVERSION DAM. THE TRANSPORT WOULD THEN HAVE TO BE CARRIED AROUND THE DAM BEFORE IT COULD CONTINUE. THIS MIGHT EXPLAIN WHY NOONE TRIED TO NAVIGATE THE RIVER IN GRAHAM COUNTY.

INCLOSED IS A STATEMENT GIVEN TO ME BY DANIEL WILFORD COLVIN WHO HAS LIVED IN EDEN, ARIZONA, FOR 90 YEARS AND WHO NEVER SAW COMMERCIAL NAVIGATION ON THE GILA RIVER. IT IS NOTARIZED.

Verna Rae Colvin

September 6, 1993

I am Daniel Wilford Colvin who was born January 10, 1903, in the small farming community of Eden, Arizona, in Graham County. I am now 90 years old and am of sound mind. My memory is good and I want to make the following statement:

As a child of eight years of age before Statehood in 1911 until I was grown, I spent many hours swimming and playing in the Gila River which was located about one half mile from my home in Eden, Arizona. During this time, I would fish for Channel Cat and Carp fish with a pitch fork. I can rightly say that I never saw a Razor Back Suckor fish in my life including today.

My friends and I played under the Cottonwood and Black Willow trees in the river bottom. There were no tamarisk trees which we call Salt Cedars lining the river bed as there are now. As a boy, I would float down the river on a log when there was enough water in the river to do so.

I remember going to the Curtis Diversion Dam where water was diverted from the Gila River into canals which carried the water to the farm land. It was built of logs, brush and rock and had to be rebuilt every time that the river flooded and washed it out. The farmers would be out of water until the dam could be rebuilt.

When I was young there were more than ten diversion dams on the Gila river between San Jose (above Safford) and Sunnyside (below Ft. Thomas). The Curtis Canal diversion dam was built in 1881 and some of the diversion dams were built as early as 1876. These dams would divert all the water in the river, except during flood stage, and return part of it as waste water after the crops were watered.

As a boy, I saw no commercial use of the Gila River between San Jose and Sunnyside. The bigest reason was the diversion dams. The second bigest reason was the lack of water. During the dry months of the year, the river would dry up and leave only sand and gravel in the river bed just as it does today.

The only boat that I ever saw on the river was the hand made boat of David Colvin's. He used the boat one year during a flood to ford the river. He had to haul the boat up the river whenever he wanted to cross. It was more work than he wanted. During a flood, people on the North side of the river would cross either by swimming or on horse back, but they did not do it very often. It wasn't until 1915 that the first bridge was built in Bryce. It made the crossing much easier.

Whenever I hear that the Gila river between San Jose and Sunnyside was used commercially and therefore is a navigable river, I wonder where they get their information. In my 90 years of living in Eden, I have seen a lot of things but the use of the Gila River for navigation was not one of them. Commercial fishing for Razorback Sucker fish was another thing that did not happen in the area where I grew up. I hope that this statement will help those who want to set the record straight for posterity.

Daniel W. Colvin

Daniel Wilford Colvin

Sign before me, a notary public, this 6th day of September, 1993, by Daniel Wilford Colvin.

Verna Rae Colvin

Notary Public

MY COMMISSION EXPIRES SEPT. 25, 1996

This is Carol Brooks on June 11,1987. Today, I'm interviewing LaVena Coffeen.

C: LaVena, tell us something about your parents. When and where were they born? What were their names?

L: My father's name was Wilbur P. Richards and he was born in Anamosa, Iowa, right out of Cedar Rapids. My mother's name was Etta Maria Ellis and she was born in Olin Iowa. Papa's father was J.J.Richards. He had a farm with animals and his grandfather also had a farm with animals. Papa's father came from England as Sir J.J.Richards and started farming. He had a sister,too, but I don't remember her name. When the estate in England was left, the sister went back to England. They wouldn't give girls the estates, you know, and my great grandfather wouldn't go back. I don't know how many children they had, that's something I would like to know.

Not being raised out there, going back on visits isn't like... kids don't know about those things too much. Anyway, that was my father's (family). His mother was Lydia Perkins from New Hampshire. Perkins, there were a lot of them there, I understand. She married grandpa and lived in Cedar Rapids to her dieing day. Papa had one sister Mary Richards, and she lived with grandma in Cedar Rapids until grandma died and then she married and left and then came back. She died in Cedar Rapids. She was 96, I think, when she died. Let's see, where do I want to go from here?

C: How about your mother's family?

L: Mama's father was Dr. I.N.Ellis, a dentist. I met two of the brothers and they were both dentists. When we'd go back to visit, they would always come to see mama. That was three dentists that I knew, but there were 15 in that family, fourteen boys and one girl. All of them but one was a doctor or dentist so whenever you see an Ellis, you know who it is. Mama's grandparents, I think, were from Iowa. They had that farm there to start out with. Grandpa told me that they came over on the Mayflower but I couldn't ever find an Ellis name on the Mayflower, as I'd look at the list, so it might be by some other name. There's a lot of interesting people on my grandmother Ellis'side,too.

C: Did your parents move from Iowa to Yuma?

L: Yeah. On the way out, he was at different places like Albuquerque. Different places where the railroad would send him to be a telegrapher. That was before they got out here.

C: When did they first come to Yuma?

L: In 1906. Down at the old depot. That I can remember because I wanted my little red hat so bad in the morning so I could see the bridge open, when the boats would start out in the morning and they never did and I always regretted that. I never knew whether the bridge opened that was or this way and I never did find out. They never did wake me up 'cause I was so tiny, but I wanted to see that bridge open.

We moved to an apartment up on First Avenue next to...I was trying to think the other day...That's one of those things I'm going to have to write down as I remember them because, if you don't get to talking, they just don't come back to you. The people that we moved next to, Dr. Yemen's oldest daughter, Edna Ewing. Then, later, we got a house down on Fourth and my brother was born there in 1910.

C: We didn't get where you were born and when.

L: I was born in 1901 on October 28th in Anamosa, Iowa, about 28 miles out of Cedar Rapids. My grandmother lived in Cedar Rapids the rest of her life and I was there a lot with her. My grandfather had a store in Cedar Rapids one time. A grocery store. I remember him talking about that.

C: Tell us about some of your earliest memories of Yuma.

L: (Pause) Well, let's see... I wish I had that address down here. The place is still there. There were four of them alike and two of them have been taken out and they've put a building in there of some sort. We moved there and Keys and Mildred (pause) lived there on First Avenue and the Alexanders lived on the corner. That's Meda Alexander and all that bunch. From there, we moved down on Main Street. There were four 'dobe houses there right across from the old school. Henry Levy, who was chief of police, lived in one; Dr. Yemen and his wife lived in the next one; we lived in the next house and, in the fourth one was more or less, transients. Next to that was the old Yuma Theater and, on the north side, was a second hand store and, on the other side, was a Chinese Store.

C: Which side of Main Street was that?

L: The east side.

C: Which block of Main Street?

L: Between Second and Third, I guess. Where's the theater that's down there now?

C: That's the second hundred block.

L: Well, that's where it was. Right there. The old school was there and then the theater. The theater must have been built in 1910, 1911 or 1912. They had that in the paper wrong because they said it was 1915 or 1916 but I think it's because it went down in the 1916 flood and then redone. On the south side of the theater was an ice cream and curio store that papa and mama ran, and on the north side was a doctor's office. Dr. Apjohn and Dr. Tolliver were there. Next to that, was a livery stable.

I can remember the livery stable because my brother was only about two years old and mama missed him one day, and darned if he wasn't over in the livery stable in a stallion's stall. You know how they build the stall, with boards up just so high? He was in there with the stallion when she found him. Another time, she found him over at the old jail, on the east side of Main Street, sound asleep in a chair. Mama got him out of there. The next time - I always think it's an interesting thing - Somebody came from California and opened up a restaurant on the other side of the livery stable, in that block. They really put on the dog because, at each table, they would have a waiter there and they even served finger bowls. My brother, being little, liked that. When he got home and a number of times afterwards,the colored girl that mama had there at the house, had to bring him a finger bowl. As little as he was, he would not leave that high chair until he got his finger bowl. I always did laugh at him about that.

Then, Sanguinetti's Store was at the corner. He had moved there. You know, they always would go in on payday to pay their bills and I can remember mama going in there and Sanguinetti giving me a box of those wafers. Whenever mama paid the bill, I always got a box of wafers.

When we left Main Street, was when the land opened out at Dome. That opened up in 1914. Papa never would stay at onyone;s farm long enough to... I guess he was used to going along with the railroad, from pillar to post, but anyway, he went out there to sell land, like McCune did, but the first year, they had a big flood and water was from mountain to mountain out there. Our house - shack, you'd say - was up on a little hill but between us and the mountain, there was an arroyo. Evidently, the river bed had been up there at one time and oh! that water was high! I think it was Christmas Day and that water was coming down there in torrents, with trees and everything and papa built a boat. And he told my mother,"Etta, when the water gets up to our door sill, we're getting out of here!" With a boat that he had just built, I don't think we'd ever have made it. I really don't, because he (brother) was about three and I think I was four and mama was scared to death of water and she couldn't have swum a lick. But darned if that water didn't come up to our door sill and start to recede. So, we got through that.

Then, we moved across the river and papa built up high, next to the railroad track. That was in 1915. Then, we had another flood with the water up the mountain. In fact, trains couldn't get through because part of the tracks was under. We were about three miles east of Dome at the time. By the time that got over, we moved to Tucson and papa worked for the Draft Board there. Later, he was the State Draft Inspector and his last place was to be in Prescott. We had gone back to Iowa to visit and papa wouldn't let us come back until Christmastime because, in Prescott the flu was so bad. There was an army base there and with flu, they were just dieing like flies. So, it was in December before we got back out there. We stayed at the Vendome Hotel. I noticed the other day where they had remodeled it. Mrs. Brow ran that and Mr. Brow owned a saloon down on She had played the piano in the saloon for years. In fact, I understand that she was part colored and she had a son that turned out colored. He was a doctor in Chicago, I think. East, somewhere. But she was a very interesting person. So, from there, we went back to Tucson for a while and then papa came back to Yuma.

C: Let's backtrack a little bit and let me ask some questions. When did your father start working for the railroad?

L: Well, before they were married. They had one daughter older than I. I was born the 28th of October in 1901 and she was two years old.

END OF TAPE #165 - SIDE 1

CONT'D. ON TAPE #165 - SIDE 2

L: Grandpa Ellis was eating hickory nuts and she went up to him, just as they were getting ready to sit down to dinner, and wanted a nut. He handed her a nut and she choked to death on Christmas Eve. She was just two years old. Then, mama had me and then, two years later, she had another daughter, but mama always said that she was born with a cold, and she died at about two years old.

C: The house that you first lived in on First Street, what do you remember about that house? What was it made of? How many rooms did it have?

L: The first one was a duplex on Forst Avenue and about Fifth, I think.

C: Was that adobe or frame?

L: It was a frame.

C: The house that you lived in on Fourth Street, that was a white frame, wasn't it?

L: It's a frame house. It's still there.

C: Those little houses are in back of Ckie's or that Park Store place, aren't they?

L: Yeah. Why Yuma has made so many darned streets that they didn't need and would cut off the back of places, it's just too bad that they did that because that used to be open clear to... there was a livery stable there. No, it wasn't called a livery stable, it was a place where they had horses and you could buy feed. It was a feed lot. I remember Annie, coming home one time, the girl that lived next to us, and saying that there was an Indian over there with a white pony for sale. So, she went to her dad and I went to my dad but she beat me there and she got the pony. We rode it together. So, that was the feed lot. Then, they tore all that down. So many things... We were just thinking today, commenting about the Clymer House, why they tore that down because that would have been such a thing to remember.

C: What do you remember of your neighbors on Fourth Street?

L: Richards.

C: Tell me about them. What kind of work did they do? What were they like?

L: Well, he came here for the railroad. He worked for the SP (Southern Pacific). Then, when he came back after the war, he came back here and went to work for the Reclamation.

C: What was he doing for them?

L: Then, he left here. He was married in 1920, at eighteen and he went back to Iowa. He thought he could go back and he started right back and was in as agent there. Then, it got too cold again and he couldn't take it, so he came back out here.

C: What do you remember of your neighbors down on Main Street?

L: Well, we had a nice group down there. We had the Zavalas. Their home was right next to the Catholic School. That was Ed and Amy Zavala. Bonnie Few lived down next to Stofellas. Stofellas is where

Old Yuma is now. Then at one time, a Catholic School came in there. I remember the sisters would always come by two's, as they'd walk by. I can remember these two sisters coming by one day. I was about 11 years old. They wanted to know what I was going to be when I grew up and I said,"I'm going to be a sister" She said,"Oh, no. You're not going to be a sister and have that beautiful hair cut off." My hair was as red as fire and very curly, just tight. When we went to Tucson, I sent in my petition to the Catholic School there, to the convent, during the war.

C: Did you start out at the Catholic School here in Yuma?

L: No. I started and I found that... (inaudible) The school up there on Second, Holcomb, was my first year of school. was having a program with Homemakers and I discovered that that was the year I'd started. Isn't that funny?

C: Do you remember who your first teacher was?

L: No, but I remember McGraw. That's another building they should have left. They could have renovated that. It's a lovely building, one worth keeping. I'd have to do some tall thinking to remember the names.

C: Let's go back to your neighbors on Main Street. You mentioned the Yemens and Levys. What were the Yemens like as a family?

L: He was a dentist and he had three daughters: Edna, who had married a Ewing; Florence married a Thacker; and then there was Frances, the youngest one. I remember Frances living right next to me. I was always carrying in old cats that were strays and I brought in one too many that papa liked, after we cleaned them up and they got to be scrappy. He would do tricks for papa and papa thought he was great but it got sick one time and mama said his throat was all... Mama didn't like cats and she put him on the back step and he died.

After he died, darned if I didn't come down with Scarlet Fever, the only case in town. It was a funny thing. The cat had it. Where he got it, I don't know. Then, Frances Yemen got it and my brother, who was just a little thing at the time, nine years younger than I. So, we had Scarlet Fever, the three of us. I remember so distinctly mama calling Dr. Apjohn and he said it was Scarlet Fever and we'll have to quarantine the patient. Mama said,"You can't do that!" papa was working on the railroad and there was nobody to keep the ice cream place open. He said,"Well, Dr. Kecherside is the health doctor. You call him in and tell him I said it was Scarlet Fever. I think it will be all right." He was the one who would have to quarantine.SO, he came and looked at us and mama told him that Dr. Apjohn had said that we had Scarlet Fever. He says,"Oh, you have Scarletina. You won't have to be quarintined. It's just Scarletina." Well, it was Scarlet Fever because Boy! I peeled from head to toe and, when mama went to wash my hair after I was on the mend, she said all she could do was take scissors right up to the scalp. so I had to go to school with that boudoir cap on me. Oh, what a mess it was! I peeled so I know we had Scarlet Fever. A few had been in and none of them took it. Wasn't that remarkable? We were the only three cases in town due to my letting in cats.

C: What did you do as a kid, other than going to schhol? What did you do for fun in your spare time?

L: Well, papa finally got me a burro. It shows in the picture there. He bought me a burro and I used to ride a burro up and down Main Street. That was the time that Charlie Meadows was here and Charlie, at that time, rode a great big Palomino horse. Charlie was a tall man and he'd come by and take me by the arm and lift me up in back of him and I'd be on the horse with him, going up and down.

Papa mentioned one time, he said...The First National Bank was down there, that was the Bard Bank and the men used to be standing out there on the corner talking. Charlie Meadows was standing there in that group when I rode by on a burro and I remember papa talking bout it. Charlie Meadows said to the group he was talking to, he said,"That's my daughter. That red headed girl on that burro is my daughter." Papa stepped up and said,"I beg your pardon, she's my daughter." But, anyway, that's the way Charlie Meadows was. I knew him afterward for years. I knew another one, one of the old-timers. Henry Levy was Chief of Police at the time.

C: What was he like?

L: A very nice person. She was,too. Later, they moved up on Second Avemue, was it?

What was Charlie Meadows like?

L: He was very well known in the history because he went up to Alaska in the gold rush. He had a saloon up there and they still have a Charlie Meadow's Day up there. They have a statue of him out in front of his saloon, that I tried to find while I was up there, but I understand that was more in Canada than in Alaska. I didn't realize that at the time. Then, he came back down here and he was killed with the druggest on Main Street...what was his name? He and Charlie had been to Mexicali and on the way back, they had a car accident on a very bad curve and killed both of them.

C: Let's go back and discuss the ice cream store that your father ran. How long did he run that?

L: Two or three years, I think.

C: Your mother worked in the ice cream store, too?

L: Yeah. She worked in there because he went back to the railroad. He went back to braking because he wanted to get outside.

C: What was the name of the ice cream store?

L: Just ice cream store. I don't remember the name of it. I remember papa having a man come down from Los Angeles to teach him how to make chocolate candy. You have to learn how to do it and he made his own candy.

I was just trying to think if there was anybody else that lived on Main Street. Bonnie Few lived there and went to the Hawaiian Islands and I haven't heard from her. She's gone by now, maybe.

C: How do you spell her last name?

L: Few. F_E_W.

C: What kind of work did her father do?

L: I don't remember. She went over there after she was married. She married Johnny Stofela first. Then, he died. He had appendicitis and they put him on the train to Los Angeles and he died on the way there. His appendix broke.

C: Why did your father give up the ice cream store?

L: He decided to go to Dome, when that land opened up, to sell lots.

C: You were here when the siphon was being built. What do you remember about that?

L: Just that it was going through down there. I don't remember too much about it because it wasn't anything that interested me. But I knew Felix Mayhew very well, too. He used to come up and get me and take me down... Mayhew and...What was the name of the people that had two lovely down on Eighth Street? Mayhew had money at that time. It was when he had the gold mine and he had gold galore. He would come and get me and take me down to his house and I'd stay there with them over the weekend.

END OF TAPE #185 - SIDE 2

CONT'D. ON TAPE SIDE 1

L: They had a movie on Fourth Street and that canal down there, we had gone down there swimming and I remember getting in the water there. I would have been 10 years old, maybe. I remember going off that. The water goes so fast through the gate and then, when you come to the end, there's cement. I had my hand up like that because I couldn't swim at the time. I remember cming up three times and I remember papa telling me,"The third time you go down, you won't come back up." Just then, Mayhew grabbed me and took me out and it was hard to get started breathing again, but I did. She thought I was just playing, but he said,"No, she's in trouble." Anyway, he got me out of there. I almost got my everlasting but it never made me afraid of water.

C: After your family came back from Tucson, did they come back and stay in Yuma then?

L: Yeah. They stayed until 1920. It was the latter psrt of 1919, when they came back from Tucson. I was taking a business course the rest of the year. Then, in June 1920, I got married. I met Phil here. I was eighteen by that time and Phil and I got married June26, 1919 and mama and papa went back to Iowa. He went to work back there for the railroad but he couldn't stand the winters, so he came back here.

Papa came back to Phoenix first and we went up there and then, we went up to Flagstaff. Papa bought some boats and had them all on the lake and that was the first that they had boats and fishing on the lake. Bobby was born in San Diego because Phil's folks lived there and my folks were in Iowa. He left me there because Yuma wasn't very big at that time; still, there were people here but we never went out with them, so he left me over there and Bobby was born in San Diego.

C: I thought you told me at one time, that your family lived up in the Castle Dome area.

L: That was before...That was when he left Dome that he was agent out there. He left Dome and went up there and then we came back to Yuma.

C: Did you live up by the Castle Dome Mine?

L: We were right at the Castle Dome Mine. Mrs. DeLuz and her son was there. I guess Mr. DeLuz had gone to Alaska and she didn't want to go. I can remember mama riding to Dome with Mrs. DeLuz several times but the one time that I definitely remember, as little as I was, mama had on one of these satin bird blouses. You know, they had a design on them? Mrs. DeLuz had a chauffeur but no top to the car, so when mamagot back, she had that whole print on her. Sore! Oh, boy, was she sunburned!

Another time up there that I can remember, we had mules that papa drove up there, and a wagon and it had a seat on it with some screens here but then just a dash board in front where you put your feet and the mules would be right down there. Well, mama wasn't an outdoor person, she was raised a lady(but she couldn't raise me like that) She was riding up there and papa went over a bump and mama slid right off in back of those mules, out over the double trees in back. Her feet caught there, luckily. I can still see those mules with their backs doubled up ready to kick heck out of mama. Papa told her,"Don't say a word, don't say anything!" He started talking to them and he got down and unhitched them and got them loose from the single tree. Whatever saved mama that time, nobody will ever know. As little as I was, I could see those mules and they are kicking fools, a mule is.

Somebody gave me a greyhound pup up there and it died of rat poisoning. You couldn't have anything there like that. They would die. Mrs. Deluz' son, Bob, got lead poisoning there one time and he was just drinking and drinking water until, when he threw it up, he threw up this ball of lead. I can remember papa and mama talking about that. He was good looking. When he went east, he became very famous.

C: What kind of house did you live in at Castle Dome ?

L: I don't remember but I have an idea most of those places were just built of wood and canvas. I don't really remember what it was.

C: Why did your mother and Mrs. DeLuz drive from Castle Dome down to Dome?

L: I imagine, maybe, for mail or food.

C: Was there a store at Dome ?

L: Oh, yes. Even in '14 and '15, they had a store there. McDaniels and there was somebody else that had a store there for years.

C: Was it kind of a general and grocery store?

L: Yes. A grocery store and a little restaurant. I think they had a few rooms, too.

C: How long did your family live at Castle Dome, then?

L: About a year.

C: What kind of work was your father doing there

L: Mining. Silver mining. He found a very rich vein of silver while he was there and, after I was married, my husband and brother and myself took him back up there, but by that time, he had trouble with his side and he couldn't walk across it but he could point where the silver mine was. It was a real wet day so, when they came back to Yuma, Phil and my brother were going to build a thing that they could put papa in and carry him over it, so they could put a claim on it, but they never got around to doing it.

When Phil came here, he was working for Standard Oil and was still doing that when we got married. Then, after we came back from Flagstaff in '27, he went into business for himself and was in business for himself the rest of the time here.

C: What kind of business was that?

L: Gasoline, mostly. He had Tidewater and he had Union. One time, he went to Union and took over but he had his own service stations. The oil companies were all kind of funny that way. When he went to work for the Union and he had his own stations, he was making more money than the president of the Union so they kept cutting his percentage down, so he quit and when he quit, he took Plez Nance, who had been working for Union Oil. Plez married Genevieve Balsz after he went to work for Phil but Phil had his own station so he I think he had Western or Tidewater after that. He had several different pumps. It was amazing how the oil companies (operated). If the dealer was making more money than they thought (he should), they'd cut them every time. Then, they'd quit and go to some other company. So, he was in business. We had three boys and raised them here. My brother died about two years before Phil did so he's been dead about 14 years, I guess. In the meantime, she remarried and had these two children, Mark and Robin. Robin is 25 now.

C: What kind of work did your brother do?

L: He was a salesman of coke machines, things like that. He did different things. He was like papa, he'd go from one thing to another.

C: How long did he live here in Yuma?

L: Well, Burton was born in 1910 and he lived here until he was... Papa worked for Babbitt's for several years up there.

Then, Burton came down and stayed with us.

C: Did your parents die here in Yuma?

L: Mama and papa both died in San Diego.

C: Is that where they were living at that time?

L: No. It just happened that mama always went over there in the summer with the children. When school was out, I'd go over there and come back when school started. I was over there and mama came over and she was sick. She went to the hospital and was operated on and she had cancer and she died. Then papa went over and he was with my brother who was staying in San Diego, too. Papa died there with a stroke.

C: When your mother died, where were they actually living?

L: Here. But she was cremated over there in San Diego. Phil's folks lived in San Diego. They came out there when Phil was real small , from Cincinnati. He had asthma in Cincinnati and he felt that he'd be better off in San Diego. His mother's father lived in Riverside. He had an orange grove there. Harding had a meat factory there and Phil's dad worked for him as his right hand man until he died.

C: How many children did you have?

L: Three boys.

C: What were their names?

L: Robert "Bobby" was the oldest, then Dick , and/ Bill Coffeen. He's a salesman out there at Cunard . He worked for Phil until Phil got out of the business. Phil let him have it for a while and he worked and then decided to quit the oil business and he went to work selling cars. The youngest boy, they were all four and a half years apart. He went to school the first year in Flagstaff college, the second year, he went to school at U of A because he didn't want to go to Flagstaff. I wanted him to go to school at Flagstaff because he had asthma and I thought he was going to grow out of it then. He had asthma as a child. Not like Phil had it, I guess, but bad. I figured , going to the higher altitude, he'd be better off. The following year, he decided to go to U of A because he knew too many kids there and he never could study. It's funny, he was so different from the other two, he always had that ability to want to study and want to do things. He hadn't any more than got started good when World War II broke out.

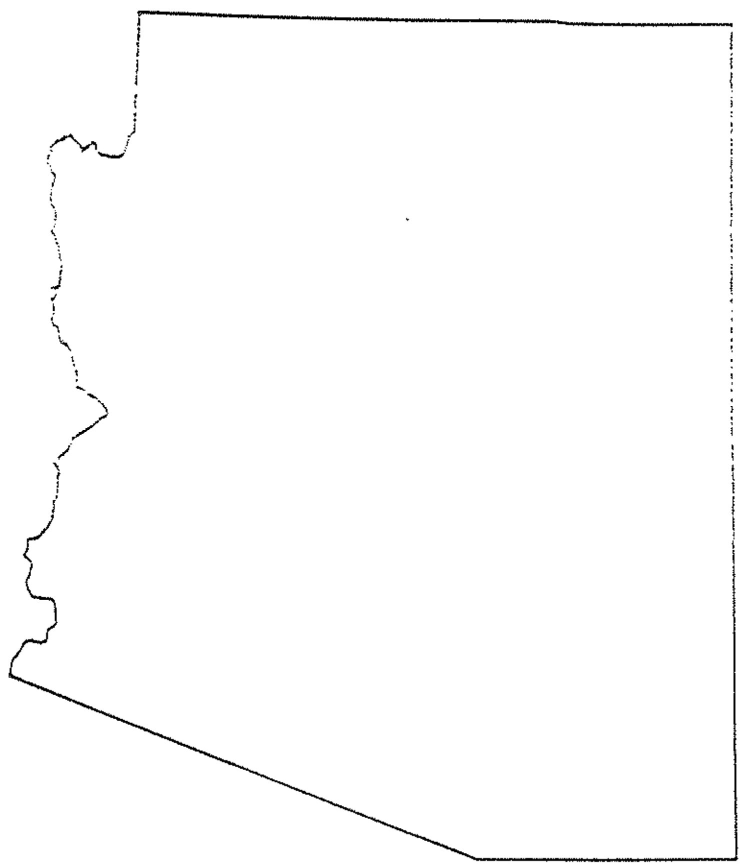
Harry Coleman was the head of the draft board here and he called me one day and said, "Bill's number is going to be called to be drafted." Phil didn't want him to be drafted so he called Bill and told him he had better come home and he joined the Navy. He went right from here to Korea and was there during the war. He had yellow jaundice and he was so sick.

THE END

Appendix E

Extract of U.S.G.S. Water Supply Papers
and Water-Data Reports (ch. 6)

Water Resources Data
Arizona
Water Year 1991



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT AZ-91-1

Prepared in cooperation with the State of Arizona
and with other agencies

09448500 GILA RIVER AT HEAD OF SAFFORD VALLEY, NEAR SOLOMON, AZ

LOCATION.--Lat 32°52'06", long 109°30'38", in SE¼NE¼ sec.31, T.6 S., R.28 E., Graham County, Hydrologic Unit 15040005, on left bank 0.6 mi downstream from intake of Brown Canal, 8 mi northeast of Solomon, and 17 mi downstream from San Francisco River. Records include flow of Brown Canal, which is measured 2,000 ft downstream from intake.

DRAINAGE AREA.--7,896 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1914 to current year. Monthly discharge only for some periods, published in WSP 1313. Prior to October 1932 and October 1940 to September 1949 published as "near Solomonsville" and October 1932 to October 1933 and May 1935 to September 1940 as "below Bonita Creek near Solomonsville."

REVISED RECORDS.--WSP 1059: 1914, 1916-17, 1923(M), 1924-25, 1927, 1929-31(M). WSP 1179: 1915, 1918-19(M). WSP 1313: 1934. WSP 1733: 1923.

GAGE.--Water-stage recorder. Datum of gage is 3,059.92 ft above National Geodetic Vertical Datum of 1929. Prior to July 8, 1980, at datum 4.96 ft higher. See WSP 1733 for history of changes prior to Jan. 1, 1941. Supplementary water-stage recorder and Parshall flume on Brown Canal.

REMARKS.--No estimated daily discharges. Records good. Records show water reaching head of Safford Valley and include water diverted to Brown Canal. Diversions above station for mining, municipal use, and for irrigation of about 17,500 acres, much of it by pumping from ground water.

COOPERATION.--Record for Brown Canal furnished by Gila Water Commissioner.

AVERAGE DISCHARGE.--77 years, 481 ft^3/s, 348,500 acre-ft/yr; median of yearly mean discharges, 330 ft^3/s, 239,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 132,000 ft^3/s Oct. 2, 1983, gage height, 20.8 ft, from rating curve extended above 52,000 ft^3/s on basis of slope-area measurements at 14.40 ft and 20.8 ft; minimum, 11 ft^3/s June 25, 1956.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 4,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 31	0300	6,250	10.66	Sept. 6	0200	7,770	11.26
Mar. 2	0815	*25,200	*14.38	Sept. 10	1430	4,320	9.97

Minimum daily discharge, 77 ft^3/s July 14.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	295	176	232	2900	399	4770	2230	654	259	93	182	546
2	738	180	227	1960	389	18600	2130	600	249	90	230	474
3	591	253	220	1580	377	12000	2210	587	247	86	322	401
4	498	282	220	1310	365	6520	2150	561	232	82	330	369
5	419	232	218	1620	349	5590	2170	530	221	111	276	1620
6	365	219	216	2550	344	5570	2290	534	211	116	547	4730
7	325	225	218	3360	344	6330	2470	522	199	109	571	1640
8	290	357	223	3220	339	5700	2600	505	192	101	535	1320
9	255	336	222	2520	336	4340	2440	509	181	95	603	993
10	238	305	214	1880	325	3370	2160	535	174	98	669	2810
11	231	284	210	1580	317	2720	1950	551	170	92	638	2000
12	221	263	209	1390	337	2250	1740	561	177	86	661	1240
13	218	249	220	1210	371	2050	1570	566	178	80	587	857
14	206	246	233	1070	381	1900	1440	550	172	77	480	695
15	197	243	296	950	394	1690	1310	527	166	86	1080	583
16	192	238	284	878	452	1540	1170	514	158	99	741	516
17	189	230	651	830	513	1440	1060	507	152	106	536	465
18	165	220	689	758	854	1320	992	494	142	105	735	473
19	187	212	799	696	1360	1180	948	475	131	94	866	408
20	189	210	782	633	1440	1140	925	453	124	90	1220	369
21	182	211	665	591	1270	1180	909	437	123	87	786	337
22	175	212	600	551	1150	1260	925	410	116	83	634	313
23	175	213	550	539	1110	1350	934	385	113	109	620	296
24	174	212	485	521	1110	1660	909	371	110	129	613	291
25	170	210	448	503	1130	1980	876	358	103	183	579	279
26	170	211	415	487	1140	2180	832	343	93	384	601	259
27	181	224	389	465	1130	2560	798	338	91	293	687	236
28	181	229	395	444	1120	2490	761	320	92	265	716	226
29	177	230	1150	428	---	2820	711	302	95	199	672	221
30	176	232	4680	425	---	2530	685	280	94	199	583	213
31	173	---	4800	414	---	2450	---	270	---	209	607	---
TOTAL	7961	7156	21160	38263	19156	112480	44295	14549	4765	4037	18913	25180
MEAN	257	239	683	1234	684	3628	1476	469	159	130	610	839
MAX	738	367	4800	3360	1440	18600	2600	654	259	384	1220	4730
MIN	170	176	209	414	317	1140	685	270	91	77	182	213
AC-FT	15790	14190	41970	75890	38000	223100	87860	28860	9450	8010	37510	49940

CAL YR 1990 TOTAL 85718 MEAN 235 MAX 4800 MIN 33 AC-FT 170000
WTR YR 1991 TOTAL 317915 MEAN 871 MAX 18600 MIN 77 AC-FT 630600

09466500 GILA RIVER AT CALVA, AZ
(National stream-quality accounting network station)

LOCATION.--Lat 33°11'08", long 110°13'10", in SW¼ sec.8, T.3 S., R.21 E. (unsurveyed), Graham County, Hydrologic Unit 15040005, in San Carlos Indian Reservation, on Southern Pacific Railroad bridge at head of San Carlos Reservoir, 2.0 mi west of Calva.

DRAINAGE AREA.--11,470 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1929 to current year.

GAGE.--Water-stage recorder. Datum of gage is 2,517.29 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1954, and Aug. 25, 1956, to Dec. 31, 1962, at datum 2.52 ft lower. Oct. 1, 1954, to Aug. 24, 1956, at datum 5.52 ft lower. Dec. 31, 1962, to Oct. 20, 1972, at site 530 ft downstream at datum 3.65 ft lower. Oct. 20, 1972, to Sept. 30, 1974, supplementary gage at bridge on U.S. Highway 70, 6.2 mi upstream at datum 2,560.19 ft, NGVD.

REMARKS.--Records poor. Diversion above station for irrigation of about 69,000 acres, metallurgical treatment of ores, and municipal uses.

AVERAGE DISCHARGE.--62 years, 332 ft^3/s, 240,500 acre-ft/yr; median of yearly mean discharges, 210 ft^3/s, 152,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 150,000 ft^3/s Oct. 3, 1983, gage height, 23.1 ft, from rating curve extended above 87,000 ft^3/s on basis of area-velocity and flow-over-road computations of peak flow; no flow at times.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1914, probably in excess of 100,000 ft^3/s Jan. 20, 1916, determined on basis of peak discharge at stations near Solomon and at Kelvin.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Jan. 1	0230	14,100	10.53	Sept. 7	0500	4,880	7.10
Jan. 8	2015	4,790	6.59	Sept. 13	0830	4,210	6.42
Mar. 3	0915	*46,400	*14.15				

Minimum daily discharge, 6.2 ft^3/s Oct. 3.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e6.5	e68	e145	12400	213	1080	2300	717	241	32	24	e290
2	e6.4	e68	e145	4520	188	2430	[illegible]	[illegible]	202	31	31	e250
3	e6.2	e70	e140	1440	186	36000	2070	637	229	28	28	e270
4	e64	e72	e135	991	178	16000	2060	627	201	26	25	e260
5	e161	e75	e141	700	172	4870	3000	605	194	27	25	254
6	e157	e80	e146	1080	181	3530	2080	592	169	29	47	1710
7	e141	e118	e137	2460	150	3330	2240	561	152	22	42	3480
8	e131	e122	e139	4190	151	5900	2440	530	128	24	159	1770
9	e116	e105	e137	4110	144	5040	2500	493	118	21	172	1700
10	e103	e104	e128	3030	131	4030	2490	511	113	24	185	1930
11	e98	e176	169	e1980	171	3140	2230	544	90	24	181	3740
12	e95	e174	171	e1550	160	3030	1900	532	84	23	e250	2860
13	e85	e172	191	e1410	137	2650	1720	558	78	22	e500	2300
14	e80	e177	213	e1280	131	2010	1550	545	[illegible]	22	e1000	1700
15	e75	e166	230	e1150	121	1500	1400	600	76	22	e1500	1390
16	e70	e164	288	e1070	120	1370	1250	606	74	22	1070	e1000
17	e65	e161	387	e971	e119	1210	1150	595	73	21	957	e900
18	e60	e160	329	e884	e118	1110	1100	580	67	20	813	e750
19	e55	e161	353	e804	105	1010	955	536	61	19	755	e650
20	e50	e155	397	e730	335	894	800	533	57	18	e1000	e550
21	e51	e156	e424	e853	827	884	899	519	52	18	e800	e460
22	e52	e149	e493	585	887	979	860	475	48	17	e650	e420
23	e53	e145	e441	535	785	953	915	439	45	16	e570	e380
24	e55	e140	e431	487	708	1110	901	415	42	16	e500	e340
25	e57	e140	e415	419	699	1470	908	411	41	16	e450	e340
26	e58	e139	e393	361	699	1810	890	405	38	15	e420	e310
27	e60	e138	e373	334	687	2030	857	392	37	15	e390	e270
28	e62	e140	e364	309	731	2480	819	370	35	14	e350	e250
29	e64	e151	e435	283	---	2480	795	348	34	16	e330	e220
30	e66	e145	e414	260	---	2720	731	302	33	20	e320	e190
31	e68	---	3330	235	---	2440	---	257	---	22	e300	---
TOTAL	2307.1	4045	11539	51041	9611	124250	45054	16193	2916	670	13857	30554
MEAN	74.4	135	372	1646	343	4008	1502	522	97.2	21.6	447	1018
MAX	161	176	3330	12400	907	36000	2560	717	241	32	1500	3740
MIN	6.2	68	130	235	118	884	731	257	33	14	24	190
AC-FT	4580	8020	22890	101200	19060	246400	89360	32120	5780	1330	27490	60600

CAL YR	1990	TOTAL	30167.60	MEAN	82.7	MAX	3330	MIN	.00	AC-FT	59840
WTR YR	1991	TOTAL	312039.1	MEAN	855	MAX	36000	MIN	6.2	AC-FT	618900

e Estimated

09469000 SAN CARLOS RESERVOIR AT COOLIDGE DAM, AZ

LOCATION.--Lat 33°10'32", long 110°31'38", in NW¼ sec.17, T.3 S., R.18 E. (unsurveyed), Gila County, Hydrologic Unit 15040005, in San Carlos Indian Reservation, at right intake tower of Coolidge Dam on Gila River.

DRAINAGE AREA.--12,886 mi^2.

REVISED RECORDS.--WSP 1049: 1929, 1934, 1937-38. WSP 1283: Drainage area.

PERIOD OF RECORD.--November 1928 to current year.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929. Prior to Jan. 15, 1937, series of stakes with tops at known elevations for reference points on right bank about 1,000 ft upstream from dam. Jan. 15, 1937, to Dec. 31, 1947, water-stage recorder at present site at datum 0.72 ft lower.

REMARKS.--Reservoir is formed by concrete multiple-dome dam. Dam completed Oct. 25, 1928; storage began Nov. 15, 1928. Usable capacity (from capacity table computed by San Carlos Irrigation District, based on an estimate of sediment deposited since 1965; used since Jan. 1, 1991) 866,500 acre-ft between elevations 2,382.63 ft, sill of lowest outlet gate, and 2,510.4 ft (revised), crest of spillway. No dead storage. Figures given herein represent usable contents. Reservoir is used to store water for irrigation of San Carlos project and for power development, dependent on irrigation demands. Spill over Coolidge Dam because of capacity storage has occurred April 22 to May 5, 1979, Feb. 24 to Mar. 13, 1980, Oct. 4-23, 28-31, Dec. 3-13, 1983, Jan. 2 to June 5, 1985.

COOPERATION.--Wire-weight gage readings furnished by U.S. Bureau of Indian Affairs.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 1,090,000 acre-ft Feb. 26 to Mar. 6, 1980; maximum elevation observed, 2,520.3 ft Feb. 28, 1980; no usable contents at times.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 511,100 acre-ft May 6, 8, elevation, 2,484.9 ft; minimum, 45,000 acre-ft Oct. 1, 2, elevation, 2,418.5 ft.

Capacity table (elevation, in feet, and usable contents, in acre-ft)

Oct. 1 to Dec. 31, 1990

2,418	43,400	2,427	71,800
2,421	52,000	2,430	83,100
2,424	61,300		

Jan. 1 to Sept. 30, 1991

2,430	82,600	2,470	353,600
2,440	132,700	2,480	455,000
2,450	193,500	2,490	573,900
2,460	267,100		

RESERVOIR STORAGE (ACRE-FEET), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY OBSERVATION AT 24:00 VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	45000	47000	52500	86600	176300	227200	451600	509200	497300	448100	380800	334100
2	45000	47200	52800	95400	177200	267900	455000	509400	495800	446500	378500	332900
3	45100	47300	53100	100500	178200	287800	457900	509900	494600	444000	376400	331400
4	45200	47300	53300	105100	179000	312000	461000	510100	493300	442000	374300	330500
5	45300	47400	53500	110300	179800	338500	464000	510600	492300	439600	372100	330000
6	45400	47500	53800	115400	180700	346300	467100	511100	490900	437500	369600	329800
7	45500	47600	54000	121700	181500	355500	470000	511000	489700	435000	367700	332400
8	45600	47700	54200	127300	182000	365900	473200	511100	488600	433100	365900	333700
9	45700	47800	54500	133700	182800	374700	477100	510600	487200	431000	363800	334600
10	45900	47900	54700	138200	183400	380600	480500	510100	486000	428800	361900	335300
11	46000	48000	54900	143200	184300	384400	482600	509700	484600	425400	361000	337500
12	46100	48200	55200	146600	185100	387300	485500	509700	483300	424000	359700	339700
13	46300	48400	55500	149700	185600	390100	488000	509200	481700	422300	358100	340900
14	46300	48600	55900	152000	186500	392500	490300	509000	480500	420400	356600	341800
15	46400	48800	56200	154600	187100	394500	492300	508500	479000	417400	355400	342200
16	46500	49100	57200	156500	187700	396100	494200	508500	477500	415400	354400	342600
17	46600	49300	58300	158500	188200	397600	495600	508400	475800	413300	353500	343000
18	46700	49600	58800	160100	189200	399000	497000	508000	474000	411000	352200	343400
19	46700	49900	59400	161800	190300	400000	498100	507800	472100	408500	350700	343800
20	46700	50200	60000	163300	191600	401400	499500	507400	470000	406800	349400	343800
21	46700	50400	60400	164700	193400	402600	500200	506800	468200	404900	348500	343800
22	46700	50600	61200	166000	195400	404700	501400	506600	465900	402300	347800	344300
23	46700	50800	62000	167300	197000	408000	502300	506400	464100	400800	346400	344300
24	46700	51000	62800	168500	198500	413500	503500	505900	462100	398300	344900	344900
25	46700	51300	63600	169600	200000	417200	504700	504900	460100	396200	343600	345000
26	46800	51500	64300	170800	201500	421400	505400	504600	458100	393900	342400	345600
27	46800	51700	65200	171800	203000	426200	506100	503600	456100	391600	340700	345600
28	46800	51900	65200	172600	205100	431500	507100	502600	454100	389200	339500	345600
29	46800	52100	72500	173900	---	437300	507800	501400	452100	387100	338300	345800
30	46900	52300	79700	174400	---	442500	508500	499400	450100	384900	337100	346000
31	46900	---	81500	175500	---	447400	---	498500	---	382900	335700	---
MAX	46900	52300	81500	175500	205100	447400	508500	511100	497300	448100	380800	346000
MIN	45000	47000	52500	86600	176300	227200	451600	498500	450100	382900	335700	329800
(*)	2419.3	2421.1	2429.6	2447.2	2451.7	2479.3	2484.7	2483.8	2479.6	2473.1	2468.0	2469.2
(**)	+2000	+5400	+29200	a+94000	+29600	+242300	+61100	-10000	-48400	-67200	-47200	+10300

CAL YR 1990 MAX 81500 MIN 33900 (**) +24700
WTR YR 1991 MAX 511100 MIN 45000 (**) a+301100

(*) Elevation in feet, at end of month.
(**) Change in contents, in acre-feet.
a Based on new capacity table effective January 1, 1991.

09469500 GILA RIVER BELOW COOLIDGE DAM, AZ

LOCATION.--Lat 33°10'10", long 110°31'50", in SW¼ sec.17, T.3 S., R.18 E. (unsurveyed), Pinal County, Hydrologic Unit 15050100, on left bank 2,200 ft downstream from Coolidge Dam.

DRAINAGE AREA.--12,886 mi^2.

PERIOD OF RECORD.--July to October 1899, April 1900 to March 1902, July to September 1902, December 1902 to December 1904, January to May 1905 (gage heights only), June to November 1905; August 1910 to February 1911 (gage heights only); April 1914 to current year. Published as "at San Carlos" 1899-1911, as "near San Carlos" 1914-26, and as "at Coolidge Dam" 1927-38.

REVISED RECORDS.--WSP 629: 1915-16. WSP 1049: 1899-1904. WSP 1149: 19M), 1921, 1922(M), 1923, 1924(M). WSP 1283: Drainage area.

GAGE.--Water-stage recorder and Parshall flume. Datum of gage is 2,309.33 ft above National Geodetic Vertical Datum of 1929. Prior to Feb. 5, 1911, nonrecording gage at various sites and datums upstream from mouth of San Carlos River. Apr. 29, 1914, to Mar. 8, 1937, water-stage recorder at various sites within 1 mi upstream from present site at different datums. Mar. 27, 1979 to Oct. 10, 1980, and since Oct. 4, 1983, supplementary water-stage recorder at site on left bank 1,000 ft upstream at datum 2,309.5 ft above NGVD, used above discharges at approximately 1,570 ft^3/s, maximum capacity of parshall flume.

REMARKS.--Records excellent except those below 20 ft^3/s, which are fair. Flow regulated by San Carlos Reservoir since Nov. 15, 1928. (See sta 09469000.) Record includes flow of Warm Springs, which enters between dam and gage. Large diversions above San Carlos Reservoir for irrigation, metallurgical treatment of ore, and municipal supply; about 69,000 acres of land was irrigated, a considerable portion by pumping from ground water.

AVERAGE DISCHARGE (adjusted for storage in San Carlos Reservoir).--79 years (water years 1901, 1904, 1915-91) 382 ft^3/s, 276,800 acre-ft/yr; median of yearly mean discharges, 230 ft^3/s, 167,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--1914-28: Maximum discharge, 130,000 ft^3/s Jan. 20, 1916, estimated on basis of peak discharge near Solomon and at Kelvin; no flow at times.
1928-91: Maximum discharge, 5,020 ft^3/s Oct. 6, 1983, gage height, 10.7 ft, at supplementary gage; no flow at times prior to 1938; minimum daily since 1938, 0.40 ft^3/s in several years.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,080 ft^3/s Aug. 7-25; minimum daily, 0.46 ft^3/s Feb. 21.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.1	1.2	1.0	.59	.87	1.0	172	250	802	922	e1050	1040
2	.93	1.0	1.0	.59	.77	.90	284	250	802	942	e1050	1020
3	.81	1.0	1.0	.59	.75	.51	284	288	775	982	e1040	948
4	.81	1.1	1.0	.75	.80	.51	285	303	757	999	e1040	887
5	.81	1.1	1.0	.71	.81	.51	284	303	757	999	e1050	802
6	.81	.81	1.0	.88	.80	.51	285	321	746	999	e1040	771
7	.81	.81	1.0	.59	.79	153	290	349	709	999	e1080	764
8	.81	.81	1.0	.59	.81	270	284	420	698	999	e1080	738
9	.81	.81	1.0	.60	.81	444	273	474	696	999	1080	528
10	.81	.81	1.0	.59	.81	551	273	484	696	999	1080	564
11	.81	.81	1.0	.59	.81	551	273	493	716	995	1080	548
12	.81	.81	1.0	.59	.81	551	273	480	735	999	1080	501
13	.81	.81	1.0	.59	.80	551	273	493	757	999	1080	490
14	.81	.81	1.0	.59	.78	567	273	501	757	1010	1080	481
15	.81	.81	1.0	.61	.55	576	251	502	757	1020	1080	471
16	.81	.81	1.2	.61	.58	577	250	501	757	1020	1080	382
17	.81	.81	e.59	.59	.60	575	250	453	802	1030	1080	314
18	.80	.81	e.59	.59	.59	577	250	428	868	1020	1080	288
19	.82	1.0	e.59	.59	.59	577	250	428	910	1020	1080	188
20	.83	1.0	e.59	.66	.47	577	250	425	910	1040	1080	138
21	.83	1.0	.59	.74	.46	508	250	428	910	1050	1080	138
22	.81	1.0	.59	.77	.47	450	250	428	910	e1050	1080	130
23	.83	1.0	.59	.77	.54	451	250	427	918	e1050	1080	130
24	.92	1.0	.59	.78	.54	452	250	432	922	e1050	1080	109
25	.94	1.0	.59	.78	.54	403	250	477	922	e1050	1080	100
26	1.0	1.0	.59	.78	.55	371	250	525	922	e1050	1070	100
27	.99	1.0	.59	.81	.52	290	250	600	922	e1050	1050	100
28	1.0	1.0	.77	.79	.70	98	250	702	922	e1050	1050	100
29	1.1	1.0	.83	.62	---	.60	250	813	922	e1050	1050	100
30	1.1	1.0	.59	.61	---	.50	250	836	922	e1050	1040	100
31	1.1	---	.59	.62	---	.52	---	809	---	e1050	1040	---
TOTAL	27.24	28.13	25.47	20.51	18.75	10145.60	7817	14637	24621	31542	33090	13098
MEAN	.88	.94	.82	.66	.67	327	261	472	821	1017	1067	437
MAX	1.1	1.2	1.2	.82	.87	577	290	836	922	1050	1080	1040
MIN	.80	.81	.59	.59	.46	.50	172	250	696	922	1040	100
AC-FT	54	56	51	41	37	20120	15510	29030	48840	62560	65630	25980

CAL YR 1990 TOTAL 22892.00 MEAN 62.7 MAX 389 MIN .59 AC-FT 45410
WTR YR 1991 TOTAL 135070.70 MEAN 370 MAX 1080 MIN .46 AC-FT 267900

e Estimated

09470000 GILA RIVER AT WINKELMAN, AZ

LOCATION.--Lat 33°00'21", Long 110°45'21", in SW¼SW¼ sec.7, T.5 S., R.15 E., Gila County, Hydrologic Unit 15050100, on right bank 1.2 mi north of Winkelman, 3.0 mi upstream from San Pedro River, and 29 mi downstream from Coolidge Dam.

DRAINAGE AREA.--13,268 mi², of which 382 mi² is below Coolidge Dam.

PERIOD OF RECORD.--September 1917 to June 1918, September 1941 to September 1980, July 1984 to September 1991 (discontinued).

REVISED RECORDS.--WSP 1283: Drainage area. WDR AZ-89-1: 1988.

GAGE.--Water-stage recorder. Elevation of gage is 1,935 ft above National Geodetic Vertical Datum of 1929, from topographic map. Sept. 10, 1917, to June 27, 1918, nonrecording gage at bridge 2.3 mi downstream at different datum. September 1941 to Jan. 5, 1964, at site 0.6 mi downstream at datum 1,920.95 ft, NGVD. Dec. 12, 1974 to Sept. 30, 1980, and July 1984 to Jan. 16, 1987, water-stage recorder 0.7 mi downstream at datum 1,921.76 ft, NGVD. Supplemental nonrecording gage 2.4 mi downstream at datum 1908.08 ft, NGVD, since Aug. 9, 1963. Supplemental water-stage recorder at bridge 2.3 mi downstream Jan. 5, 1964 to Nov. 24, 1975, at datum 1907.00 ft, NGVD.

REMARKS.--Records good except for estimated daily discharges, which are fair. Large diversions above station for irrigation, metallurgical treatment of ore, and municipal supply, but none between Coolidge Dam and this station. About 69,000 acres irrigated in the basin above Coolidge Dam, a considerable portion by pumping from ground water. Flow regulated by San Carlos Reservoir (See sta 09469000).

AVERAGE DISCHARGE (adjusted for storage in San Carlos Reservoir).--46 years (water years 1942-80, 1985-91), 324 ft³/s, 236,900 acre-ft/yr; median of yearly mean discharges, 190 ft³/s, 138,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 55,000 ft³/s of which 500 ft³/s was released by Coolidge Dam, Aug. 9, 1944, gage height, 18.40 ft, site and datum then in use, from rating curve extended above 2,800 ft³/s on basis of slope-area measurement of peak flow; no flow at times.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge during period Oct. 1930 to June 1934, 17,000 ft³/s, Oct. 2, 1933, gage height 16.3 ft, from flood mark, at former site 0.7 mi downstream, from rating curve extended above 6,000 ft³/s, (no significant release from Coolidge Dam).

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,680 ft³/s, Mar. 2, gage height, 3.11 ft, unadjusted for release from Coolidge Dam; minimum daily, 2.6 ft³/s Oct. 27-Nov. 1.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	2.6	6.[illegible]	14	13	398	102	294	697	921	1190	1050
2	12	4.8	6.[illegible]	13	13	1630	355	298	797	938	1100	1040
3	5.9	5.1	7.4	21	19	716	366	300	777	985	1100	999
4	5.1	4.6	6.8	13	18	127	355	347	704	1010	1100	897
5	4.8	4.6	6.8	129	19	91	350	355	700	1010	1110	937
6	4.1	4.8	6.7	352	19	72	348	383	764	1010	1110	761
7	4.1	4.8	6.3	110	18	90	344	394	734	1010	1130	738
8	3.7	4.6	6.3	64	18	e240	338	414	807	1020	1130	715
9	3.3	4.6	6.3	17	18	e480	312	551	698	1020	1140	647
10	3.5	4.6	6.3	38	18	e620	309	550	715	1010	1140	513
11	3.4	4.6	6.3	30	19	e620	306	564	712	1010	1140	496
12	3.8	4.6	6.3	30	19	e620	302	555	770	1020	1130	446
13	3.8	4.6	7.0	28	19	e620	304	541	771	1020	1130	425
14	3.8	4.6	7.4	27	19	e630	305	524	763	1030	1140	511
15	3.8	4.6	7.4	25	19	e640	307	525	773	1050	e1140	531
16	3.8	4.5	49	25	19	e640	286	518	769	1060	e1140	516
17	3.5	4.6	31	24	19	e640	282	494	762	1060	e1140	378
18	3.5	4.3	17	23	51	e640	283	422	891	1060	e1140	367
19	3.5	4.4	13	22	34	e640	284	413	943	1060	e1140	341
20	3.5	4.5	12	22	27	647	280	415	940	1080	e1130	198
21	3.5	4.6	21	22	22	761	279	415	930	1100	e1130	181
22	3.5	5.0	24	22	20	812	283	412	902	1100	e1130	189
23	3.5	5.0	21	22	18	688	286	409	902	1100	e1150	184
24	3.4	5.0	16	21	18	611	286	407	924	1100	e1190	152
25	3.0	5.3	15	21	18	560	287	414	919	1100	e1130	157
26	3.0	5.4	14	21	17	500	290	476	917	1100	e1110	163
27	2.6	5.9	14	21	17	473	288	517	917	1100	1110	160
28	2.6	6.2	52	20	27	567	286	645	914	1110	1110	157
29	2.6	6.4	151	20	---	367	286	726	918	1110	1100	151
30	2.6	6.7	146	20	---	232	290	859	921	1110	1090	143
31	2.6	---	56	19	---	134	---	807	---	1100	1060	---
TOTAL	153.4	146.3	751.3	1330	588	16017	8981	14970	24658	32504	34840	14153
MEAN	4.95	4.88	24.2	42.9	21.0	517	299	483	822	1049	1124	472
MAX	12	6.7	151	352	51	1630	366	859	943	1110	1190	1050
MIN	2.6	2.6	6.3	19	17	72	102	294	697	921	1060	143
AC-FT	249	290	1490	2640	1170	31770	17810	29690	48910	64470	69110	28070

CAL YR 1990 TOTAL 26273.48 MEAN 72.0 MAX 1220 MIN .03 AC-FT 52110
WTR YR 1991 TOTAL 149064.3 MEAN 408 MAX 1630 MIN 2.6 AC-FT 295700

e Estimated

09474000 GILA RIVER AT KELVIN, AZ

LOCATION.--Lat 33°06'10", long 110°58'33", in NE¼NW¼ sec.12, T.4 S., R.13 E., Pinal County, Hydrologic Unit 15050100, on left bank at Kelvin, 500 ft downstream from Mineral Creek, 18 mi downstream from San Pedro River, and 19 mi upstream from Ashurst-Hayden Dam.

DRAINAGE AREA.--18,011 mi^2, of which 5,125 mi^2 is below Coolidge Dam.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1911 to current year.

REVISED RECORDS.--WSP 329: 1911. WSP 509: 1916(M). WSP 629: 1914-17. WSP 1119: 1913, 1915, 1917(M), 1921(M), 1922-23, 1927(M). WSP 1283: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,745.02 ft above National Geodetic Vertical Datum of 1929. Prior to June 15, 1914, and Dec. 1, 1914, to Aug. 31, 1915, nonrecording gages at several sites within 2 mi of present site at different datums. Sept. 1, 1915, to Sept. 30, 1963, water-stage recorder at site 900 ft downstream at datum 1.80 ft lower. Jan. 16, 1985, to June 1990, supplementary water-stage recorder at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are poor. Large diversions above station for irrigation, of which about 90 percent is above Coolidge Dam. About 82,000 acres irrigated, a considerable portion by pumping from ground water. Flow regulated by San Carlos Reservoir 49 mi upstream since Nov. 15, 1928. (See sta 09469000.) San Pedro River contributes major portion of unregulated inflow.

AVERAGE DISCHARGE (adjusted for storage in San Carlos Reservoir).--80 years, 501 ft^3/s, 363,000 acre-ft/yr; median of yearly mean discharges, 340 ft^3/s, 246,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--1911-28: Maximum discharge, about 132,000 ft^3/s Jan. 20, 1916, gage height, 19.5 ft, site and datum then in use, from rating curve extended above slope-area measurement at gage height, 16.2 ft for flood of Sept. 28, 1926; no flow Feb. 25, 1913.
1929-91: Maximum discharge, 100,000 ft^3/s Oct. 2, 1983, gage height, 33.0 ft from floodmark, from rating curve extended above 12,000 ft^3/s on basis of peak discharge computed by step-backwater method at Hayden Railroad Bridge, 17.3 mi upstream, and by flood-routing; minimum daily, 1.1 ft^3/s June 25, 1981.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 4,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Mar. 3	unknown	*11,100	*15.69

Minimum daily discharge, 6.3 ft^3/s, Oct. 29-Nov. 1.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	6.3	11	2330	41	523	537	326	e770	924	e1100	1100
2	26	6.3	11	1370	41	4870	524	320	e750	927	e1060	1100
3	19	7.3	12	539	40	e3200	575	328	e730	967	e1050	1070
4	13	8.3	12	241	39	e1070	540	340	e710	981	e1050	999
5	15	8.3	12	275	39	e735	516	349	e700	1010	e1050	1040
6	14	7.7	13	483	39	e300	495	350	e675	1010	e1060	864
7	10	7.9	12	e1950	38	245	477	357	e671	1010	1080	796
8	9.9	7.9	12	e1300	38	315	460	375	645	1000	1090	790
9	8.7	8.1	13	e1270	37	421	e430	440	638	1010	1080	765
10	8.7	8.1	14	e300	35	665	e410	458	642	1000	1090	644
11	8.2	7.9	14	95	35	704	e400	471	636	1000	1100	595
12	8.2	7.9	15	83	37	688	e385	473	647	1010	1150	544
13	8.2	7.8	17	74	e37	680	e375	471	674	1010	1100	502
14	8.3	7.6	18	68	e40	677	e365	468	682	1010	1100	490
15	8.0	7.2	18	63	e36	559	e360	476	673	1030	1090	479
16	7.8	7.3	71	59	e36	720	e345	482	675	1030	1120	474
17	7.9	7.7	163	56	e46	712	337	485	672	1030	1120	404
18	7.8	7.9	97	52	e82	733	330	448	748	1090	1120	354
19	7.8	7.7	77	50	e78	724	324	439	812	1050	1110	326
20	7.5	8.3	429	49	e76	846	322	e435	821	1100	1110	254
21	7.5	8.7	e325	47	e56	974	318	e430	818	1150	1110	201
22	7.4	8.9	216	44	e50	1230	316	e425	809	1130	1110	205
23	7.3	9.0	199	44	e45	1170	316	e420	823	1130	1280	223
24	7.0	8.7	210	43	39	1180	315	e410	849	1130	1160	e185
25	6.9	9.0	199	43	37	1180	313	e400	857	1130	1150	179
26	6.7	9.6	194	42	36	1010	303	e400	883	1130	1150	147
27	6.7	10	194	41	36	1120	304	e440	902	1130	1120	143
28	6.5	9.7	366	41	43	1180	301	e630	906	1140	1110	143
29	6.3	10	1400	43	---	1480	e302	e720	906	1140	1100	140
30	6.3	10	2130	44	---	1170	330	e780	917	1160	1110	132
31	6.3	---	2420	43	---	776	---	e770	---	1150	1090	---
TOTAL	287.9	247.3	8899	11082	1233	31987	11631	14112	22652	32729	34340	15290
MEAN	9.29	8.24	287	357	44.0	1032	388	455	755	1056	1108	510
MAX	26	10	2420	2330	82	4870	575	780	917	1160	1280	1100
MIN	6.3	6.3	11	41	35	245	301	320	636	924	1050	132
AC-FT	571	491	17650	21980	2450	63450	23070	27990	44930	64920	68110	30330

CAL YR	1990	TOTAL	47086.6	MEAN	129	MAX	2420	MIN	6.3	AC-FT	93400
WTR YR	1991	TOTAL	184490.2	MEAN	505	MAX	4870	MIN	6.3	AC-FT	365900

e Estimated

09479500 GILA RIVER NEAR LAVEEN, AZ

LOCATION.--Lat 33°15'25", long 112°09'59", in SW¼NW¼ sec.16, T.2 S., R.2 E., Pinal County, Hydrologic Unit 15050100, in Gila River Indian Reservation, on left abutment of highway bridge, 2.1 mi upstream from Santa Cruz River, 2.6 mi south of Komatke, and 7.3 mi south of Laveen.

DRAINAGE AREA.--20,615 mi^2, of which 696 mi^2 is in Mexico.

PERIOD OF RECORD.--January 1940 to September 1946, December 1947 to current year.

GAGE.--Water-stage recorder above concrete diversion dam. Datum of gage is 1,018.90 ft above National Geodetic Vertical Datum of 1929. Since July 9, 1969, supplementary water-stage recorder on overflow channel at highway bridge 0.2 mi south at same datum. Oct. 16, 1940, to July 8, 1969, supplementary staff gage or water-stage recorder on overflow channel at datum 0.23 ft lower.

REMARKS.--Records fair. Records include flow over dam and in overflow channel. Large diversions above station for irrigation. Most low flow is waste water from irrigated lands and from Chandler, Arizona treatment plant (1979-83). Flow partly regulated by storage in San Carlos Reservoir. (See elsewhere in this report.)

AVERAGE DISCHARGE.--49 years (water years 1941-46, 1949-91), 32.5 ft^3/s, 23,550 acre-ft/yr; median of yearly mean discharges, 10 ft^3/s, 7,200 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 35,000 ft^3/s Oct. 4, 1983, gage height, 12.08 ft main gage, 12.34 ft overflow gage, result of flow routing computation; no flow at times in most years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 203 ft^3/s, Mar. 6, gage height, 4.44 ft main gage; no flow for many days.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.70	.78	10	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.35	.78	8.0	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.27	1.3	7.9	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.42	.97	5.6	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.50	39	5.8	.00	.00	.00	.00	.00
6	.00	.00	.00	.00	.78	61	5.8	.00	.00	.00	e.00	.00
7	.00	.00	.00	.00	.78	9.3	5.6	.00	.00	.00	e.00	.00
8	.00	.00	.00	.00	.78	3.6	4.4	.00	.00	.00	e.00	.00
9	.00	.00	.00	.00	.78	2.7	3.8	.00	.00	.00	e.00	.00
10	.00	.00	.00	.00	.78	5.1	5.6	.00	.00	.00	e.00	.00
11	.00	.00	.00	.00	.78	4.5	4.5	.00	.00	.00	e.00	.00
12	.00	.00	.00	.00	.78	2.8	3.8	.00	.00	.00	e.00	.00
13	.00	.00	.00	.00	.78	3.8	3.6	.00	.00	.00	e.00	.00
14	.00	.00	.00	.00	.79	3.4	3.8	.00	.00	.00	e.00	.00
15	.00	.00	.00	.00	.88	2.6	3.6	.00	.00	.00	e.00	.00
16	.00	.00	.00	.00	.42	6.5	3.8	.00	.00	.00	e.00	.00
17	.00	.00	2.3	.00	.42	5.3	3.8	.00	.00	.00	e.00	.00
18	.00	.00	.32	.00	.54	3.0	3.8	.00	.00	.00	e.00	.00
19	.00	.00	.00	.00	.78	3.2	3.8	.00	.00	.00	e.00	.00
20	.00	.00	.00	.00	.78	4.1	3.5	.00	.00	.00	e.00	.00
21	.00	.00	.00	.00	.78	5.8	3.8	.00	.00	.00	.00	.00
22	.00	.00	.00	.00	.78	4.1	3.6	.00	.00	.00	.00	.00
23	.00	.00	.00	.00	.78	3.8	3.8	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.78	3.3	3.8	.00	.00	.00	.00	.00
25	.00	.00	.00	.00	.78	2.6	3.6	.00	.00	.00	.00	.00
26	.00	.00	.00	.00	.78	4.1	3.8	.00	.00	.00	.00	.00
27	.00	.00	.00	.00	.78	6.7	3.6	.00	.00	.00	.00	.00
28	.00	.00	.00	.00	.78	10	3.6	.00	.00	.00	.00	.00
29	.00	.00	.00	.00	---	9.3	3.2	.00	.00	.00	.00	.00
30	.00	.00	.00	.00	---	7.8	.41	.00	.00	.00	.00	.00
31	.00	---	.00	.52	---	6.6	---	.00	---	.00	.00	---
TOTAL	0.00	0.00	2.62	0.52	19.13	229.03	132.41	0.00	0.00	0.00	0.00	0.00
MEAN	.000	.000	.085	.017	.68	7.39	4.41	.000	.000	.000	.000	.000
MAX	.00	.00	2.3	.52	.78	61	10	.00	.00	.00	.00	.00
MIN	.00	.00	.00	.00	.27	.78	.41	.00	.00	.00	.00	.00
AC-FT	.00	.00	5.2	1.0	38	454	263	.00	.00	.00	.00	.00

CAL YR 1990 TOTAL 951.25 MEAN 2.69 MAX 388 MIN .00 AC-FT 1950
WTR YR 1991 TOTAL 383.71 MEAN 1.05 MAX 61 MIN .00 AC-FT 761

e Estimated

09514300 GILA RIVER AT U.S. HIGHWAY 85, NEAR BUCKEYE, AZ

LOCATION.--Lat 33°20'03", long 112°37'22", in SW¼SW¼SW¼ sec.13, T.1 S., R.4 W., Maricopa County, Hydrologic Unit 15070101, on U.S. Highway 85 bridge, 3.4 mi southwest of Buckeye.

DRAINAGE AREA.--46,345 mi^2.

PERIOD OF RECORD.--May 1979 to September 1980, December 1989 to current year.

GAGE.--Water-stage recorder. Datum of gage is 806.15 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records fair except for estimated daily discharges, which are poor. Most of base flow is effluent from municipal sewage treatment plant at 91st Avenue approximately 20 mi upstream.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 176,000 ft^3/s Feb. 16, 1980, computed by flood-routing method; maximum gage height unknown; minimum daily discharge, 2.7 ft^3/s Sept. 26, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,240 ft^3/s Apr. 2, gage height, 6.87 ft; minimum daily, 21 ft^3/s Oct. 13.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e160	42	295	87	67	121	2100	47	37	38	32	35
2	166	45	259	88	68	135	1570	47	32	38	29	39
3	56	70	273	94	89	553	1170	47	34	32	28	35
4	53	74	242	99	83	457	616	54	31	29	30	38
5	41	71	211	99	71	283	1210	53	31	28	28	37
6	37	69	206	101	71	186	892	43	30	27	26	54
7	36	64	183	98	73	256	705	40	32	32	26	48
8	39	73	168	98	52	231	503	41	34	30	28	46
9	30	84	225	106	77	157	350	47	37	32	34	47
10	35	85	185	95	80	142	744	37	40	30	31	46
11	39	84	124	92	75	130	1040	37	29	33	35	46
12	31	83	104	84	58	121	595	45	30	33	34	47
13	e21	87	95	92	56	116	384	41	35	38	27	37
14	e21	89	87	85	57	e110	304	33	35	31	30	44
15	31	83	81	84	69	e110	246	36	34	29	34	46
16	33	78	76	80	73	136	188	43	34	38	33	45
17	29	85	75	81	71	155	137	38	40	26	34	44
18	34	94	73	90	56	158	110	36	41	23	43	41
19	38	99	72	86	90	141	113	44	45	30	41	33
20	31	115	75	84	80	156	146	41	38	22	30	31
21	32	122	94	80	89	188	146	43	35	22	30	35
22	32	137	96	94	82	210	118	44	33	23	35	35
23	54	124	84	94	94	216	108	50	30	28	34	33
24	58	137	104	82	95	215	112	54	30	28	32	26
25	69	204	108	80	87	225	98	49	27	26	32	34
26	55	247	95	82	100	221	78	56	30	27	30	34
27	59	253	86	95	100	340	76	57	32	32	30	39
28	54	279	77	103	109	425	80	53	27	34	32	41
29	47	272	89	95	---	571	70	43	32	35	32	46
30	39	279	84	90	---	1350	46	42	36	33	35	45
31	40	---	89	88	---	1730	---	37	---	32	37	---
TOTAL	1514	3628	4172	2868	2302	9570	14569	1385	1011	910	1002	1207
MEAN	48.8	121	135	92.5	82.2	309	486	44.7	33.7	29.4	32.3	40.2
MAX	166	279	295	106	109	1730	2100	57	45	38	43	54
MIN	21	42	72	80	52	110	46	36	27	22	26	26
AC-FT	3000	7200	8280	5690	4570	18980	28940	2750	2010	1800	1990	2390

CAL YR	1990	TOTAL	45118	MEAN	124	MAX	1110	MIN	21	AC-FT	89490
WTR YR	1991	TOTAL	44158	MEAN	121	MAX	2100	MIN	21	AC-FT	87590

e Estimated

09518000 GILA RIVER ABOVE DIVERSIONS, AT GILLESPIE DAM, AZ
(National stream-quality accounting network)

LOCATION.--Lat 33°13'45", long 112°46'00", in SE¼NE¼ sec.28, T.2 S., R.5 W., Maricopa County, Hydrologic Unit 15070101, at Gillespie Dam, 8 mi downstream from Hassayampa River. Gila Bend Canal diverts from left end, and Enterprise Canal diverts from right end, of Gillespie Dam.

DRAINAGE AREA.--49,650 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1935 to November 1939 (monthly discharge only published in WSP 1313), December 1939 to September 1971 (published with records for sta 09519500, Gila River below Gillespie Dam), 1972 and 1973 (water year estimates only, listed in REMARKS for sta 09519500), October 1973 to current year. Low-flow records prior to October 1970 are not equivalent as leakage less than 5 ft^3/s is not included.
09518500. Gila Bend Canal: May 1935 to September 1971, October 1973 to current year (since October 1941, monthly discharge only).
09519000. Enterprise Canal: June 1935 to September 1939 (discharge measurements and monthly estimates only), October 1939 to September 1971, April 1974 to current year (since October 1941, monthly discharge only). Published as "Gillespie Canal" prior 1951.

GAGE.--Gila Bend Canal: Water-stage recorder 200 ft downstream from headgates.
Enterprise Canal: Water-stage recorder 600 ft downstream from intake at dam.

REMARKS.--Records poor. Record is obtained by combining, on a daily basis, the flows of Gila Bend Canal, Enterprise Canal, and Gila River below Gillespie Dam (see sta 09519500).
Many large diversions above station for irrigation, municipal, and industrial use. Flow of Gila River and tributaries above this station is regulated: by San Carlos Reservoir on Gila River - capacity, 1,073,600 acre-ft; by a series of reservoirs on Salt River - capacity, 1,755,000 acre-ft; by Bartlett and Horseshoe Reservoirs on Verde River - capacity, 317,700 acre-ft; and by Lake Pleasant on Agua Fria River - capacity, 157,600 acre-ft.

AVERAGE DISCHARGE.--56 years, 391 ft^3/s, 283,300 acre-ft/yr; median of yearly mean discharges, 120 ft^3/s, 86,900 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 124,000 ft^3/s Feb. 17, 1980; no flow except for possible leakage of less than 5 ft^3/s Nov. 24-27, 1966, July 14, 1967.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,900 ft^3/s Apr. 2; minimum daily, 54 ft^3/s Aug. 22.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e253	e140	e170	e260	e239	e252	e1770	e150	127	138	130	147
2	e298	e129	e210	e271	e250	e1230	e1900	e165	137	98	138	149
3	e297	e169	e220	e249	e265	e464	e1340	e161	150	87	88	147
4	e265	e179	e240	e227	e274	e381	e1100	e155	118	77	98	147
5	e264	e194	e230	e290	250	e334	e1120	e153	105	73	101	147
6	e263	e171	e190	e299	238	e264	e1200	e161	80	77	58	161
7	e249	e173	e200	e260	241	e257	e664	e133	142	98	65	187
8	e212	e205	e180	e243	245	e247	e546	117	135	104	75	185
9	e189	e235	e183	e231	233	e215	e519	159	122	89	94	161
10	e169	e225	e187	e210	e200	e185	e519	150	117	93	100	157
11	e150	e194	e217	211	e224	e182	e1030	126	98	107	126	110
12	e150	e203	e179	224	e218	e175	e619	128	100	132	139	106
13	e211	e183	e159	222	e214	e164	e477	157	101	98	108	160
14	e192	e173	e197	220	e228	e154	e390	135	124	77	97	158
15	e227	e165	e188	212	e230	e170	e350	107	142	77	81	182
16	e184	e177	e178	212	e221	e188	e323	109	64	75	70	139
17	e173	e167	e199	185	e228	e221	e284	112	75	111	69	154
18	e156	e203	e199	212	e233	e231	e239	115	78	127	70	140
19	e121	e170	e209	210	e191	e236	e206	119	60	97	106	181
20	e132	e151	e238	199	e209	e247	e196	147	60	132	104	151
21	e148	e116	e226	229	e243	e237	e202	136	118	173	55	127
22	e208	e141	e218	209	e240	e228	e228	109	124	164	54	120
23	e268	e171	e239	217	e205	e207	e210	94	135	113	77	136
24	e267	e140	e255	235	e195	e202	e161	111	170	97	97	102
25	e196	e140	e269	e203	e222	e320	e185	131	126	86	127	157
26	e139	e80	e310	e188	e251	e463	e164	141	126	79	131	e161
27	e179	e119	e294	e215	e240	e389	e163	148	120	95	189	160
28	e229	e139	e260	248	e235	e467	e182	117	118	99	189	160
29	e229	e160	e239	236	---	e348	e211	102	110	137	142	159
30	e193	e170	e229	239	---	e668	e211	101	100	88	111	168
31	e162	---	e260	230	---	e1270	---	104	---	100	151	---
TOTAL	6373	4988	6793	7101	6499	10627	17009	4073	3454	3200	3217	4513
MEAN	206	166	219	229	232	343	567	131	115	103	104	150
MAX	298	235	310	299	274	1270	1900	165	170	173	189	187
MIN	121	80	167	188	191	154	151	94	60	73	54	102
AC-FT	12640	9890	13470	14080	12890	21080	33740	8080	6850	6350	6380	8950
(*)	1060	602	1110	2160	6820	5560	11770	6240	6070	5610	5530	4970
(**)	1060	1170	1180	1160	931	915	871	902	718	742	764	883

CAL YR 1990 TOTAL 83507 MEAN 229 MAX 1410 MIN 35 AC-FT 165600 (*) 61820 (**) 12790
WTR YR 1991 TOTAL 77847 MEAN 213 MAX 1900 MIN 54 AC-FT 154400 (*) 57500 (**) 11300

e Estimated
(*) Diversions, in acre-feet, to Gila Bend Canal (sta 09518500). See Remarks above. For records prior to 1972, see sta 09519500.
(**) Diversions, in acre-feet, to Enterprise Canal (sta 09519000). See Remarks above. For records prior to 1972, see sta 09519500.

09519500 GILA RIVER BELOW GILLESPIE DAM, AZ

LOCATION.--Lat 33°13'45", long 112°46'00", in SE¼NE¼ sec.28, T.2 S., R.5 W., Maricopa County, Hydrologic Unit 15070101, at left end of Gillespie Dam, 8 mi downstream from Hassayampa River.

DRAINAGE AREA.--49,650 mi^2.

PERIOD OF RECORD.--August 1921 to current year. Low-flow records prior to October 1970 are not equivalent as leakage of less than 5 ft^3/s not included, and from October 1971 to September 1973, when no leakage was included. Annual estimate of leakage was listed in REMARKS for the 1972 water year. Prior to 1939, published as "at Gillespie Dam."

REVISED RECORDS.--WSP 1213: 1939. WSP 1243: 1924(M). WSP 1926: Drainage area.

GAGE.--Water-stage recorder since July 28, 1924. Datum of gage is 9.95 ft below average elevation of crest of dam, which is 753.46 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 11, 1924, depth of water read on crest at left end of dam. Nov. 11, 1924, to July 22, 1932, datum of gage was at average elevation of dam crest. July 23, 1932, to Apr. 27, 1955, datum of gage was 5.00 ft below average elevation of crest of dam. Apr. 2, 1974 to Jan. 31, 1986, supplementary water-stage recorder and concrete control 70 ft downstream from crest of dam at datum 5.64 ft lower than datum of base gage. Since Jan. 31, 1986, supplementary water-stage recorder at bridge 0.1 mi downstream at different datum.

REMARKS.--Records poor. Flow consists of water passing over the dam, and seepage through the dam, but does not include water diverted to Gila Bend or Enterprise Canals. See sta 09518000, Gila River above diversions, at Gillespie Dam, for records of flow reaching dam, and of diversions to Gila Bend and Enterprise Canals. For diversions and regulation above station, see REMARKS for sta 09518000.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 178,000 ft^3/s Feb. 16, 1980, gage height, 18.81 ft, present datum; no flow at times.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1891, 250,000 ft^3/s, estimated, in February 1891.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,800 ft^3/s Apr. 2; no flow for many days.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e240	e120	e150	e200	e100	e110	e1700	e35	1.9	.00	.00	.00
2	e260	e100	e190	e210	e100	e1100	e1800	e30	1.9	.00	.00	.00
3	e280	e120	e200	e190	e130	e350	e1200	e30	1.8	.00	.00	.00
4	e250	e130	e220	e180	e140	e250	e920	e35	1.8	.00	.00	.00
5	e250	e150	e210	e250	121	e230	e900	e35	1.8	.00	.00	.00
6	e250	e130	e170	e260	105	e150	e920	e25	1.8	.00	.00	34
7	e240	e140	e180	e220	100	e150	e600	e30	3.4	.00	.00	38
8	e200	e170	e170	e210	93	e120	e360	25	1.4	.00	.00	37
9	e170	e200	e160	e210	88	e85	e220	44	1.0	.00	.00	13
10	e150	e190	e130	e180	e95	e50	e220	31	1.5	.00	.00	1.3
11	e130	e180	e180	191	e90	e50	e730	2.5	1.5	.00	.00	.19
12	e120	e170	e140	204	e85	e40	e300	22	1.4	.00	.00	.00
13	e180	e150	e130	201	e80	e50	e180	53	1.7	.00	.00	.00
14	e140	e140	e140	201	e80	e55	e80	33	1.2	.00	.00	.00
15	e130	e130	e150	182	e60	e60	e50	3.1	1.3	.00	.00	54
16	e140	e140	e140	178	e70	e100	e25	3.1	1.2	.00	.00	19
17	e130	e130	e160	149	e70	e110	e15	3.1	1.2	.00	.00	18
18	e110	e170	e160	164	e80	e120	e20	3.0	1.2	.00	.00	3.2
19	e75	e150	e170	180	e65	e220	e30	3.4	1.2	.00	.00	94
20	e85	e130	e200	153	e65	e230	e25	22	1.3	.00	.00	112
21	e100	e95	e190	204	e75	e220	e30	2.0	1.4	.00	.00	65
22	e180	e120	e180	164	e80	e210	e40	1.9	1.4	.00	.00	53
23	e220	e150	e200	161	e75	e150	e45	1.8	1.1	.00	.00	75
24	e200	e120	e220	147	e65	e70	e35	1.8	.38	.00	.00	75
25	e150	e100	e240	e95	e110	e160	e30	3.0	.00	.00	.00	140
26	e90	e60	e270	e95	e100	e270	e30	2.1	.00	.00	.00	145
27	e130	e100	e240	e120	e100	e230	e30	5.4	.00	.00	40	144
28	e180	e120	e200	153	e110	e360	e25	2.1	.00	.00	2.6	144
29	e180	e140	e180	144	---	e250	e25	2.5	.00	.00	.55	143
30	e150	e150	e170	136	---	e500	e30	2.1	.00	.00	.00	152
31	e140	---	e200	107	---	e1200	---	1.9	---	.00	.00	---
TOTAL	5300	4095	5640	5429	2591	7360	10655	472.1	36.38	0.00	43.15	1560.69
MEAN	171	136	182	175	92.5	237	355	15.2	1.21	.000	1.39	52.0
MAX	280	200	270	280	140	1200	1800	53	3.4	.00	40	152
MIN	75	60	130	95	65	40	15	1.8	.00	.00	.00	.00
AC-FT	10510	8120	11190	10770	5140	14600	21130	936	72	.00	86	3100

CAL YR 1990 TOTAL 45691.3 MEAN 125 MAX 1160 MIN 1.5 AC-FT 91030
WTR YR 1991 TOTAL 43182.30 MEAN 118 MAX 1800 MIN .00 AC-FT 85650

e Estimated

09519800 GILA RIVER BELOW PAINTED ROCK DAM, AZ

LOCATION.--Lat 33°04'30", long 113°00'50", in SE¼ sec.18, T.4 S., R.7 W., Maricopa County, Hydrologic Unit 15070201, on left bank 0.3 mi downstream from Painted Rock Dam and 19 mi northeast of Sentinel.

DRAINAGE AREA.--50,910 mi^2, approximately.

PERIOD OF RECORD.--October 1959 to current year.

GAGE.--Water-stage recorder. Datum of gage is 518.69 ft above National Geodetic Vertical Datum of 1929 (levels by Army Corps of Engineers). Auxiliary gage at site 0.3 mi upstream: May 5, 1969, to Mar. 30, 1973, at datum 2.37 ft higher; since Feb. 8, 1979 at same datum.

REMARKS.--No estimated daily discharges. Records fair. Many diversions above station for irrigation. Flow above station regulated by many reservoirs, the largest of which is Painted Rock Reservoir - capacity, 2,492,000 acre-ft. (See REMARKS for sta 09518000, Gila River above diversions, at Gillespie Dam.)

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,190 ft^3/s, result of a discharge measurement May 3, 1983, gage height, 9.36 ft, maximum gage height, 10.57 ft Feb. 9, 1979; no flow for many days in most years.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 291 ft^3/s, Apr. 10; no flow for many days.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	40	27	2.2	.47	92	1.7	.30	.00	.00
2	.00	.00	.12	43	34	2.3	.56	86	1.6	.28	.00	.00
3	.00	.00	.45	45	35	2.9	.68	72	1.5	.23	.00	.00
4	.00	.00	.73	48	25	2.5	.75	20	1.5	.20	.00	.00
5	.00	.00	1.2	51	19	40	79	10	1.4	.13	.00	.00
6	.00	.00	1.8	57	15	144	158	9.1	1.3	.06	.00	.00
7	.00	.00	2.6	55	15	226	151	8.2	1.3	.05	.00	.00
8	.00	.00	3.4	53	21	249	194	7.4	1.2	.04	.00	.00
9	.00	.00	4.3	59	21	207	262	6.7	1.2	.00	.00	.00
10	.00	.00	5.1	63	15	112	291	5.8	1.1	.00	.00	.00
11	.00	.00	6.3	65	11	131	201	5.3	1.1	.00	.00	.00
12	.00	.00	7.7	66	8.2	91	147	4.6	1.0	.00	.00	.00
13	.00	.00	9.0	69	6.6	73	150	4.3	1.0	.00	.00	.00
14	.00	.00	10	73	5.4	53	150	4.5	.96	.00	.00	.00
15	.00	.00	12	74	4.8	29	151	4.1	.88	.00	.00	.00
16	.00	.00	12	75	4.4	24	150	3.3	.81	.00	.00	.00
17	.00	.00	13	74	4.1	23	146	3.6	.75	.00	.00	.00
18	.00	.00	14	77	3.8	23	146	3.3	.68	.00	.00	.00
19	.00	.00	16	77	3.4	35	145	3.2	.67	.00	.00	.00
20	.00	.00	17	73	2.9	37	143	3.1	.62	.00	.00	.00
21	.00	.00	18	60	2.7	40	142	2.8	.60	.00	.00	.00
22	.00	.00	20	56	2.6	53	139	2.7	.57	.00	.00	.00
23	.00	.00	20	57	2.6	62	138	2.6	.54	.00	.00	.00
24	.00	.00	23	57	2.4	92	135	2.6	.51	.00	.00	.00
25	.00	.00	26	58	2.3	93	130	2.4	.46	.00	.00	.00
26	.00	.00	28	57	2.3	105	119	2.2	.45	.00	.00	.00
27	.00	.00	30	55	2.2	39	117	2.1	.42	.00	.00	.00
28	.00	.00	32	46	2.2	.48	110	2.0	.39	.00	.00	.00
29	.00	.00	35	35	---	.42	102	1.9	.36	.00	.00	.00
30	.00	.00	37	25	---	.42	99	1.8	.33	.00	.00	.00
31	.00	---	38	22	---	.44	---	1.9	---	.00	.00	---
TOTAL	0.00	0.00	442.70	1757	302.9	2018.26	3897.46	382.5	25.92	1.31	0.00	0.00
MEAN	.000	.000	14.3	57.0	10.8	65.1	130	12.3	.90	.042	.000	.000
MAX	.00	.00	38	77	35	249	291	92	1.7	.30	.00	.00
MIN	.00	.00	.00	22	2.2	.42	.47	1.8	.33	.00	.00	.00
AC-FT	.00	.00	878	3500	601	4000	7730	759	53	2.6	.00	.00

CAL YR 1990 TOTAL 559.80 MEAN 1.53 MAX 38 MIN .00 AC-FT 1110
WTR YR 1991 TOTAL 8839.05 MEAN 24.2 MAX 291 MIN .00 AC-FT 17530

09520360 GILA RIVER NEAR MOHAWK, AZ

LOCATION.--Lat 32°47'18", long 113°45'48", in NE¼SE¼ sec. 26, T.7 S., R.15 W., Yuma County, Hydrologic Unit 15070201, in center of channel at culvert outlet at Avenue 51E, and 4.0 mi north of Mohawk.

DRAINAGE AREA.--55,430 mi^2, approximately.

PERIOD OF RECORD.--February to April 1966 (published in WSP 1850-C), April 1973 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 295 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to March 1983 at site 70 ft upstream at datum 6.45 ft higher.

REMARKS.-No estimated daily discharges. Records good. Flow regulated by Painted Rock Dam; capacity of reservoir at Painted Rock Dam is 2,492,000 acre-ft, (see REMARKS for sta 09519800).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,270 ft^3/s Apr. 30, 1980, gage height, 11.28 ft, site and datum then in use; maximum gage height, 14.20 ft June 7, 8, 1983, present site and datum; no flow most of time most years.

EXTREMES FOR CURRENT YEAR.--No flow for entire year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29	.00	.00	.00	.00	---	.00	.00	.00	.00	.00	.00	.00
30	.00	.00	.00	.00	---	.00	.00	.00	.00	.00	.00	.00
31	.00	---	.00	.00	---	.00	---	.00	---	.00	.00	---
TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEAN	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MAX	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MIN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC-FT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

CAL YR 1990 TOTAL 0.00 MEAN .000 MAX .00 MIN .00 AC-FT .00
WTR YR 1991 TOTAL 0.00 MEAN .000 MAX .00 MIN .00 AC-FT .00

09520500 GILA RIVER NEAR DOME, AZ

LOCATION.--Lat 32°45'39", long 114°25'11", in SW¼ sec.4, T.8 S., R.21 W., Yuma County, Hydrologic Unit 15070201, on right bank 440 ft upstream from McPhaul bridge on old route of State Highway 95, 3 mi west of Dome, and 12 mi upstream from mouth.

DRAINAGE AREA.--57,850 mi², approximately - includes 373 mi² in Aubrey Valley Playa, a closed basin, but excludes all other closed basins.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1903 to current year. Monthly total, maximum, and minimum daily discharges only for January 1903 to December 1904 and January 1906 to July 1929 in WSP 918 or WSP 1313. Published as "at Yuma and Gila City" 1903, as "near Dome" 1904, and as "at Dome (Gila City)" 1905-6. Records for 1907-29 are published in WSP 918 as "at Yuma and at and near Dome."

REVISED RECORDS.--WSP 918: 1905. WSP 1733: July 1942. WSP 1926: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 139.18 ft above National Geodetic Vertical Datum of 1929. Prior to October 1903 and January 1907 to April 1929, no gage; discharge estimated. October 1903 to December 1906, principal nonrecording gage 4 mi upstream at datum 19.19 ft higher, supplemented by many nonrecording gages at different datums. May 1929 to May 31, 1981, at datum 9.00 ft higher.

REMARKS.--No estimated daily discharges. Records poor. Many diversions above station for irrigation. Flow above station regulated by reservoirs at and above Painted Rock Dam; capacity of reservoir at Painted Rock Dam is 2,492,000 acre-ft. Painted Rock Reservoir, which is for flood control only, was completed in October 1959 (see also REMARKS for sta 09518000).

EXTREMES FOR PERIOD OF RECORD.--1903-29: Maximum daily discharge, 200,000 ft³/s, roughly estimated, Jan. 22, 1916. 1929-59: Maximum discharge, 20,700 ft³/s Feb. 15, 1932, gage height, 25.75 ft, present datum; no flow for part or all of most years.
1959-91: Maximum discharge, 4,820 ft³/s Sept. 16, 1963, gage height, 16.20 ft; no flow for part or all of most years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 671 ft³/s Sept. 5, gage height, 16.25 ft; minimum daily, 0.62 ft³/s Aug. 25.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.5	3.9	3.0	3.5	3.1	4.1	3.3	3.7	3.7	17	1.3	.79
2	3.6	5.1	2.8	3.6	3.4	3.3	3.7	4.6	3.0	4.0	1.3	.81
3	8.6	3.1	3.1	4.5	3.7	3.3	3.3	5.1	2.8	5.4	1.3	.80
4	3.6	4.5	2.9	4.4	3.5	3.9	3.1	3.7	3.0	[illegible]	1.0	3.3
5	3.1	4.4	3.6	7.2	3.0	4.1	3.5	3.0	3.3	3.6	1.4	91
6	7.5	5.1	3.4	6.5	3.6	4.0	3.5	3.3	2.6	3.3	1.7	2.2
7	5.0	3.4	3.4	4.9	3.0	4.1	3.0	4.0	2.7	3.4	1.1	2.1
8	4.7	4.9	3.2	5.0	2.5	4.5	3.3	3.5	3.0	3.0	1.1	2.2
9	3.3	4.2	3.3	4.1	2.3	3.6	3.5	3.6	2.5	3.4	1.4	1.3
10	4.1	4.0	4.0	4.6	2.6	3.3	10	3.4	2.5	3.6	3.1	1.0
11	3.4	4.5	4.1	3.5	3.0	3.4	3.4	3.1	3.2	3.4	1.5	1.5
12	4.1	3.0	3.9	3.7	2.7	3.2	4.1	3.0	2.2	3.0	1.4	1.4
13	3.3	2.4	5.1	3.1	3.3	3.0	3.2	3.0	2.5	2.9	1.3	1.4
14	4.8	2.5	4.7	3.1	2.8	4.1	3.7	3.0	2.4	2.5	1.2	1.4
15	3.7	3.8	3.9	3.9	3.1	3.5	3.7	3.4	2.2	2.3	1.1	1.4
16	3.8	3.2	4.1	3.5	2.1	3.0	3.1	3.5	2.0	2.4	1.1	1.9
17	4.6	4.2	4.4	4.2	2.5	2.9	1.8	3.8	2.4	2.5	.99	2.3
18	4.6	2.9	4.5	3.5	2.6	3.0	2.5	3.3	2.1	2.0	.91	1.4
19	3.8	2.3	4.9	3.1	2.4	3.2	2.0	3.2	2.5	1.8	.84	1.7
20	3.0	3.1	4.6	4.5	2.0	3.4	1.8	2.8	3.4	1.6	.72	1.8
21	3.0	4.6	4.2	4.2	1.8	3.0	1.8	3.3	2.5	1.3	.72	1.7
22	3.5	4.0	3.9	4.8	1.8	5.1	5.1	4.7	1.8	1.3	.75	1.3
23	3.5	4.7	3.7	3.6	1.6	3.8	5.2	3.0	2.4	1.3	.63	1.7
24	4.4	3.4	3.5	3.0	2.1	3.7	4.7	2.6	2.7	1.5	.64	1.8
25	3.9	2.3	3.3	4.0	2.3	3.6	5.8	2.7	3.4	1.2	.62	1.7
26	3.0	84	3.5	3.9	2.0	3.2	5.8	2.8	2.7	1.1	.63	1.6
27	3.2	74	3.4	4.0	2.0	4.5	3.9	3.2	3.4	1.1	.67	2.0
28	2.6	18	3.6	3.8	3.2	4.0	3.9	2.9	3.4	1.0	.71	1.6
29	2.4	13	3.7	4.5	---	3.2	4.1	2.5	3.1	1.0	.73	1.6
30	2.9	14	3.9	2.5	---	2.8	3.6	2.4	3.2	1.3	.76	2.2
31	3.1	---	4.0	2.2	---	2.8	---	3.6	---	1.2	.79	---
TOTAL	143.3	297.9	116.5	125.0	72.3	111.4	111.6	103.9	81.7	90.3	34.31	140.13
MEAN	4.62	9.93	3.76	4.03	2.58	3.59	3.72	3.35	2.72	2.91	1.11	4.67
MAX	8.6	84	5.1	7.2	3.6	5.1	10	5.1	3.4	17	3.1	91
MIN	2.4	2.1	2.4	2.2	1.6	2.8	1.8	2.4	1.8	1.0	.62	.79
AC-FT	284	591	231	248	143	221	221	206	162	179	68	278

CAL YR	1990	TOTAL	3040.49	MEAN	8.33	MAX	823	MIN	.09	AC-FT	6030
WTR YR	1991	TOTAL	1428.44	MEAN	3.91	MAX	91	MIN	.62	AC-FT	2830

Magnitude and Frequency of Floods in the United States

Part 9. Colorado River Basin

By JAMES L. PATTERSON *and* WILLIAM P. SOMERS

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1683

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1966

4420. Gila River near Clifton, Ariz.
(Published as "at Guthrie" 1910-16)

Location.--Lat 32°57'50", long 109°18'15", in SW¼SW¼ sec.30, T.5 S., R.30 E., 1,100 ft upstream from bridge on former U.S. Highway 666, 6 miles upstream from San Francisco River, and 7 miles south of Clifton.

Drainage area.--4,010 sq mi. For site at Guthrie, 1910-16, drainage area is 3,867 sq mi.

Gage.--Nonrecording prior to May 16, 1914; recording thereafter. At sites 5½ miles upstream at Guthrie at different datums prior to July 12, 1918. At site 1,100 ft downstream at datum 4.03 ft lower March 1928 to June 1948. Datum of gage is 3,339.50 ft above mean sea level, datum of 1929, supplementary adjustment of 1959.

Stage-discharge relation.--Defined by current-meter measurements. Ratings at all sites subject to considerable shifting.

Historical data.--Studies by Corps of Engineers, U.S. Army, indicate that the flood of Sept. 29, 1941, was the greatest since 1891.

Remarks.--Peak discharges not materially affected by irrigation diversions. Base for partial-duration series, 2,500 cfs. Only annual peaks are shown prior to 1928.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)
1911	July 25, 1911	15.0	18,000
1912	Mar. 11, 1912	16.5	21,000
1913	Sept.22, 1913	8.2	1,200
1914	Aug. 6, 1914	9.4	5,700
1915	Dec. 20, 1914	11.4	12,000
1916	Jan. 18, 1916	10.2	7,600
1917	Oct. 18, 1916	14.7	19,500
1928	July 31, 1928	9.40	2,570
1929	July 24, 1929	8.96	2,530
	July 27, 1929	11.08	5,600
	July 30, 1929	14.5	11,200
	Aug. 11, 1929	10.04	3,510
	Aug. 15, 1929	9.43	3,030
	Sept.23, 1929	11.5	6,500
1930	Oct. 13, 1929	9.12	2,670
	July 17, 1930	10.9	5,240
	July 19, 1930	10.27	4,510
	July 25, 1930	10.47	4,780
	Aug. 9, 1930	10.16	4,350
	Aug. 11, 1930	11.5	6,300
1931	Aug. 3, 1931	9.74	4,080
	Aug. 5, 1931	10.55	5,550
	Aug. 10, 1931	10.33	5,760
	Sept. 4, 1931	10.95	6,300
	Sept. 7, 1931	9.98	2,530
1932	July 9, 1932	11.15	4,500
	July 30, 1932	11.10	4,470
	Aug. 9, 1932	9.70	3,030
1933	Sept. 9, 1933	10.67	4,000
	Sept.11, 1933	9.17	2,550
	Sept.14, 1933	9.98	3,290
1934	Aug. 26, 1934	16.0	17,000
1935	Aug. 31, 1935	10.22	3,100
1936	Aug. 29, 1936	10.95	4,300
1937	Feb. 18, 1937	12.72	7,450
	Mar. 18, 1937	9.31	3,550
	Aug. 5, 1937	9.29	2,950
	Aug. 23, 1937	9.36	2,550
	Sept.10, 1937	10.0	3,600
1937	Sept.22, 1937	10.16	3,800
1938	July 21, 1938	9.18	2,770
	Aug. 5, 1938	11.50	5,930
	Sept. 2, 1938	9.82	3,270
1939	July 22, 1939	9.80	3,100
	Aug. 5, 1939	13.45	5,870
	Sept.12, 1939	11.16	4,580
1940	Oct. 5, 1939	12.05	6,300
	Feb. 2, 1940	9.55	3,300
	Sept. 6, 1940	9.32	2,920
1941	Jan. 1, 1941	10.05	3,750
	Mar. 17, 1941	9.21	3,200
	July 21, 1941	9.61	3,200
	Sept. 1, 1941	9.57	3,200
	Sept.29, 1941	20.12	28,000
1942	Aug. 6, 1942	8.82	3,280
	Sept.12, 1942	8.68	3,130
1943	June 30, 1943	9.40	4,250
	July 25, 1943	8.41	2,830
	Aug. 10, 1943	10.52	6,230
	Sept.27, 1943	10.82	6,770
1944	Aug. 19, 1944	6.38	2,610
1945	July 31, 1945	8.58	2,780
	Aug. 3, 1945	9.59	4,540
	Aug. 11, 1945	9.48	4,360
1946	Oct. 9, 1945	10.26	5,800
	Aug. 9, 1946	8.87	3,200
	Aug. 16, 1946	10.45	4,270
1948	Aug. 3, 1948	5.08	1,090
1949	Dec. 29, 1948	9.17	3,960
	Jan. 15, 1949	15.3	13,900
	Mar. 3, 1949	9.2	5,940
	July 24, 1949	6.2	2,390
	Sept.14, 1949	9.5	6,560
1950	July 30, 1950	4.80	1,680
1951	Aug. 3, 1951	7.75	4,900
1952	Jan. 20, 1952	7.98	4,290
	Sept.24, 1952	6.06	2,300
1953	July 30, 1953	7.38	3,700

Peak stages and discharges of Gila River near Clifton, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1954	July 3, 1954	8.40	2,720	1957	Aug. 29, 1957	11.72	9,070
	July 20, 1954	7.05	3,370		Aug. 31, 1957	8.37	3,320
	July 20, 1954	8.82	4,780				
	Aug. 11, 1954	9.25	4,280	1958	Mar. 24, 1958	9.5	3,980
	Aug. 21, 1954	7.28	3,050		July 19, 1958	7.5	3,070
	Aug. 23, 1954	9.75	6,300		Aug. 22, 1958	7.95	3,370
	Aug. 24, 1954	6.90	2,570		Sept.13, 1958	7.7	3,190
1955	Oct. 9, 1954	6.96	2,570	1959	Aug. 4, 1959	7.9	3,380
	July 11, 1955	9.35	6,280		Aug. 7, 1959	7.7	3,070
	July 23, 1955	11.9	9,460		Aug. 14, 1959	8.05	3,560
	July 29, 1955	7.89	3,600		Aug. 17, 1959	9.1	5,130
	Aug. 11, 1955	7.75	3,440		Aug. 20, 1959	7.3	2,630
	Aug. 20, 1955	8.58	4,140		Aug. 25, 1959	9.0	5,290
	Aug. 26, 1955	8.73	4,560		Aug. 28, 1959	9.4	5,610
					Aug. 29, 1959	8.1	3,650
1956	Oct. 3, 1955	12.83	10,800				
	Oct. 4, 1955	13.29	12,700	1960	Jan. 13, 1960	8.85	4,000
1957	July 27, 1957	8.34	3,710	1961	Aug. 13, 1961	7.40	2,400
	Aug. 7, 1957	9.08	3,560				
	Aug. 23, 1957	5.95	3,420	1962	Sept.26, 1962	11.39	8,950

4406.5. Trout Creek near New Mexico-Arizona State line, near Luna, N. Mex.

Location.--Lat 33°55', long 109°02', in W½ sec.24, T.4 S., R.21 W., on culvert on Luna-Underwood Lake road, 1 mile east of State line and 5 miles northwest of Luna.

Drainage area.--9.9 sq mi, approximately.

Gage.--Crest-stage gage. Altitude of gage is 8,050 ft (from topographic map).

Stage-discharge relation.--Defined by three current-meter measurements below gage height 8.17, and extended above on basis of conveyance comparison at gage height 8.50 ft.

Remarks.--There are no known diversions above station. Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1958	-	8.50	56	1961	April 1961	8.10	17
1959	-	8.31	26	1962	-	8.48	35
1960	March 1960	8.50	33				

4406.6. Trout Creek near Luna, N. Mex.

Location.--Lat 33°51', long 108°58', in NW¼ sec.33, T.5 S., R.20 W., on right bank 500 ft downstream from bridge on Luna-Red Hill road and 2.6 miles north of Luna.

Drainage area.--30 sq mi, approximately.

Gage.--Crest-stage gage. Altitude of gage is 7,400 ft (from topographic map).

Stage-discharge relation.--Defined by three current-meter measurements below gage height 1.5 ft and extended above on basis of three indirect measurements at gage heights 1.80, 2.00, and 4.00 ft.

Remarks.--There are no known diversions above station. Only annual peaks are shown.

Peak stages and discharges of Eagle Creek above pumping plant, near Morenci, Ariz.--Con.

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1959	Aug. 4, 1959	5.3	1,240	1960	Jan. 12, 1960	7.6	6,550
	Aug. 11, 1959	5.3	2,260				
	Aug. 15, 1959	4.2	395	1961	July 28, 1961	3.96	316
	Aug. 17, 1959	7.35	4,750		Sept. 9, 1961	4.67	652
	Aug. 19, 1959	5.65	2,000		Sept.12, 1961	5.18	1,210
	Aug. 22, 1959	4.4	460		Sept.13, 1961	4.33	448
	Aug. 24, 1959	4.9	860				
	Aug. 25, 1959	5.75	2,180	1962	Dec. 16, 1961	5.13	1,140
	Aug. 26, 1959	5.9	2,460		Jan. 25, 1962	4.75	745
	Aug. 26, 1959	4.35	915		July 18, 1962	5.57	1,850
	Aug. 27, 1959	4.1	550		July 20, 1962	-	1,600
					Sept. 4, 1962	4.75	745
1960	Nov. 1, 1959	3.90	302		Sept. 6, 1962	4.15	378
	Dec. 26, 1959	6.75	3,340				

4485. Gila River at head of Safford Valley, near Solomon, Ariz.
(Published as "near Solomonsville" 1914 to September 1920,
1941-43, and as "below Bonita Creek near Solomonsville"
October 1920 to September 1940)

Location.--Lat 32°52'10", long 109°30'40", in SE¼NE¼ sec.21, T.6 S., R.28 E., 0.5 mile downstream from intake of Brown Canal, 5 miles northeast of Solomon, and 12 miles downstream from San Francisco River.

Drainage area.--7,896 sq mi; 7,850 sq mi at site in use October 1920 to December 1940.

Gage.--Recording. At datum 1.50 ft higher Apr. 21, 1914, to Sept. 13, 1917, and at datum 1.39 ft higher Sept. 13, 1917, to Sept. 30, 1920. At site 3 miles upstream and three-eighths of a mile below Bonita Creek at different datum Oct. 1, 1920, to Dec. 31, 1940. At present site and datum thereafter. Datum of gage is 3,064.38 ft above mean sea level, datum of 1929, supplementary adjustment of 1933.

Stage-discharge relation.--Defined by current-meter measurements below 28,000 cfs and extended above on basis of slope-area measurements. Relation subject to considerable shifting.

Bankfull stage.--10 ft.

Remarks.--Peak discharges not materially affected by irrigation diversions. Base for partial-duration series, 4,000 cfs.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1914	Aug. 21, 1914	4.15	a9,000	1921	July 26, 1921	4.6	5,600
					July 31, 1921	-	59,000
1915	Oct. 4, 1914	4.0	14,000		Aug. 4, 1921	-	59,500
	Nov. 10, 1914	3.7	3,000		Aug. 10, 1921	6.1	10,600
	Dec. 30, 1914	6.75	50,000		Aug. 21, 1921	7.55	18,700
	Jan. 30, 1915	6.6	48,000				
	Feb. 10, 1915	2.85	4,080	1922	Aug. 15, 1922	3.6	3,780
	Feb. 21, 1915	4.1	10,600				
	Mar. 29, 1915	3.5	9,000	1923	July 22, 1923	5.20	7,050
	Apr. 7, 1915	3.76	7,600		July 26, 1923	4.32	4,100
	July 26, 1915	5.3	10,000		July 31, 1923	3.96	4,080
					Aug. 4, 1923	4.09	4,360
1916	Jan. 19, 1916	14.0	100,000		Aug. 9, 1923	6.00	9,720
	Jan. 29, 1916	6.0	38,000		Aug. 10, 1923	5.8	10,600
	Feb. 15, 1916	2.50	4,310		Aug. 15, 1923	5.39	7,630
	Mar. 1, 1916	2.6	4,900		Aug. 20, 1923	4.27	5,290
	Mar. 25, 1916	2.46	4,400		Aug. 26, 1923	5.0	5,210
					Sept. 5, 1923	4.46	4,350
1917	Oct. 14, 1916	10.7	a67,300				
				1924	Nov. 11, 1923	4.22	4,260
1918	July 1, 1918	3.1	2,700		Dec. 29, 1923	6.5	10,800
1919	July 14, 1919	5.75	10,600	1925	June 24, 1925	4.4	6,140
	Aug. 3, 1919	6.60	15,000		July 31, 1925	5.50	7,630
					Sept. 3, 1925	9.1	15,200
1920	Dec. 5, 1919	5.2	7,620				
	Feb. 10, 1920	5.0	7,020	1926	Mar. 30, 1926	4.07	4,300
	Feb. 23, 1920	4.6	5,520		Apr. 7, 1926	4.58	5,660

a Annual peaks only.
b Estimated.

Peak stages and discharges of Gila River at head of Safford Valley, near Solomon, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)
1927	Feb. 17, 1927	4.25	4,530
	July 6, 1927	4.15	4,500
	Sept.13, 1927	6.08	9,320
1928	Aug. 1, 1928	3.64	3,230
1929	July 27, 1929	5.04	6,350
	July 30, 1929	7.15	12,700
	Aug. 3, 1929	4.90	5,940
	Aug. 10, 1929	5.53	7,630
	Aug. 14, 1929	5.42	7,340
	Sept.23, 1929	5.65	7,920
1930	July 26, 1930	5.2	6,770
	Aug. 4, 1930	4.75	5,540
	Aug. 8, 1930	6.30	10,000
	Aug. 11, 1930	6.32	10,100
1931	Feb. 15, 1931	6.45	10,800
	Aug. 5, 1931	5.76	8,010
	Aug. 10, 1931	5.05	6,420
	Sept. 4, 1931	4.47	4,910
	Sept.19, 1931	4.36	5,220
	Sept.29, 1931	4.48	5,120
1932	Feb. 10, 1932	11.05	24,000
	Mar. 1, 1932	4.59	4,420
	July 30, 1932	5.25	6,570
	Aug. 10, 1932	5.5	6,450
1933	Feb. 27, 1933	12.15	4,750
	Aug. 31, 1933	13.1	6,000
	Sept. 9, 1933	15.4	9,500
	Sept.14, 1933	14.1	6,670
1934	Aug. 27, 1934	19.4	a23,000
1935	Sept. 1, 1935	13.5	a5,550
1936	Feb. 17, 1936	11.94	8,000
1937	Feb. 8, 1937	19.1	33,700
	Feb. 17, 1937	15.6	12,700
	Mar. 18, 1937	13.19	5,430
1938	Mar. 4, 1938	12.85	4,690
1939	Aug. 6, 1939	14.20	7,370
1940	Oct. 8, 1939	14.75	8,070
	Feb. 3, 1940	13.07	4,930
	Sept. 6, 1940	15.24	9,840
1941	Dec. 25, 1940	16.35	12,000
	Dec. 31, 1940	19.1	17,600
	Jan. 25, 1941	7.15	9,140
	Feb. 8, 1941	5.92	5,490
	Mar. 15, 1941	8.64	10,300
	Apr. 27, 1941	5.24	4,180
	May 2, 1941	5.22	4,610
	Sept.30, 1941	13.43	31,900
1942	Dec. 12, 1941	6.33	7,730
	Sept.13, 1942	5.55	5,820
1943	Mar. 5, 1943	5.38	4,260
	Aug. 10, 1943	5.73	6,100
	Sept.27, 1943	5.37	5,660

Water year	Date	Gage height (feet)	Discharge (cfs)
1944	Sept.25, 1944	9.00	15,800
1945	Aug. 11, 1945	5.7	4,820
1946	Oct. 9, 1945	5.83	5,100
1947	Aug. 23, 1947	6.86	6,100
	Aug. 30, 1947	7.30	9,250
1948	June 1, 1948	5.56	2,540
1949	Dec. 29, 1948	6.69	4,170
	Jan. 14, 1949	11.5	25,000
	Jan. 24, 1949	6.71	5,210
	Mar. 9, 1949	7.61	8,050
1950	July 30, 1950	5.30	1,240
1951	Aug. 3, 1951	6.98	4,240
1952	Jan. 14, 1952	10.30	18,600
	Jan. 19, 1952	10.50	19,700
1953	July 30, 1953	6.42	3,040
1954	Mar. 24, 1954	6.24	9,850
	July 22, 1954	6.70	4,920
	Aug. 3, 1954	6.82	4,800
	Aug. 5, 1954	6.80	4,270
	Aug. 6, 1954	7.55	7,000
	Aug. 11, 1954	6.60	4,200
1955	July 12, 1955	7.29	6,030
	July 20, 1955	6.97	4,020
	July 24, 1955	8.35	11,700
	July 25, 1955	7.78	6,450
	Aug. 28, 1955	7.17	4,350
1956	Oct. 3, 1955	7.70	6,380
	Oct. 4, 1955	9.20	12,300
1957	July 28, 1957	8.05	6,980
	Aug. 5, 1957	7.20	4,050
	Aug. 7, 1957	7.77	6,150
	Aug. 19, 1957	7.19	4,040
	Aug. 23, 1957	7.34	4,340
	Aug. 25, 1957	7.20	4,060
	Aug. 29, 1957	7.67	5,040
1958	Mar. 13, 1958	7.77	5,820
	Mar. 23, 1958	9.19	9,060
	Apr. 18, 1958	6.54	6,210
	Sept.13, 1958	9.23	7,310
1959	Aug. 19, 1959	6.9	4,130
	Aug. 25, 1959	7.55	6,330
	Aug. 27, 1959	7.45	6,100
	Aug. 28, 1959	8.5	7,860
1960	Dec. 26, 1959	7.9	6,460
	Jan. 12, 1960	10.9	16,700
1961	Sept.10, 1961	7.29	4,800
1962	Dec. 16, 1961	7.34	4,930
	Jan. 26, 1962	5.91	4,260
	Feb. 14, 1962	5.32	4,450
	Sept.25, 1962	10.48	16,100

a Annual peaks only.

4585. Gila River at Safford, Ariz.

Location.--Lat 32°50'50", long 109°42'55", in SW¼SW¼ sec.5, T.7 S., R.26 E., at highway bridge 1 mile north of Safford and 4½ miles downstream from San Simon River.

Drainage area.--10,459 sq mi.

Gage.--Recording. At site 1,400 ft upstream at datum 6.91 ft higher June 1940 to June 1942. Datum of gage is 2,880.07 ft above mean sea level, datum of 1929.

Stage-discharge relation.--Defined by current-meter measurements.

Remarks.--Peak discharge unaffected by irrigation diversions, but affected to some extent after May 27, 1953, by flood-control reservoir on San Simon River (capacity, 3,070 acre-ft at emergency spillway level). Base for partial-duration series, 4,000 cfs.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)
1940	Sept. 6, 1940	5.06	a26,600
1941	Dec. 25, 1940	5.44	9,920
	Dec. 31, 1940	6.9	15,200
	Jan. 28, 1941	5.05	9,560
	Feb. 4, 1941	4.05	4,380
	Mar. 16, 1941	5.28	10,400
	Apr. 25, 1941	3.53	4,030
	May 2, 1941	3.55	4,140
	Aug. 17, 1941	6.4	9,150
	Sept.29, 1941	5.15	5,320
	Sept.30, 1941	13.0	33,000
1942	Dec. 12, 1941	5.00	7,500
	Sept.24, 1942	7.46	[illegible]
1943	Mar. 6, 1943	6.68	4,270
	Aug. 2, 1943	6.3	4,370
	Aug. 10, 1943	6.60	4,140
	Aug. 18, 1943	6.68	4,080
	Aug. 24, 1943	7.38	5,580
	Sept.27, 1943	7.15	5,780
1944	Aug. 19, 1944	7.5	6,730
	Sept. 5, 1944	7.45	6,580
	Sept.26, 1944	10.4	13,600
1945	Aug. 3, 1945	7.9	5,320
1946	Oct. 9, 1945	8.00	6,340
	Aug. 30, 1946	7.2	4,390
1947	Aug. 23, 1947	7.18	4,350
	Aug. 31, 1947	7.3	4,800
1948	Aug. 7, 1948	9.34	6,090
1949	Dec. 30, 1948	7.65	4,320
	Jan. 14, 1949	13.1	23,900
	Jan. 24, 1949	7.35	5,000
	Mar. 9, 1949	6.45	7,790
	July 9, 1949	7.5	5,000
	Aug. 9, 1949	8.35	8,400

Water year	Date	Gage height (feet)	Discharge (cfs)
1950	July 30, 1950	5.50	1,960
1951	Aug. 3, 1951	8.75	4,390
1952	Jan. 14, 1952	11.24	14,900
	Jan. 19, 1952	11.42	15,700
	Aug. 17, 1952	7.83	4,230
1953	July 7, 1953	5.56	2,670
1957	July 26, 1957	9.7	8,160
	Aug. 5, 1957	8.2	4,350
	Aug. 7, 1957	8.2	4,550
	Aug. 15, 1957	7.56	5,790
	Aug. 23, 1957	7.8	4,330
	Aug. 26, 1957	7.7	4,000
	Aug. 30, 1957	8.2	4,880
	Aug. 31, 1957	10.4	10,300
1958	Mar. 13, 1958	8.07	4,830
	Mar. 23, 1958	9.83	8,210
	Apr. 18, 1958	7.60	4,440
	Sept.13, 1958	9.9	9,660
	Sept.25, 1958	8.05	4,720
1959	Aug. 15, 1959	8.05	3,540
	Aug. 23, 1959	8.3	3,950
	Aug. 25, 1959	9.5	5,820
	Aug. 27, 1959	9.15	5,640
	Aug. 28, 1959	9.5	6,610
1960	Dec. 26, 1959	9.25	5,970
	Jan. 12, 1960	12.0	15,400
1961	July 28, 1961	8.40	3,840
	Aug. 15, 1961	9.65	4,740
	Aug. 20, 1961	9.75	5,990
	Aug. 29, 1961	9.12	5,780
1962	Dec. 17, 1961	9.00	5,540
	Jan. 26, 1962	8.68	4,210
	Feb. 16, 1962	9.53	4,150
	Sept.27, 1962	13.04	16,300

a Annual peak only.

4622. Agricultural Research Service Safford watershed W-II, Arizona

Location.--Lat 32°50'08", long 109°59'37", in SE¼ sec.9, T.7 S., R.23 E., 14 miles west of Thatcher, Graham County.

Drainage area.--1.07 sq mi.

Gage.--Recording, with 6-hour chart.

Stage-discharge relation.--16-inch broadcrested, triangular weir with 5:1 side slopes.

Remarks.--Only annual peaks are shown. Records furnished by Agricultural Research Service, U.S. Department of Agriculture.

Peak stages and discharges

Calendar year	Date	Gage height (feet)	Discharge (cfs)	Calendar year	Date	Gage height (feet)	Discharge (cfs)
1939	Aug. 3, 1939	-	949	1951	Aug. 15, 1951	-	96
1940	July 25, 1940	-	595	1952	Aug. 17, 1952	-	364
1941	Sept.26, 1941	-	397	1953	July 15, 1953	-	96
1942	Aug. 7, 1942	-	585	1954	July 22, 1954	-	447
1943	Aug. 9, 1943	-	488	1955	Aug. 3, 1955	-	49
1944	Oct. 13, 1944	-	206	1956	Aug. 20, 1956	-	282
1945	Aug. 10, 1945	-	519	1957	Aug. 30, 1957	-	41
1946	Aug. 26, 1946	-	505	1958	-	-	0
1947	Oct. 13, 1947	-	337	1959	July 16, 1959	-	335
1948	July 25, 1948	-	722	1960	-	-	0
1949	July 10, 1949	-	729	1961	Aug. 22, 1961	-	309
1950	-	-	0	1962	Sept. 3, 1962	-	50

4665. Gila River at Calva, Ariz.

Location.--Lat 33°11'11", long 110°13'10", in SW¼ sec.5, T.3 S., R.21 E. (unsurveyed), at railroad bridge, in San Carlos Indian Reservation, at head of San Carlos Reservoir, 1¼ miles northwest of Calva.

Drainage area.--11,470 sq mi.

Gage.--Recording. At datum 3.00 ft lower Oct. 1, 1934, to Aug. 29, 1958. Datum of gage is 2,514.77 ft above mean sea level, datum of 1909.

Stage-discharge relation.--Defined by current-meter measurements.

Historical data.--The greatest known flood, that of Jan. 20, 1916, was estimated as 100,000 cfs or greater on basis of records at Solomon and at Kelvin.

Remarks.--Peak discharges not materially affected by irrigation diversions. Base for partial-duration series, 3,000 cfs.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1916	Jan. 20, 1916	-	a100,000	1933	Feb. 27, 1933	5.34	5,250
1930	Oct. 14, 1929	5.48	3,330		Sept. 9, 1933	6.23	6,560
	July 10, 1930	5.43	3,310		Sept.14, 1933	5.46	4,050
	July 29, 1930	7.40	9,600	1934	July 20, 1934	6.40	6,100
	Aug. 9, 1930	6.41	6,680		Aug. 22, 1934	5.75	4,130
	Aug. 13, 1930	6.37	7,120		Aug. 29, 1934	9.35	19,000
	Sept. 8, 1930	5.53	3,400		Sept.23, 1934	5.87	4,540
1931	Feb. 16, 1931	6.50	6,850	1935	Jan. 6, 1935	5.54	3,560
	Aug. 6, 1931	6.55	7,340		July 31, 1935	6.24	4,470
	Aug. 11, 1931	7.12	9,900		Aug. 2, 1935	6.00	3,750
	Aug. 24, 1931	5.23	3,110		Aug. 31, 1935	6.01	4,520
	Aug. 30, 1931	6.35	6,770		Sept. 2, 1935	5.68	3,450
	Sept.19, 1931	6.14	5,320				
	Sept.29, 1931	6.17	5,470	1936	Feb. 18, 1936	6.56	5,640
1932	Oct. 1, 1931	6.55	6,520		July 26, 1936	5.60	3,200
	Feb. 12, 1932	9.7	21,500		Aug. 20, 1936	5.51	3,730
	Mar. 2, 1932	6.20	5,580		Sept.11, 1936	6.22	6,000
	July 30, 1932	6.82	7,900		Sept.25, 1936	6.04	4,380

a Estimated.

Peak stages and discharges of Gila River at Calva, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)
1937	Feb. 3, 1937	9.37	12,800
	Feb. 18, 1937	8.06	8,960
	Mar. 19, 1937	7.35	7,250
1938	Mar. 5, 1938	6.08	4,310
1939	Aug. 7, 1939	6.49	4,260
	Sept.17, 1939	6.50	4,130
1940	Oct. 9, 1939	7.15	5,620
	Feb. 4, 1940	6.67	4,320
	Aug. 14, 1940	6.69	5,150
	Sept. 7, 1940	6.59	4,600
1941	Dec. 27, 1940	7.67	6,200
	Jan. 2, 1941	9.44	14,300
	Jan. 29, 1941	7.62	7,260
	Feb. 8, 1941	6.51	5,150
	Feb. 25, 1941	5.80	3,420
	Mar. 17, 1941	9.05	13,000
	Apr. 28, 1941	6.15	3,990
	Mar. 3, 1941	6.16	3,990
	Aug. 17, 1941	6.17	4,700
	Sept.28, 1941	6.60	5,150
1942	Oct. 1, 1941	11.62	27,900
	Dec. 12, 1941	6.61	5,750
	Sept.14, 1942	5.88	3,320
1943	Mar. 6, 1943	5.50	3,550
	Aug. 24, 1943	5.59	3,090
	Sept.28, 1943	5.76	3,710
1944	Aug. 19, 1944	5.82	3,260
	Sept.27, 1944	9.49	12,800
1945	Aug. 3, 1945	6.00	3,390
	Aug. 12, 1945	6.02	3,050
1946	Oct. 10, 1945	6.40	4,560
1947	Aug. 24, 1947	6.20	3,200
1948	Aug. 7, 1948	6.06	2,570
1949	Dec. 30, 1948	6.38	3,030
	Jan. 15, 1949	11.47	19,400
	Jan. 25, 1949	6.38	5,230
	Mar. 10, 1949	7.81	6,090
	Aug. 9, 1949	5.24	4,400
1950	July 30, 1950	5.30	3,210
1951	Aug. 4, 1951	5.97	2,970
1952	Jan. 16, 1952	9.00	7,890
1952	Jan. 20, 1952	11.45	13,200
	Aug. 17, 1952	6.08	3,350
1953	July 30, 1953	4.93	2,040
1954	Mar. 25, 1954	7.13	4,260
	Aug. 4, 1954	6.32	3,320
	Aug. 5, 1954	6.17	3,170
	Aug. 8, 1954	6.30	3,100
	Aug. 12, 1954	7.05	3,990
	Aug. 23, 1954	6.53	3,550
	Aug. 24, 1954	6.08	3,080
	Aug. 25, 1954	6.51	3,530
1955	July 12, 1955	9.74	3,140
	July 26, 1955	10.23	4,920
	July 31, 1955	10.34	4,750
	Aug. 4, 1955	10.31	4,950
	Aug. 7, 1955	9.29	5,710
	Aug. 20, 1955	9.15	3,600
	Aug. 28, 1955	9.16	3,490
1956	Oct. 3, 1955	9.46	3,720
	Oct. 5, 1955	9.63	4,240
	July 29, 1956	8.58	3,000
1957	July 28, 1957	10.3	3,200
	Aug. 5, 1957	10.16	3,520
	Aug. 19, 1957	9.5	3,400
	Aug. 23, 1957	9.65	3,660
	Aug. 27, 1957	9.7	3,520
	Aug. 30, 1957	9.3	3,200
	Sept. 1, 1957	10.25	4,000
1958	Oct. 12, 1957	10.2	5,150
	Mar. 19, 1958	9.77	4,560
	Mar. 26, 1958	11.55	5,700
	Apr. 18, 1958	9.35	3,950
	Sept.15, 1958	5.69	4,310
	Sept.28, 1958	5.82	3,460
1959	Aug. 18, 1959	5.60	3,040
	Aug. 25, 1959	5.5	3,920
	Aug. 27, 1959	5.1	3,460
	Aug. 29, 1959	5.2	3,790
1960	Dec. 27, 1959	5.51	4,130
	Jan. 14, 1960	9.7	9,090
1961	Aug. 23, 1961	5.90	3,090
1962	Dec. 18, 1961	5.85	4,490
	Jan. 27, 1962	5.30	4,040
	Feb. 15, 1962	5.07	3,150
	Sept.29, 1962	8.50	9,000

Peak stages and discharges of San Carlos River near Peridot, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1952	Dec. 31, 1951	9.82	9,390	1956	Jan. 29, 1956	6.88	9,300
	Jan. 13, 1952	12.54	39,200	1957	July 25, 1957	9.2	7,310
	Jan. 19, 1952	10.0	23,900	1958	Oct. 12, 1957	5.55	2,260
	Aug. 5, 1952	6.41	3,040		Mar. 14, 1958	6.0	2,540
	Aug. 11, 1952	7.70	6,400		Mar. 17, 1958	7.5	4,550
	Aug. 18, 1952	6.54	3,300		Mar. 22, 1958	[illegible]	7,570
	Aug. 19, 1952	6.24	2,720		Aug. 18, 1958	6.3	2,300
1953	Aug. 27, 1953	5.48	860	1959	Aug. 16, 1959	5.60	2,280
1954	Mar. 23, 1954	11.00	23,800	1960	Oct. 30, 1959	6.25	4,100
	July 12, 1954	9.07	11,100		Nov. 2, 1959	6.60	4,750
	July 29, 1954	7.47	4,100		Dec. 25, 1959	10.5	14,300
	Aug. 3, 1954	9.00	9,800		Jan. 11, 1960	6.0	3,910
	Aug. 5, 1954	7.42	3,970	1961	July 22, 1961	7.05	6,210
	Aug. 22, 1954	6.30	2,510		July 28, 1961	6.10	3,880
1955	July 20, 1955	6.82	2,970		Aug. 22, 1961	6.60	4,320
	July 24, 1955	6.73	2,610	1962	Dec. 15, 1961	5.9	3,800
	July 29, 1955	7.12	3,240		Jan. 1, 1962	5.35	3,350
	Aug. 3, 1955	8.99	9,840		Sept.26, 1962	5.38	4,400
	Aug. 5, 1955	9.82	14,800				
	Aug. 13, 1955	7.70	4,740				
	Aug. 19, 1955	9.07	5,600				
	Aug. 20, 1955	6.87	9,250				
	Aug. 23, 1955	7.60	4,520				

4695. Gila River below Coolidge Dam, Ariz.
(Published as "near San Carlos" 1914-28, and as "at Coolidge Dam" 1929-38)

Location.--Lat 33°10'25", long 110°31'46", in SW¼ sec.17, T.3 S., R.18 E. (unsurveyed), 2,000 ft downstream from Coolidge Dam.

Drainage area.--12,886 sq mi.

Gage.--Recording. At various sites and datums within 1 mile upstream Apr. 29, 1914, to Mar. 5, 1937; at present site and datum thereafter. Datum of gage is 2,309.80 ft above mean sea level, datum of 1929.

Stage-discharge relation.--1914-37: Defined by current-meter measurements below [illegible] cfs and extended above by logarithmic plotting and comparison with flood records for stations near Solomon and at Kelvin.
1937-62: Defined by current-meter measurements; conforms closely to theoretical rating of Parshall flume.

Historical data.--Notable floods occurred in 1891 and 1905. Flood of 1891 was considered highest in the preceding 25 to 30 years at site near Florence (60 miles downstream). Flood of Nov. 28, 1905, exceeded the 1891 flood at this point. On this basis, flood of Nov. 28, 1905 (estimated discharge, 150,000 cfs), can be considered greatest since about 1861. Discussion and estimates on these floods is contained in WSP 38 and House Document No. 791.

Remarks.--Peak discharges not significantly affected by irrigation diversions. Completely regulated at Coolidge Dam after Nov. 15, 1928. Base for partial-duration series, 3,500 cfs. Only annual peaks are shown prior to 1916 and subsequent to 1928.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1906	Nov. 28, 1905	-	a150,000	1918	Aug. 6, 1918	6.34	8,850
1914	Aug. 24, 1914	8.25	7,400	1919	July 2, 1919	7.7	6,400
1915	Dec. 20, 1914	16.4	42,000		July 6, 1919	8.55	8,400
1916	Jan. 20, 1916	25.5	130,000		July 15, 1919	9.65	11,600
	Jan. 29, 1916	-	a30,000		July 19, 1919	7.65	6,300
	Mar. 2, 1916	-	a5,500		Aug. 3, 1919	11.3	16,000
	Mar. 25, 1916	7.7	6,400		Sept.27, 1919	6.48	4,100
	Aug. 26, 1916	6.46	4,000	1920	Dec. 5, 1919	11.8	18,000
	Sept.10, 1916	7.3	5,600		Feb. 11, 1920	9.0	9,700
1917	Oct. 14, 1916	20.4	74,000		Feb. 21, 1920	13.0	23,000
	Jan. 22, 1917	13	23,000		Feb. 23, 1920	8.42	7,600

a Estimated.

Peak stages and discharges of Gila River below Coolidge Dam, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1921	July 10, 1921	7.2	5,200	1933	July 11, 1933	5.98	1,040
	July 21, 1921	6.46	3,350	1934	Apr. 23, 1934	5.30	535
	July 27, 1921	7.57	5,200	1935	June 16, 1935	5.54	767
	July 31, 1921	9.9	12,300				
	Aug. 4, 1921	8.28	7,500	1936	Apr. 24, 1936	5.80	980
	Aug. 22, 1921	-	a14,000	1937	July 31, 1937	4.35	1,340
				1938	June 19, 1938	2.92	620
1922	Aug. 21, 1922	5.65	2,800	1939	Apr. 16, 1939	2.34	620
				1940	Aug. 17, 1940	2.94	534
1923	July 22, 1923	-	a9,000				
	Aug. 10, 1923	10.3	13,500	1941	July 22, 1941	4.17	1,110
	Aug. 12, 1923	-	a9,000	1942	Aug. 26, 1942	4.07	1,130
	Aug. 20, 1923	7.15	5,200	1943	July 17, 1943	3.92	1,040
				1944	Aug. 7, 1944	3.52	861
1924	Dec. 28, 1923	11.0	15,100	1945	July 16, 1945	2.88	616
1925	Aug. 1, 1925	10.3	5,550	1946	Aug. 29, 1946	1.98	345
	Sept. 4, 1925	14.1	14,400	1947	Mar. 7, 1947	2.65	551
	Sept.17, 1925	9.88	4,350	1948	Apr. 12, 1948	2.09	350
	Sept.19, 1925	10.67	6,350	1949	July 19, 1949	4.07	1,090
				1950	Apr. 30, 1950	3.15	725
1926	Mar. 30, 1926	9.5	4,650				
	Apr. 5, 1926	11.9	9,980	1951	Sept.13, 1951	1.90	321
				1952	July 29, 1952	4.64	1,350
1927	Feb. 18, 1927	11.22	7,080	1953	Dec. 16, 1953	2.13	373
	Feb. 17, 1927	11.9	9,100	1954	June 24, 1954	2.67	545
	Sept.12, 1927	8.85	4,300	1955	July 23, 1955	2.57	511
1928	Aug. 26, 1928	9.4	6,500	1956	Mar. 28, 1956	4.08	1,270
	Aug. 25, 1928	9.75	7,200	1957	July 31, 1957	2.58	509
				1958	July 12, 1958	3.86	924
1929	Sept.26, 1929	4.57	341	1959	June 29, 1959	3.04	671
1930	Sept. 6, 1930	5.70	954	1960	July 30, 1960	3.43	861
1931	July 20, 1931	5.95	1,100	1961	Feb. 25, 1961	1.30	311
1932	July 24, 1932	5.34	950	1962	Aug. 18, 1962	3.33	811

a Estimated.

4700. Gila River at Winkelman, Ariz.

Location.--Lat 33°00'12", long 110°45'55", in NW¼NE¼ sec.18, T.5 S., R.15 E., 1/4 mile north of Winkelman, 2 miles upstream from San Pedro River, and 33 miles downstream from Coolidge Dam.

Drainage area.--13,768 sq mi (includes 882 sq mi below Coolidge Dam).

Gage.--Recording. Datum of gage is 1,920.95 ft above mean sea level, datum of 1929, supplementary adjustment of 1949.

Stage-discharge relation.--Defined by current-meter measurements below 2,900 cfs and extended above on basis of slope-area measurement at gage height 18.40 ft.

Remarks.--Runoff from area above Coolidge Dam is completely regulated. Peak discharges are adjusted by amount of released water to show natural flow from 882 sq mi drainage area below Coolidge Dam, and differ in some instances from previously published figures. Base for partial-duration series, 1,000 cfs.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1942	Aug. 9, 1942	7.35	3,350	1946	Aug. 15, 1946	5.05	1,400
					Aug. 20, 1946	10.70	12,500
1943	Mar. 5, 1943	5.37	1,550		Aug. 30, 1946	6.10	2,320
	July 30, 1943	5.45	1,010		Sept.10, 1946	4.85	1,150
	Aug. 3, 1943	6.28	2,120		Sept.19, 1946	7.72	5,010
	Sept.26, 1943	8.70	5,470		Sept.27, 1946	6.5	3,100
1944	Oct. 19, 1943	5.60	1,570	1947	Aug. 8, 1947	13.68	24,300
	Aug. 7, 1944	6.15	1,830		Aug. 12, 1947	5.54	1,920
	Aug. 9, 1944	18.40	54,500		Sept.19, 1947	6.10	2,420
1945	Aug. 1, 1945	4.70	1,040	1948	July 26, 1948	4.89	1,220
	Aug. 9, 1945	5.37	1,650				
	Aug. 31, 1945	5.59	1,640	1949	June 18, 1949	5.85	1,630
					July 30, 1949	5.38	1,100
1946	Oct. 7, 1945	5.03	1,100		Sept.13, 1949	6.70	2,680
	Jan. 5, 1946	4.85	1,210				

Peak stages and discharges of Gila River at Winkelman, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1950	July 7, 1950	5.13	1,330	1955	Aug. 13, 1955	5.25	1,390
	July 21, 1950	5.97	3,550		Aug. 24, 1955	8.50	4,180
	July 30, 1950	7.90	4,360	1956	July 29, 1956	5.65	1,100
1951	Aug. 2, 1951	15.15	26,100	1957	Aug. 12, 1957	5.76	930
	Aug. 27, 1951	6.90	2,310	1958	Oct. 12, 1957	5.50	1,350
1952	Dec. 31, 1951	5.63	1,570		Sept. 3, 1958	5.99	1,600
	Jan. 13, 1952	6.28	2,240	1959	Oct. 6, 1958	5.35	1,230
1953	Aug. 25, 1953	4.36	640	1960	Oct. 29, 1959	6.76	1,730
1954	Mar. 22, 1954	8.44	4,590		Oct. 30, 1959	7.05	2,020
	July 20, 1954	5.76	1,200		Dec. 25, 1959	6.44	1,580
	July 31, 1954	6.49	1,740		Dec. 26, 1959	7.44	2,370
	Aug. 2, 1954	6.45	[illegible]		Sept. 8, 1960	7.08	1,520
	Aug. 3, 1954	8.47	[illegible]	1961	Aug. 3, 1961	6.75	1,730
	Aug. 5, 1954	17.89	51,700		Aug. 22, 1961	11.15	-
	Aug. 23, 1954	5.84	1,370		Sept. 8, 1961	7.36	3,670
	Sept.24, 1954	7.24	2,570		Sept.11, 1961	6.30	1,240
1955	July 22, 1955	5.45	1,200	1962	July 22, 1962	5.65	420
	July 28, 1955	12.0	13,200				
	July 29, 1955	7.30	3,250				

4705. San Pedro River at Palominas, Ariz.

Location.--Lat 31°22'48", long 110°16'08", on section line between sec.33, T.23 S., R.22 E., and sec.4, T.24 S., R.22 E., at highway bridge 0.7 mile east of Palominas, 1½ miles upstream from Greenbush Creek, 4½ miles downstream from international boundary, and 10 miles southwest of Bisbee.

Drainage area.--741 sq mi, of which 696 sq mi is in Mexico.

Gage.--Recording. Prior to Oct. 18, 1936, at datum 3.72 ft higher; Oct. 18, 1936, to Oct. 11, 1938, at datum 0.31 ft higher; Oct. 11, 1938, to July 14, 1941, at datum 1.00 ft lower; July 14, 1941, to Feb. 13, 1955, at present datum; Feb. 14, to Nov. 30, 1955, at site 400 ft downstream at datum 1.84 ft lower. Datum of gage is 4,187.00 ft above mean sea level (State Highway Department bench mark).

Stage-discharge relation.--Defined by current-meter measurements below 5,600 cfs and extended above on basis of slope-area measurement at gage height 16.16 ft, present datum.

Historical data.--Flood of Sept.28, 1926, reached a stage of about 23.9 ft, present datum, from floodmarks (discharge not determined).

Remarks.--Peak discharges unaffected by small irrigation diversions. Base for partial-duration series, 2,400 cfs.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1926	Sept.28, 1926	23.9	-	1936	Aug. 19, 1936	6.83	3,200
1930	July 22, 1930	7.36	4,140		Sept.10, 1936	10.15	13,500
	July 28, 1930	7.49	3,500	1937	July 18, 1937	5.75	2,650
	Aug. 7, 1930	9.75	9,400		Aug. 17, 1937	6.65	4,060
1931	Aug. 1, 1931	7.70	3,360		Aug. 20, 1937	6.31	4,090
	Aug. 6, 1931	7.30	3,450		Aug. 23, 1937	5.90	4,360
	Aug. 8, 1931	9.6	9,300		Aug. 26, 1937	6.74	4,730
	Aug. 30, 1931	7.61	3,730		Sept. 7, 1937	5.64	2,860
	Sept. 1, 1931	7.71	3,940	1938	July 28, 1938	5.77	3,040
1932	Oct. 1, 1931	7.46	3,490		Aug. 7, 1938	7.55	6,500
	July 29, 1932	8.3	5,190	1939	July 17, 1939	5.18	3,140
	Aug. 9, 1932	9.3	6,000		July 22, 1939	5.30	4,030
1933	July 13, 1933	7.75	4,020		Aug. 3, 1939	6.77	4,960
	Sept.12, 1933	8.1	4,700		Aug. 6, 1939	8.05	7,500
1935	Aug. 14, 1935	6.74	3,000	1940	July 25, 1940	10.12	3,920
1936	July 1, 1936	5.40	2,420		Aug. 4, 1940	9.34	3,150
					Aug. 14, 1940	16.45	22,000

Peak stages and discharges of Aravaipa Creek near Feldman, Ariz.

Water year	Date	Gage height (feet)	Discharge (cfs)
1919	Aug. 3, 1919	5.3	a20,000
1920	Jan. 5, 1920	4.03	a7,400
1921	July 31, 1921	5.0	a12,600
1931	Aug. 20, 1931	8.11	4,700
1932	Oct. 1, 1931	9.0	5,300
	Dec. 10, 1932	8.92	2,800
	Feb. 10, 1932	7.75	4,090
	Aug. 9, 1932	6.79	2,610
1933	July 18, 1933	7.1	3,070
	July 23, 1933	10.5	9,340
1934	July 20, 1934	7.12	3,100
	Aug. 30, 1934	6.85	2,700
1935	Jan. 6, 1935	7.75	4,090
	Feb. 7, 1935	8.0	4,500
	Aug. 2, 1935	7.35	3,460
	Aug. 13, 1935	8.79	3,610
	Aug. 15, 1935	10.9	10,200
	Aug. 24, 1935	10.3	6,900
	Aug. 29, 1935	10.2	8,590
1936	Feb. 18, 1936	7.57	3,800
	July 22, 1936	7.2	3,220
	July 25, 1936	9.1	6,500
	Aug. 9, 1936	7.55	3,770
	Sept. 7, 1936	7.1	3,070
1937	Feb. 7, 1937	7.30	3,380
1938	Mar. 4, 1938	7.56	3,600
1939	Aug. 5, 1939	9.1	5,450
	Aug. 7, 1939	7.4	3,340
	Sept. 5, 1939	7.3	3,170
	Sept. 11, 1939	8.25	4,830
1940	Oct. 7, 1939	8.35	4,920
	Feb. 23, 1940	7.20	3,080
	June 23, 1940	6.97	2,600
	June 25, 1940	7.32	3,950
	Aug. 4, 1940	7.15	2,840
	Sept. 21, 1940	8.6	5,480
1941	Nov. 19, 1940	8.4	4,480
	Dec. 31, 1940	10.88	b9,600
	Feb. 7, 1941	[illegible]	5,400
	Mar. 16, 1941	[illegible]	5,400

a Annual peak only. b Probably maximum for year; no record July to September.

4740. Gila River at Kelvin, Ariz.

Location.--Lat 33°06'10", long 110°58'45", in NW¼NE¼ sec.12, T.4 S., R.13 E., at Kelvin, 1,000 ft downstream from Mineral Creek, 17 miles downstream from San Pedro River, and 19½ miles upstream from Ashurst-Hayden Dam.

Drainage area.--18,011 sq mi, of which 5,135 sq mi is below Coolidge Dam.

Gage.--Nonrecording Jan. 26, 1911, to June 14, at several sites within three-quarters of a mile downstream at different datums; Dec. 1, 1914, to Aug. 31, 1915, at several sites from 1¼ miles upstream to half a mile downstream, except for March 1915 at Florence; all gage-height readings reduced to present datum. Recording June 15 to Nov. 30, 1914, and since Sept. 1, 1915, at present site. Datum of gage is 1,746.28 ft above mean sea level, datum of 1929, supplementary adjustment of 1949.

Stage-discharge relation.--Defined by current-meter measurements below 38,000 cfs and extended above on basis of slope-area measurement at 82,000 cfs.

Historical data.--A peak discharge of 100,000 cfs Feb. 22, 1891, by slope-area measurement, was observed at station at the Buttes, 15½ miles downstream. This flood was considered highest in at least the preceding 25 to 30 years. Flood of Nov. 28, 1905, was estimated as 190,000 cfs. Discussion of these floods and basis for estimates can be found in WSP 33 and House Document No. 791.

Remarks.--Prior to Nov. 15, 1928, peak discharges unaffected by irrigation diversions. Since Nov. 15, 1928, flow from area above Coolidge Dam has been completely regulated, and peak discharges represent natural runoff from drainage area below the dam, which is affected only to a minor extent by releases at the dam. Base for partial-duration series, 6,000 cfs prior to Nov. 15, 1928; 4,000 cfs thereafter.

Peak stages and discharges of Gila River at Kelvin, Ariz.

Water year	Date	Gage height (feet)	Discharge (cfs)
1891	Feb. 20, 1891	-	a102,000
1905	Nov. 28, 1905	-	ab190,000
1912	Mar. 12, 1912	16.0	35,000
	July 25, 1912	10	12,500
	July 30, 1912	8.4	7,300
	Aug. 31, 1912	8.5	7,600
1913	Feb. 25, 1913	5.5	4,400
1914	Aug. 19, 1914	7.55	16,700
	Sept.15, 1914	4.68	5,700
	Sept.21, 1914	8.26	18,000
1915	Oct. 6, 1914	5.6	3,500
	Dec. 21, 1914	14.0	55,000
	Dec. 24, 1914	16.1	67,300
	Jan. 1, 1915	7.1	12,800
	Jan. 20, 1915	15.0	66,000
	Feb. 21, 1915	6.6	18,600
	Mar. 27, 1915	4.9	6,000
	Apr. 1, 1915	5.0	8,400
	Apr. 3, 1915	5.4	7,800
	July 25, 1915	7.2	13,200
1916	Jan. 20, 1916	19.8	132,000
	Jan. 29, 1916	10.35	27,000
	Mar. 24, 1916	5.50	5,400
	Sept. 9, 1916	7.0	11,600
1917	Oct. 15, 1916	14.0	55,000
	Jan. 23, 1917	-	20,000
1918	Aug. 6, 1918	7.9	15,100
1919	July 3, 1919	5.1	6,400
	July 5, 1919	5.54	7,800
	July 16, 1919	7.66	14,000
	July 28, 1919	5.63	7,100
	Aug. 3, 1919	8.0	20,800
	Aug. 27, 1919	5.65	7,000
1920	Dec. 5, 1919	10.25	25,800
	Feb. 11, 1920	6.4	9,200
	Feb. 21, 1920	7.3	13,000
1921	July 11, 1921	5.5	6,000
	July 29, 1921	6.25	8,500
	July 31, 1921	9.8	24,000
	Aug. 9, 1921	-	7,000
	Aug. 22, 1921	8.1	16,000
1922	Aug. 22, 1922	4.25	2,800
1923	July 14, 1923	6.9	11,700
	July 23, 1923	6.0	8,500
	Aug. 11, 1923	6.4	9,700
	Aug. 13, 1923	6.6	10,500
	Aug. 16, 1923	6.35	9,500
	Sept.12, 1923	5.5	6,450
1924	Dec. 29, 1923	6.9	11,700
1925	Aug. 6, 1925	5.50	5,420
	Aug. 30, 1925	5.4	5,100
	Sept. 4, 1925	6.9	11,200
	Sept.18, 1925	5.77	7,250
1926	Apr. 7, 1926	5.95	9,000
	Sept.28, 1926	16.2	82,000
1927	Feb. 18, 1927	6.15	8,570
	Sept.12, 1927	5.76	6,870
1928	Aug. 2, 1928	7.05	12,000
	Aug. 28, 1928	6.25	8,640
1929	July 30, 1929	5.68	6,500
	Aug. 1, 1929	5.00	7,330
	Aug. 9, 1929	5.32	5,120
	Sept.24, 1929	7.22	11,600
1930	Mar. 18, 1930	4.90	4,020
	July 3, 1930	5.69	5,690
	July 10, 1930	5.76	5,310
	July 20, 1930	6.02	7,500
	Aug. 9, 1930	10.6	42,300
	Sept. 7, 1930	5.05	4,350
1931	Feb. 16, 1931	5.97	5,030
	Aug. 3, 1931	5.02	4,020
	Aug. 10, 1931	7.55	11,600
	Aug. 30, 1931	10.6	28,800
	Sept.19, 1931	5.18	4,000
1932	Oct. 2, 1931	7.5	12,800
	Dec. 10, 1931	5.50	4,850
	Feb. 10, 1932	6.0	6,060
	July 1, 1932	5.31	4,650
	Aug. 10, 1932	5.34	4,350
1933	July 24, 1933	6.45	9,800
	Aug. 20, 1933	6.27	4,590
1934	July 20, 1934	5.25	4,590
	Aug. 23, 1934	5.82	6,750
	Sept.23, 1934	5.47	5,140
1935	Jan. 6, 1935	5.25	4,390
	Feb. 7, 1935	5.90	6,670
	Aug. 2, 1935	6.10	7,400
	Aug. 10, 1935	5.02	4,060
	Aug. 15, 1935	7.44	9,030
	Aug. 24, 1935	9.4	12,200
	Aug. 29, 1935	9.20	21,000
	Sept. 1, 1935	5.50	7,400
1936	July 28, 1936	5.30	4,780
	Aug. 9, 1936	6.38	9,310
	Sept.11, 1936	7.45	12,600
1937	Feb. 7, 1937	6.60	8,740
	Aug. 21, 1937	6.94	10,200
1938	Aug. 5, 1938	6.55	5,660
	Aug. 8, 1938	6.45	5,360
1939	Aug. 3, 1939	6.55	5,470
	Aug. 7, 1939	7.63	9,320
1940	Aug. 14, 1940	12.06	38,200
	Sept.12, 1940	5.0	4,040
1941	Dec. 24, 1940	7.10	7,170
	Dec. 31, 1940	10.06	23,300
	Feb. 7, 1941	6.07	4,150
	Mar. 15, 1941	8.35	11,600
	July 23, 1941	7.77	6,270
	Aug. 9, 1941	6.62	4,450
	Aug. 17, 1941	6.70	4,170
	Sept.28, 1941	7.09	5,410
1942	Aug. 9, 1942	6.55	3,300
1943	Jan. 23, 1943	7.26	5,960
	Mar. 5, 1943	6.64	4,040
	Aug. 10, 1943	7.0	5,300
	Sept.26, 1943	7.10	6,290
1944	Aug. 9, 1944	10.95	28,000
	Sept.25, 1944	6.8	4,710
1945	Aug. 10, 1945	9.10	9,200
1946	Aug. 5, 1946	7.92	6,440
	Aug. 31, 1946	5.87	4,320
	Sept.19, 1946	7.35	5,300
1947	Aug. 8, 1947	8.57	10,000
	Sept. 8, 1947	6.98	4,730
	Sept.20, 1947	7.05	4,860
1948	Aug. 3, 1948	7.70	5,850
1949	July 31, 1949	6.81	4,740
	Aug. 8, 1949	7.07	5,230
	Sept.13, 1949	6.66	4,500

a Annual peak only. b Estimated.

Peak stages and discharges of Queen Creek at Whitlow damsite, near Superior, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1955	Aug. 13, 1955	5.23	1,240	1958	Oct. 31, 1957	5.74	2,280
					Feb. 4, 1958	5.30	1,240
1956	July 25, 1956	5.55	1,400		Mar. 7, 1958	4.74	650
	Aug. 17, 1956	6.83	4,100		Mar. 22, 1958	7.00	3,970
					Apr. 16, 1958	5.95	1,000
1957	July 26, 1957	6.40	2,580		Sept.13, 1958	5.50	550
	Aug. 12, 1957	5.83	2,070				
	Aug. 15, 1957	5.96	2,200	1959	Oct. 6, 1958	4.70	480
	Aug. 19, 1957	8.85	8,250		Aug. 17, 1959	-	a30,000

a About.

4795. Gila River near Laveen, Ariz.

Location.--Lat 33°15'25", long 112°09'59", in SW¼NW¼ sec.16, T.2 S., R.2 E., in Gila River Indian Reservation, at highway bridge 0.6 mile south of Komatke and 7.3 miles south of Laveen.

Drainage area.--20,615 sq mi, of which 7,709 sq mi is below Coolidge Dam.

Gage.--Recording above concrete diversion dam on main channel. Auxiliary recording or nonrecording gage on overflow channel at highway bridge a quarter of a mile south since Oct. 16, 1940. Datum of base gage is 1,012.90 ft above mean sea level, datum of 1929, supplementary adjustment of 1949. Datum of auxiliary gage is 0.23 ft lower.

Stage-discharge relation.--Defined by current-meter measurements. Relation is complex, owing to operational procedures at the dam and is subject to large shifts during flood periods.

Remarks.--Peak discharges represent runoff from drainage area below Coolidge Dam and may be slightly affected by irrigation diversions. Base for partial-duration series, 700 cfs.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1940	Aug. 17, 1940	9.21	9,740	1949	Sept.17, 1949	6.68	1,010
1941	Nov. 20, 1940	5.75	1,510	1950	July 9, 1950	5.72	706
	Dec. 26, 1940	5.49	1,440		July 19, 1950	6.08	777
	Jan. 2, 1941	9.33	11,900		July 23, 1950	6.60	1,040
	Jan. 13, 1941	5.08	1,040		Aug. 2, 1950	7.22	1,500
	Jan. 30, 1941	5.72	1,720		Aug. 6, 1950	7.02	1,160
	Feb. 9, 1941	6.19	1,330				
	Feb. 25, 1941	6.21	1,600	1951	Aug. 5, 1951	6.93	1,100
	Mar. 17, 1941	7.80	4,710		Aug. 29, 1951	7.29	1,210
	July 24, 1941	6.00	1,420				
	Aug. 11, 1941	5.42	1,730	1952	Jan. 15, 1952	6.70	871
	Aug. 18, 1941	5.43	1,750		Jan. 20, 1952	7.03	1,070
	Sept.19, 1941	5.14	1,560				
	Sept.29, 1941	5.62	1,300	1953	July 31, 1953	6.76	565
1942	Dec. 12, 1941	4.90	1,170	1954	Mar. 25, 1954	6.81	774
					July 23, 1954	7.64	1,440
1943	Jan. 25, 1943	4.68	714		Aug. 4, 1954	7.96	1,390
	Mar. 5, 1943	5.13	1,550		Aug. 8, 1954	9.15	4,510
	Aug. 4, 1943	4.70	702		Aug. 15, 1954	7.76	1,300
	Aug. 11, 1943	5.41	1,470		Aug. 17, 1954	7.93	1,560
	Aug. 15, 1943	4.70	730		Aug. 21, 1954	7.37	1,520
	Sept.27, 1943	5.78	1,570		Sept.26, 1954	7.33	764
1944	Aug. 11, 1944	5.83	1,330	1955	July 27, 1955	8.14	2,100
					Aug. 1, 1955	6.38	1,300
1945	Aug. 13, 1945	7.42	2,300		Aug. 5, 1955	7.30	1,630
					Aug. 10, 1955	8.54	2,700
1946	Oct. 6, 1945	5.63	1,250		Aug. 17, 1955	7.56	1,060
	Aug. 6, 1946	5.76	1,180		Aug. 24, 1955	8.76	3,230
	Sept.20, 1946	5.26	1,260				
				1956	Jan. 31, 1956	4.00	46
1948	July 26, 1948	5.70	1,230				
	Aug. 5, 1948	6.09	1,430	1957	Aug. 20, 1957	5.0	446
1949	July 25, 1949	6.22	880	1958	Aug. 9, 1958	7.73	983
	Aug. 1, 1949	5.90	755		Aug. 19, 1958	7.75	995
	Aug. 10, 1949	5.64	1,250				
	Sept.14, 1949	5.96	776	1959	Aug. 19, 1959	7.54	934

Peak stages and discharges of Gila River near Laveen, Ariz.--Continued

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1960	Nov. 1, 1959	7.70	1,080	1961	Aug. 25, 1961	7.19	555
	Dec. 28, 1959	8.12	1,680				
	Jan. 14, 1960	8.18	1,760	1962	Dec. 18, 1961	7.75	1,020

4800. Santa Cruz River near Lochiel, Ariz.

Location.--Lat 31°21'20", long 110°35'05", in SW¼ sec.11, T.24 S., R.17 E. (unsurveyed), at bridge on county road on southern border of Spanish land grant of San Rafael, 1½ miles upstream from international boundary, and 2½ miles northeast of Lochiel.

Drainage area.--82.2 sq mi.

Gage.--Recording. Altitude of gage is 4,630 ft (from topographic map).

Stage-discharge relation.--Defined by current-meter measurements below 1,400 cfs and extended above on basis of slope-area measurement at gage height 6.75 ft.

Remarks.--Peak discharges unaffected by small irrigation diversions. Base for partial-duration series, 1,000 cfs.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1949	Aug. 5, 1949	5.70	1,400	1955	Aug. 3, 1955	6.54	2,860
	Sept.13, 1949	5.75	1,650		Aug. 6, 1955	8.30	4,300
					Aug. 9, 1955	4.90	1,620
1950	July 3, 1950	6.65	4,300		Aug. 19, 1955	7.70	5,980
	July 20, 1950	5.45	3,040		Aug. 20, 1955	7.60	4,020
	July 10, 1950	4.35	3,790		Aug. 23, 1955	4.45	1,160
	July 30, 1950	4.75	4,500		Aug. 24, 1955	4.35	1,350
	Aug. 5, 1950	6.74	4,490		Aug. 27, 1955	4.23	1,000
1951	Aug. 2, 1951	5.45	2,860	1956	July 17, 1956	4.70	1,560
1952	Aug. 18, 1952	3.71	550	1957	Aug. 9, 1957	3.71	488
1953	July 7, 1953	4.80	1,730	1958	Aug. 7, 1958	4.89	280
	July 12, 1953	5.00	2,130				
	July 14, 1953	6.05	3,320	1959	Aug. 14, 1959	4.40	243
	July 15, 1953	4.57	1,500				
	July 30, 1953	4.85	1,480	1960	July 30, 1960	4.95	625
1954	July 20, 1954	4.69	1,510	1961	Aug. 6, 1961	5.65	1,120
	July 22, 1954	4.69	1,570				
	July 31, 1954	4.60	1,560	1962	July 29, 1962	2.21	7.5
1955	July 22, 1955	5.26	2,340				

4805. Santa Cruz River near Nogales, Ariz.

Location.--Lat 31°20'40", long 110°51'05", in NW¼ sec.13, T.24 S., R.13 E. (unsurveyed), in Spanish land grant of Maria Santisima del Carmen, three-quarters of a mile downstream from international boundary, 5¼ miles upstream from Yerba Buena damsite, and 5½ miles east of Nogales.

Drainage area.--533 sq mi (includes 348 sq mi in Mexico).

Gage.--Recording. Datum of gage is 3,700.64 ft above mean sea level, datum of 1929 (levels by International Boundary and Water Commission).

Stage-discharge relation.--Defined by current-meter measurements below 2,300 cfs and extended above on basis of slope-area measurements at gage heights 9.5, 10.9, and 12.03 ft. Relation subject to extreme shifting.

Remarks.--Peak discharges unaffected by irrigation diversions. Records were obtained for period 1913-22 at Yerba Buena damsite, 5½ miles downstream, but did not adequately define peak flow periods and are not included here. Base for partial-duration series, 2,000 cfs.

5005. Gila River near Dome, Ariz.

Location.--Lat 32°45'40", long 114°05'10", in SW¼ sec.4, T.8 S., R.21 W., 440 ft upstream from bridge on Yuma-Quartzite highway, 3 miles west of Dome, and 12 miles upstream from mouth.

Drainage area.--58,100 sq mi, approximately (including 373 sq mi in Aubrey Valley Playa, a closed basin).

Gage.--Nonrecording 4 miles upstream, Oct. 15, 1903, to Dec. 31, 1906, with numerous supplementary staff gages following radical changes in channel in 1905 and 1906. Datum of principal gage is 158.37 ft above mean sea level, adjustment of 1912. 1907-28, no gage; estimates of discharge within the 20-mile reach upstream from mouth, between Dome and Yuma. Recording since May 1929. Datum of gage is 148.18 ft above mean sea level, datum of 1929.

Stage-discharge relation.--Defined by current-meter measurements since 1929. Relation subject to large shifts.

Historical data.--Flood of Jan. 20, 1916 (estimated daily mean discharge, [illegible] cfs), was probably the greatest flood since Feb. 26, 1891, when a greater discharge may have occurred.

Remarks.--This tabulation is of annual floods only. Prior to 1929, maximum daily mean discharges are the only figures available, but on the large floods they are probably close to the instantaneous maxima. Many of those figures were estimated from record of Colorado River at Yuma and scattered observations of floodflows and therefore are considered as rough estimates only. Flood record increasingly affected by diversions, and after completion of Roosevelt Dam on Salt River in 1911, by storage in major reservoirs. See record for Gila River below Gillespie Dam for details.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (cfs)	Water year	Date	Gage height (feet)	Discharge (cfs)
1904	Aug. 30, 1904	-	4,580	1933	Oct. 11, 1932	5.30	[illegible]
1905	Mar. 20, 1905	-	35,000	1934	Aug. 5, 1934	5.34	[illegible]
				1935	Feb. 16, 1935	5.66	[illegible]
1906	Nov. 29, 1905	-	95,000	1936	-	-	0
1907	Mar. [illegible], 1907	-	50,000	1937	Mar. 24, 1937	10.08	3,530
1908	Feb. [illegible], 1908	-	37,500	1938	Mar. 10, 1938	10.92	9,470
1909	Dec. 19, 1908	-	60,500	1939	Sept.13, 1939	7.47	305
1910	Jan. 5, 1910	-	45,000	1940	-	-	0
1911	Jan.15,Feb.6, Mar.10,1911	-	10,000	1941	Apr. 20, 1941	13.93	14,000
1912	Mar.15,16,1912	-	10,000	1942	-	-	0
1913	Mar. 14, 1913	-	3,500	1943	-	-	0
1914	Feb.22-27,1914	-	3,000	1944	-	-	0
1915	Feb. 3, 1915	-	90,000	1945	-	-	0
1916	Jan. 20, 1916	-	200,000	1946	-	-	0
1917	Apr. 20, 1917	-	40,000	1947	Aug. 9, 1947	5.05	380
1918	Mar. 14, 1918	-	30,300	1948	-	-	0
1919	Aug. 5, 1919	-	5,000	1949	-	-	0
1920	Feb. 25, 1920	-	95,000	1950	-	-	0
1921	Aug. 24, 1921	-	25,000	1951	Sept. 7, 1951	7.34	1,100
1922	Jan. 4, 1922	-	35,000	1952	Oct. 30, 1951	5.24	293
1923	Sept.21, 1923	-	3,000	1953	Sept.17, 1953	4.[illegible]	17
1924	Dec. 30, 1923	-	48,500	1954	Sept. 3, 1954	4.[illegible]	46
1925	Sept.20, 1925	-	6,500	1955	Aug. 17, 1955	9.82	1,070
1926	Apr. 11, 1926	-	20,000	1956	Oct. 12, 1955	4.39	86
1927	Feb. 21, 1927	-	61,000	1957	Aug. 29, 1957	4.70	[illegible]
1928	Feb. 3, 1928	-	1,120	1958	July 31, 1958	[illegible]	713
1929	Apr. 3, 1929	-	14,500	1959	Aug. 8, 1959	9.45	902
1930	Aug. 14, 1930	10.50	3,600	1960	Sept. 1, 1960	10.12	2,130
1931	Feb. 13, 1931	12.79	11,400	1961	Aug. 5, 1961	5.33	158
1932	Feb. 15, 1932	13.75	20,[illegible]	1962	Aug. 29, 1962	5.18	[illegible]

a Estimated.

Note.--Maximum daily mean discharges are shown prior to 1929.

Compilation of Rec rds of Surface Waters of the United States through September 1950

Part 9. Colorado River Basin

Prepared under the direction of J. V. B. WELLS, Chief, Surface Water Branch

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1313

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1954

Yearly discharge, in second-feet, of Gila River at Kelvin, Ariz.

Year	W.S.P. no.	Water year ending Sept. 30: Momentary maximum Discharge	Momentary maximum Date	Minimum day	Mean	Runoff in acre-feet	Calendar year: Mean	Runoff in acre-feet
1911	309, 329	-	-	-	-	-	-	-
1912	329, 1119	35,000	Mar. 12, 1912	3	720	522,800	621	450,600
1913	359, 1119	4,400	Feb. 25, 1913	0	243	176,100	308	223,000
1914	(a)	18,000	Sept. 21, 1914	1	606	438,900	1,731	1,253,000
1915	(b)	67,300	Dec. 24, 1914	45	3,103	2,246,000	1,936	1,401,000
1916	(c)	132,000	Jan. 20, 1916	29	1,948	1,414,000	2,255	1,637,000
1917	(d)	55,000	Oct. 15, 1916	24	815	589,700	471	341,200
1918	479	15,100	Aug. 6, 1918	4	210	152,100	239	172,800
1919	509	20,800	Aug. 3, 1919	9	1,017	736,200	1,204	871,600
1920	509	25,800	Dec. 5, 1919	6	955	693,500	758	549,900
1921	529, 1119	24,000	July 31, 1921	1	638	461,500	634	459,300
1922	549, 1119	2,800	Aug. 22, 1922	4.5	169	122,700	158	114,200
1923	569, 1119	11,700	July 14, 1923	.5	478	345,700	681	492,900
1924	589	11,700	Dec. 29, 1923	1	520	377,800	305	221,600
1925	609	11,200	Sept. 4, 1925	1	246	177,900	312	225,700
1926	629	82,000	Sept. 28, 1926	2	560	405,700	575	416,100
1927	649, 1119	8,570	Feb. 18, 1927	6	448	324,300	397	287,700
1928	669	12,000	Aug. 2, 1928	1	208	151,200	186	135,300
1929	689	11,600	Sept. 24, 1929	1	135	97,690	156	112,800
1930	704	42,800	Aug. 8, 1930	31	474	342,900	476	344,700
1931	719	28,600	Aug. 30, 1931	27	502	363,400	531	384,400
1932	734	12,800	Oct. 2, 1931	55	503	365,400	491	356,700
1933	749	8,800	July 24, 1933	54	516	373,300	517	374,200
1934	764	6,750	Aug. 23, 1934	50	304	220,000	280	202,700
1935	789	21,000	Aug. 29, 1935	39	462	334,300	478	346,400
1936	809	12,600	Sept. 11, 1936	40	416	301,700	423	307,400
1937	829	10,200	Aug. 21, 1937	47	504	365,200	526	381,000
1938	859	5,660	Aug. 5, 1938	37	323	234,000	267	193,200
1939	879	9,320	Aug. 7, 1939	2	216	156,600	242	175,500
1940	899	38,200	Aug. 14, 1940	26	309	224,300	370	268,400
1941	929	23,300	Dec. 31, 1940	40	657	475,800	632	457,700
1942	959	3,300	Aug. 9, 1942	110	539	390,400	546	395,500
1943	979	6,290	Sept. 26, 1943	197	590	427,500	578	418,500
1944	1009	28,000	Aug. 9, 1944	67	468	339,700	467	339,200
1945	1039	9,200	Aug. 10, 1945	69	364	264,000	332	240,600
1946	1059	6,440	Aug. 5, 1946	1	166	120,000	142	102,800
1947	1089	10,000	Aug. 8, 1947	.3	120	87,060	113	81,640
1948	1119	5,850	Aug. 3, 1948	5	126	91,590	120	86,790
1949	1149	5,510	Sept. 15, 1949	2.4	406	293,800	438	316,900
1950	1179	6,920	July 30, 1950	8	253	182,900	-	-

a W.S.P.s 389,629,1119.
b W.S.P.s 409,629,1119.
c W.S.P.s 439,609,629.
d W.S.P.s 459,629,1119.

734. Gila River at the Buttes, Ariz.

Location.--Lat 33°05'30", long. 111°11'30", in SW¼ sec. 11, T. 4 S., R. 11 E., at the Buttes, 12 miles east of Florence and 22½ miles downstream from San Pedro River.
Drainage area.--18,300 sq mi, approximately.
Supplemental records available.--Records of suspended sediment loads for 1895 and 1899 and much additional information regarding this station are published in Water-Supply Paper 33.
Gage.--Staff gage at downstream end of canyon between the Buttes after Feb. 20, 1896. Datum of gage was 1,582.09 ft above mean sea level, datum of 1929. Aug. 26, 1889, to Feb. 19, 1896, staff gage near abandoned smelter just upstream from canyon between the Buttes.
Extremes.--1889-99: Maximum discharge, 102,000 cfs Feb. 22, 1891, by slope-area determination of peak flow; probably no flow on several days.
Remarks.--Diversions for irrigation above station. No storage above station during period of these records. Records show water available at Buttes dam site.

Monthly and yearly mean discharge, in second-feet

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1889	-	-	-	-	-	-	-	-	-	-	-	120	-
1890	157	212	275	601	578	387	238	84	28.3	130	3,130	-	-
1895	-	-	-	-	-	-	-	-	-	-	1,583	812	-
1896	1,577	1,103	751	396	209	242	180	32.5	4.7	1,441	810	980	647
1897	4,145	1,038	630	1,286	883	702	694	224	51.9	565	799	2,371	1,118
1898	800	613	490	640	485	473	547	292	252	2,022	537	270	622
1899	79	101	318	318	239	130	62.3	18.3	5.1	1,188	672	733	324

Monthly and yearly runoff, in acre-feet, of Gila River at the Buttes, Ariz.

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1889	-	-	-	-	-	-	-	-	-	-	-	7,420	-
1890	9,640	12,600	16,910	41,860	32,110	23,800	14,170	5,160	1,690	8,010	92,900	-	-
1895	-	-	-	-	-	-	-	-	-	-	97,320	48,3[illegible]	-
1896	96,970	65,630	46,180	24,370	12,020	14,900	10,680	2,050	280	88,630	49,820	59,270	469,8[illegible]
1897	254,800	61,750	38,720	79,080	49,020	43,160	41,300	13,770	3,090	34,740	49,150	141,100	809,7[illegible]
1898	49,190	36,490	30,130	39,350	26,940	29,080	32,550	17,950	15,000	24,300	33,020	16,070	450,1[illegible]
1899	4,865	6,010	19,530	19,570	13,260	8,020	3,710	1,120	313	73,060	41,330	43,630	234,4[illegible]

Yearly discharge, in second-feet

Year	W.S.P. no.	Water year ending Sept. 30: Momentary maximum Discharge	Momentary maximum Date	Minimum day	Mean	Runoff in acre-feet	Calendar year: Mean	Runoff in acre-feet
1889	33	-	-	-	-	-	-	-
1890	33	-	-	-	-	-	-	-
1891	33, 81	a102,000	Feb. 22, 1891	-	-	-	-	-
1895	33		-	-	-	-	-	-
1896	33	-	-	1	647	469,800	849	616,300
1897	33	-	-	0	1,118	809,700	750	570,200
1898	33	-	-	-	622	450,100	504	364,700
1899	33	-	-	.2	324	234,400	-	-

a Maximum for water year.

735. Florence-Casa Grande Canal near Florence, Ariz.

Location.--Lat 33°05', long. 111°17', in NE¼ sec. 14, T. 4 S., R. 10 E., at China Wash, 2.6 miles downstream from head at Ashurst-Hayden Dam, and 6¼ miles northeast of Florence.
Supplemental records available.--Records of daily mean head on crest of Ashurst-Hayden Dam for the period July 1923 to September 1950 are published in reports of Geological Survey.
Gage.--Water-stage recorder and Parshall flume since Jan. 12, 1937, 900 ft downstream from head at Ashurst-Hayden Dam. Prior to Jan. 11, 1937, water-stage recorder on canal intake structure just upstream from crest of dam. Discharge often determined on basis of diversions to laterals many miles downstream.
Head on crest of dam obtained from water-stage recorder on canal intake structure just upstream from crest of dam.
Average discharge.--22 years (1928-50), 295 cfs.
Remarks.--Canal diverts from left side of Gila River at Ashurst-Hayden Dam in NW¼ sec. 8, T. 4 S., R. 11 E., for irrigation of lands under San Carlos Project in Pinal County. Records shown herewith represent quantity of water diverted at Ashurst-Hayden Dam; records are kept of the quantities of water sluiced from or pumped into the canal between the dam and gage and these respective quantities are added to or subtracted from the flow at the gage. Most of the diverted water passed through San Carlos Reservoir and was released at Coolidge Dam; the remainder originated in unregulated flow below Coolidge Dam, mostly from San Pedro River basin.

Monthly and yearly diversion, in acre-feet

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1928	-	-	-	10,780	6,340	10,620	3,320	973	0	5,300	25,000	5,91[illegible]	-
1929	2,900	4,270	842	873	1,670	1,930	2,140	166	0	11,610	24,190	6,45[illegible]	[illegible],550
1930	13,580	7,220	5,360	4,520	6,660	12,590	25,560	23,500	30,940	28,960	26,200	[illegible]	221,5[illegible]
1931	12,770	8,020	5,290	5,742	9,510	17,300	29,870	29,260	31,320	42,030	28,270	21,9[illegible]	250,4[illegible]
1932	11,800	5,150	1,480	6,280	9,260	22,450	44,900	31,600	30,300	39,500	16,630	40,[illegible]	2[illegible],400
1933	13,380	11,650	7,240	6,920	8,150	28,400	40,500	35,800	43,090	48,550	48,800	34,4[illegible]	324,700
1934	17,200	13,850	7,850	7,300	9,450	17,100	24,600	23,000	17,950	21,800	21,800	13,4[illegible]	201,700
1935	11,400	6,470	5,550	7,770	11,400	13,650	23,300	25,000	29,800	32,600	35,600	28,8[illegible]	231,300
1936	15,700	11,200	8,350	5,920	14,190	17,800	26,800	29,900	28,500	31,900	29,590	26,0[illegible]	244,[illegible]
1937	17,500	9,650	6,950	8,230	9,840	17,120	26,400	33,750	32,140	39,510	53,5[illegible]	33,20[illegible]	305,[illegible]
1938	22,810	15,760	10,730	10,550	8,630	14,160	19,410	18,610	17,880	12,350	22,940	16,[illegible]	188,100
1939	5,380	553	6,810	6,210	6,820	12,540	19,540	13,040	4,510	2,640	21,5[illegible]	14,530	115,100
1940	10,850	9,920	11,590	8,520	12,020	14,720	16,010	14,370	9,430	10,330	23,920	13,[illegible]	160,700
1941	7,430	6,850	12,280	8,360	8,770	7,120	18,200	34,420	37,980	48,400	38,290	36,[illegible]	264,[illegible]
1942	27,710	21,710	13,320	13,340	18,310	24,430	35,930	33,980	39,710	52,460	55,01[illegible]	45,[illegible]	375,[illegible]
1943	26,970	19,660	17,100	16,010	18,750	27,240	35,730	39,860	44,560	48,170	43,420	34,140	371,900
1944	23,100	19,090	13,500	10,700	11,730	14,640	29,020	28,760	29,500	40,160	39,450	[illegible]	2[illegible],100
1945	21,520	13,570	15,670	10,740	10,240	14,030	19,120	20,570	19,610	27,600	20,420	21,9[illegible]	224,1[illegible]
1946	12,980	7,150	8,280	5,450	7,090	10,760	9,020	7,360	1,070	3,520	15,510	10,47[illegible]	99,[illegible]
1947	4,050	4,680	5,920	7,840	5,680	7,950	9,820	696	0	28	15,170	12,26[illegible]	74,0[illegible]
1948	5,280	1,790	2,460	3,880	5,230	8,820	12,120	4,650	4,610	8,250	16,[illegible]	[illegible]	[illegible]
1949	194	1,2[illegible]	2,970	6,0[illegible]	3,440	28,300	32,840	22,450	[illegible]	43,5[illegible]	47,520	26,[illegible]	[illegible]
1950	9,390	4,540	9,490	5,020	5,920	18,980	24,240	8,270	13,670	21,930	17,29[illegible]	1,21[illegible]	[illegible]

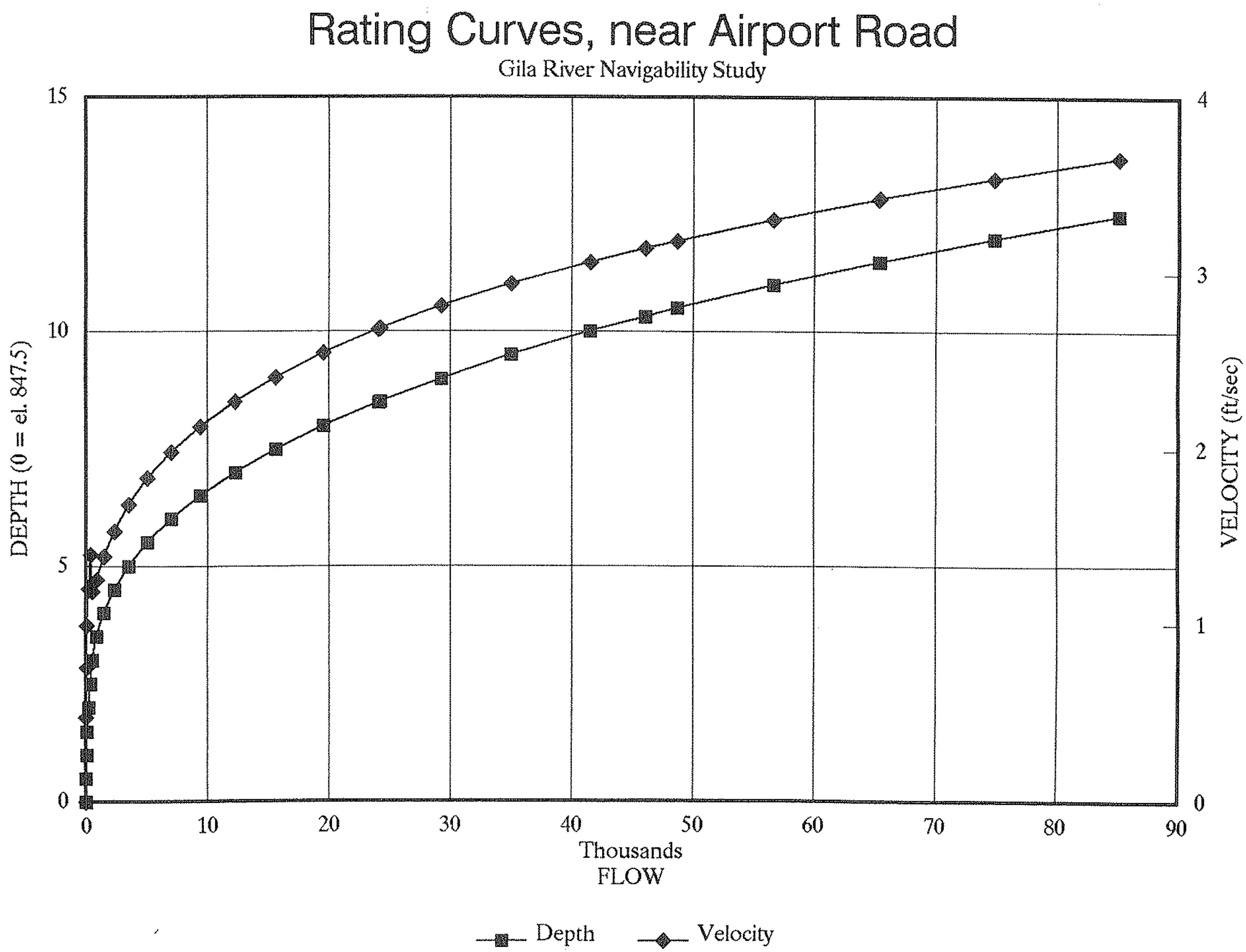
Appendix F

Rating Curves

Gila River Navigability Study 08/29/96
near Airport Road (east of Buckeye), rating curve & cross section information

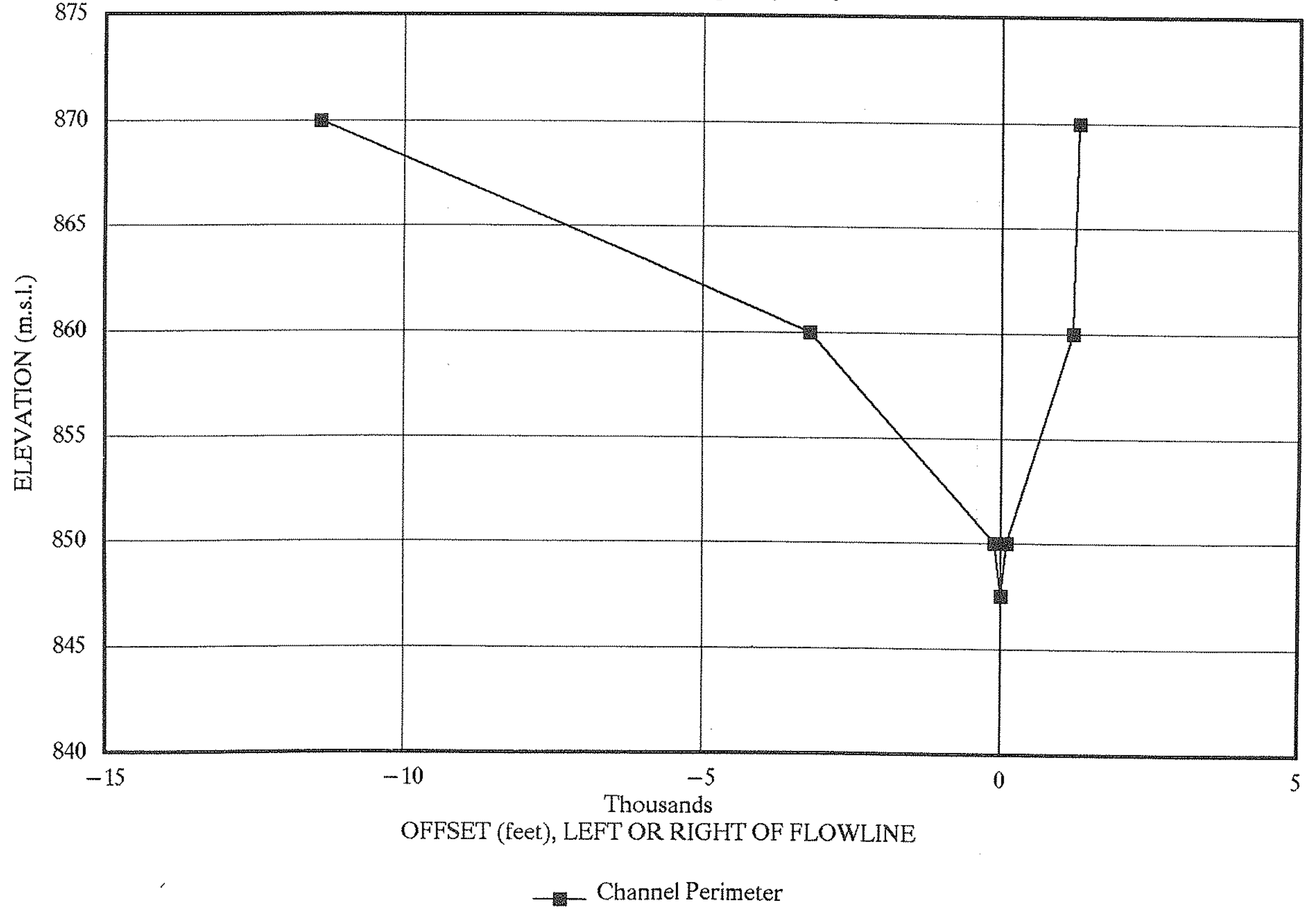
channel slope = 0.0008065
roughness, n = 0.035

Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
22.50	870.00	0.50	108750.0	12700.63	0.0008065	8.56	5.05	548805
22.00	869.50	0.50	102503.8	12285.60	0.0008065	8.34	4.96	508419
21.50	869.00	0.50	96465.0	11870.58	0.0008065	8.13	4.87	470134
21.00	868.50	0.50	90633.8	11455.55	0.0008065	7.91	4.79	433903
20.50	868.00	0.50	85010.0	11040.53	0.0008065	7.70	4.70	399678
20.00	867.50	0.50	79593.8	10625.50	0.0008065	7.49	4.62	367411
19.50	867.00	0.50	74385.0	10210.48	0.0008065	7.29	4.53	337053
19.00	866.50	0.50	69383.8	9795.45	0.0008065	7.08	4.45	308555
18.50	866.00	0.50	64590.0	9380.43	0.0008065	6.89	4.36	281869
18.00	865.50	0.50	60003.8	8965.40	0.0008065	6.69	4.28	256943
17.50	865.00	0.50	55625.0	8550.38	0.0008065	6.51	4.20	233729
17.00	864.50	0.50	51453.8	8135.35	0.0008065	6.32	4.12	212176
16.50	864.00	0.50	47490.0	7720.33	0.0008065	6.15	4.05	192235
16.00	863.50	0.50	43733.8	7305.30	0.0008065	5.99	3.98	173856
15.50	863.00	0.50	40185.0	6890.28	0.0008065	5.83	3.91	156989
15.00	862.50	0.50	36843.8	6475.25	0.0008065	5.69	3.84	141586
14.50	862.00	0.50	33710.0	6060.23	0.0008065	5.56	3.79	127602
14.00	861.50	0.50	30783.8	5645.20	0.0008065	5.45	3.74	114992
13.50	861.00	0.50	28065.0	5230.17	0.0008065	5.37	3.70	103717
13.00	860.50	0.50	25553.8	4815.15	0.0008065	5.31	3.67	93743
12.50	860.00	0.50	23250.0	4400.12	0.0008065	5.28	3.66	85045
12.00	859.50	0.49	21102.5	4190.12	0.0008065	5.04	3.54	74758
11.51	859.01	0.01	19079.9	3982.22	0.0008065	4.79	3.43	65383
11.50	859.00	0.50	19060.0	3980.12	0.0008065	4.79	3.43	65292
11.00	858.50	0.50	17122.5	3770.11	0.0008065	4.54	3.31	56619
10.50	858.00	0.18	15290.0	3560.11	0.0008065	4.29	3.19	48711
10.32	857.82	0.32	14652.5	3484.09	0.0008065	4.21	3.14	46031
10.00	857.50	0.50	13562.5	3350.11	0.0008065	4.05	3.06	41538
9.50	857.00	0.50	11940.0	3140.11	0.0008065	3.80	2.94	35072
9.00	856.50	0.49	10422.5	2930.10	0.0008065	3.56	2.81	29283
8.51	856.01	0.01	9042.7	2725.14	0.0008065	3.32	2.68	24256
8.50	856.00	0.50	9010.0	2720.10	0.0008065	3.31	2.68	24140
8.00	855.50	0.50	7702.5	2510.10	0.0008065	3.07	2.55	19612
7.50	855.00	0.50	6500.0	2300.09	0.0008065	2.83	2.41	15666
7.00	854.50	0.50	5402.5	2090.09	0.0008065	2.58	2.27	12269
6.50	854.00	0.50	4410.0	1880.09	0.0008065	2.35	2.13	9387
6.00	853.50	0.50	3522.5	1670.08	0.0008065	2.11	1.98	6985
5.50	853.00	0.50	2740.0	1460.08	0.0008065	1.88	1.83	5026
5.00	852.50	0.50	2062.5	1250.08	0.0008065	1.65	1.68	3472
4.50	852.00	0.50	1490.0	1040.07	0.0008065	1.43	1.53	2283
4.00	851.50	0.50	1022.5	830.07	0.0008065	1.23	1.39	1417
3.50	851.00	0.50	660.0	620.07	0.0008065	1.06	1.26	830
3.00	850.50	0.50	402.5	410.07	0.0008065	0.98	1.19	479
2.50	850.00	0.50	250.0	200.06	0.0008065	1.25	1.40	350
2.00	849.50	0.50	160.0	160.05	0.0008065	1.00	1.21	193
1.50	849.00	0.50	90.0	120.04	0.0008065	0.75	1.00	90
1.00	848.50	0.50	40.0	80.02	0.0008065	0.50	0.76	30
0.50	848.00	0.50	10.0	40.01	0.0008065	0.25	0.48	5
0.00	847.50		0.0	0.0			0.00	0


Rating Curves, near Airport Road
Gila River Navigability Study
DEPTH (0 = el. 847.5)
VELOCITY (ft/sec)
15
10
5
0
4
3
2
1
0
0
10
20
30
40
50
60
70
80
90
Thousands
FLOW
Depth
Velocity

Cross-section, at Airport Road

Gila River Navigability Study



channel slope = 0.001351
roughness, n = 0.035

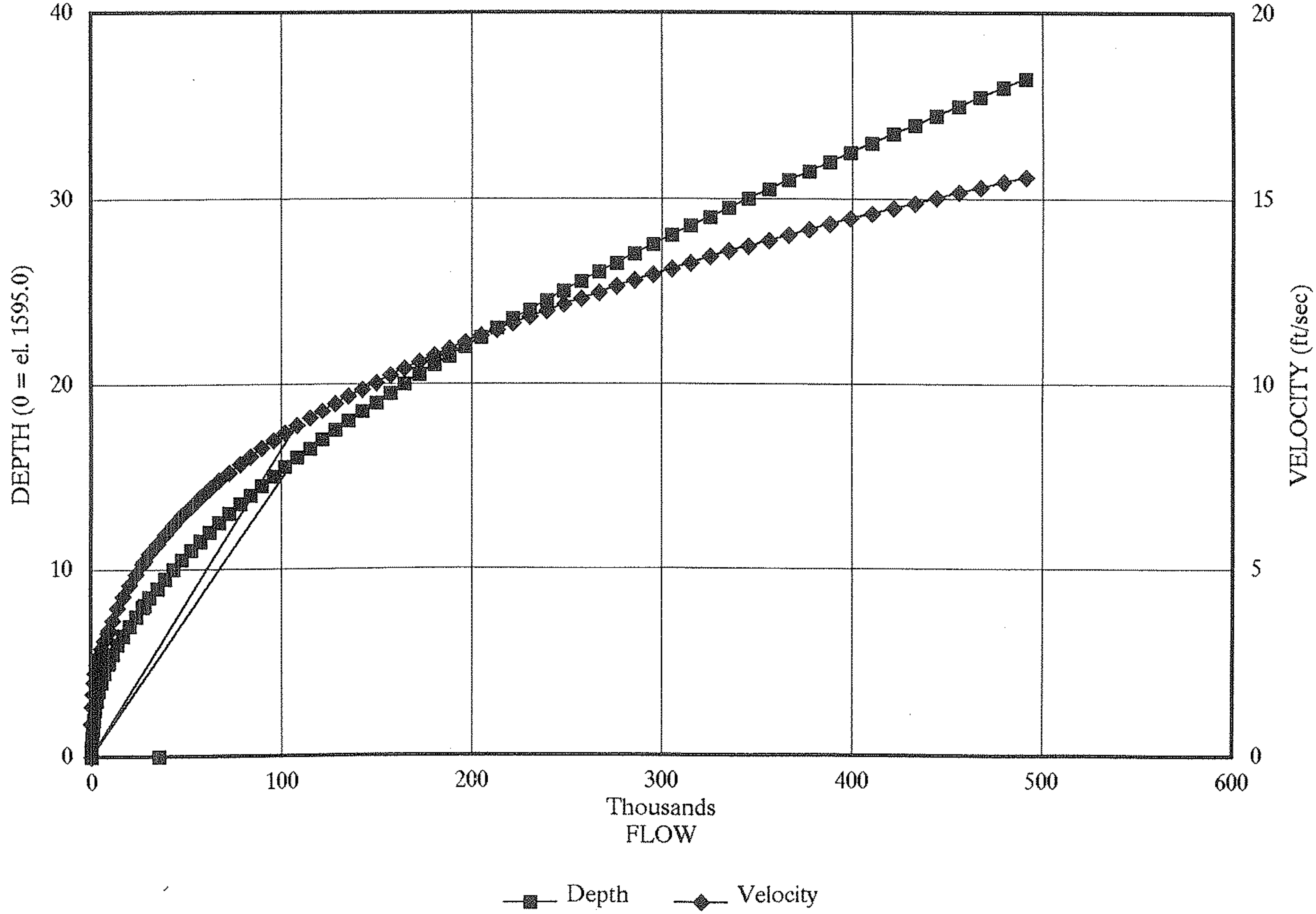
Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
105.00	1700.00	65.00	108875.0	1320.10	0.0013510	82.47	29.57	3219249
40.00	1635.00	0.50	34978.1	1014.71	0.0013510	34.47	16.53	578155
39.50	1634.50	0.50	34479.3	1012.36	0.0013510	34.06	16.40	565351
39.00	1634.00	0.50	33981.5	1010.01	0.0013510	33.64	16.26	552669
38.50	1633.50	0.50	33484.8	1007.66	0.0013510	33.23	16.13	540108
38.00	1633.00	0.50	32989.1	1005.31	0.0013510	32.81	16.00	527670
37.50	1632.50	0.50	32494.5	1002.96	0.0013510	32.40	15.86	515353
37.00	1632.00	0.50	32001.0	1000.62	0.0013510	31.98	15.72	503160
36.50	1631.50	0.50	31508.5	998.27	0.0013510	31.56	15.59	491090
36.00	1631.00	0.50	31017.1	995.92	0.0013510	31.14	15.45	479143
35.50	1630.50	0.50	30526.8	993.57	0.0013510	30.72	15.31	467321
35.00	1630.00	0.50	30037.5	991.22	0.0013510	30.30	15.17	455622
34.50	1629.50	0.50	29549.3	988.87	0.0013510	29.88	15.03	444049
34.00	1629.00	0.50	29062.1	986.52	0.0013510	29.46	14.89	432600
33.50	1628.50	0.50	28576.0	984.17	0.0013510	29.04	14.74	421277
33.00	1628.00	0.50	28091.0	981.82	0.0013510	28.61	14.60	410080
32.50	1627.50	0.50	27607.0	979.47	0.0013510	28.19	14.45	399009
32.00	1627.00	0.50	27124.1	977.12	0.0013510	27.76	14.31	388065
31.50	1626.50	0.50	26642.3	974.77	0.0013510	27.33	14.16	377249
31.00	1626.00	0.50	26161.5	972.43	0.0013510	26.90	14.01	366560
30.50	1625.50	0.50	25681.8	970.08	0.0013510	26.47	13.86	356000
30.00	1625.00	0.50	25203.1	967.73	0.0013510	26.04	13.71	345568
29.50	1624.50	0.50	24725.5	965.38	0.0013510	25.61	13.56	335266
29.00	1624.00	0.50	24249.0	963.03	0.0013510	25.18	13.41	325094
28.50	1623.50	0.50	23773.5	960.68	0.0013510	24.75	13.25	315052
28.00	1623.00	0.50	23299.1	958.33	0.0013510	24.31	13.10	305141
27.50	1622.50	0.50	22825.8	955.98	0.0013510	23.88	12.94	295362
27.00	1622.00	0.50	22353.5	953.63	0.0013510	23.44	12.78	285715
26.50	1621.50	0.50	21882.3	951.28	0.0013510	23.00	12.62	276202
26.00	1621.00	0.50	21412.1	948.93	0.0013510	22.56	12.46	266821
25.50	1620.50	0.50	20943.0	946.59	0.0013510	22.12	12.30	257576
25.00	1620.00	0.50	20475.0	944.24	0.0013510	21.68	12.14	248465
24.50	1619.50	0.50	20008.0	941.89	0.0013510	21.24	11.97	239490
24.00	1619.00	0.50	19542.1	939.54	0.0013510	20.80	11.80	230651
23.50	1618.50	0.50	19077.3	937.19	0.0013510	20.36	11.63	221950
23.00	1618.00	0.50	18613.5	934.84	0.0013510	19.91	11.46	213387
22.50	1617.50	0.50	18150.8	932.49	0.0013510	19.46	11.29	204963
22.00	1617.00	0.50	17689.1	930.14	0.0013510	19.02	11.12	196678
21.50	1616.50	0.50	17228.5	927.79	0.0013510	18.57	10.94	188535
21.00	1616.00	0.50	16769.0	925.44	0.0013510	18.12	10.77	180533
20.50	1615.50	0.50	16310.5	923.09	0.0013510	17.67	10.59	172674
20.00	1615.00	0.50	15853.1	920.74	0.0013510	17.22	10.41	164959
19.50	1614.50	0.50	15396.8	918.40	0.0013510	16.76	10.22	157389
19.00	1614.00	0.50	14941.5	916.05	0.0013510	16.31	10.04	149965
18.50	1613.50	0.50	14487.3	913.70	0.0013510	15.86	9.85	142688
18.00	1613.00	0.50	14034.1	911.35	0.0013510	15.40	9.66	135560
17.50	1612.50	0.50	13582.0	909.00	0.0013510	14.94	9.47	128581
17.00	1612.00	0.50	13131.0	906.65	0.0013510	14.48	9.27	121754
16.50	1611.50	0.50	12681.0	904.30	0.0013510	14.02	9.07	115079

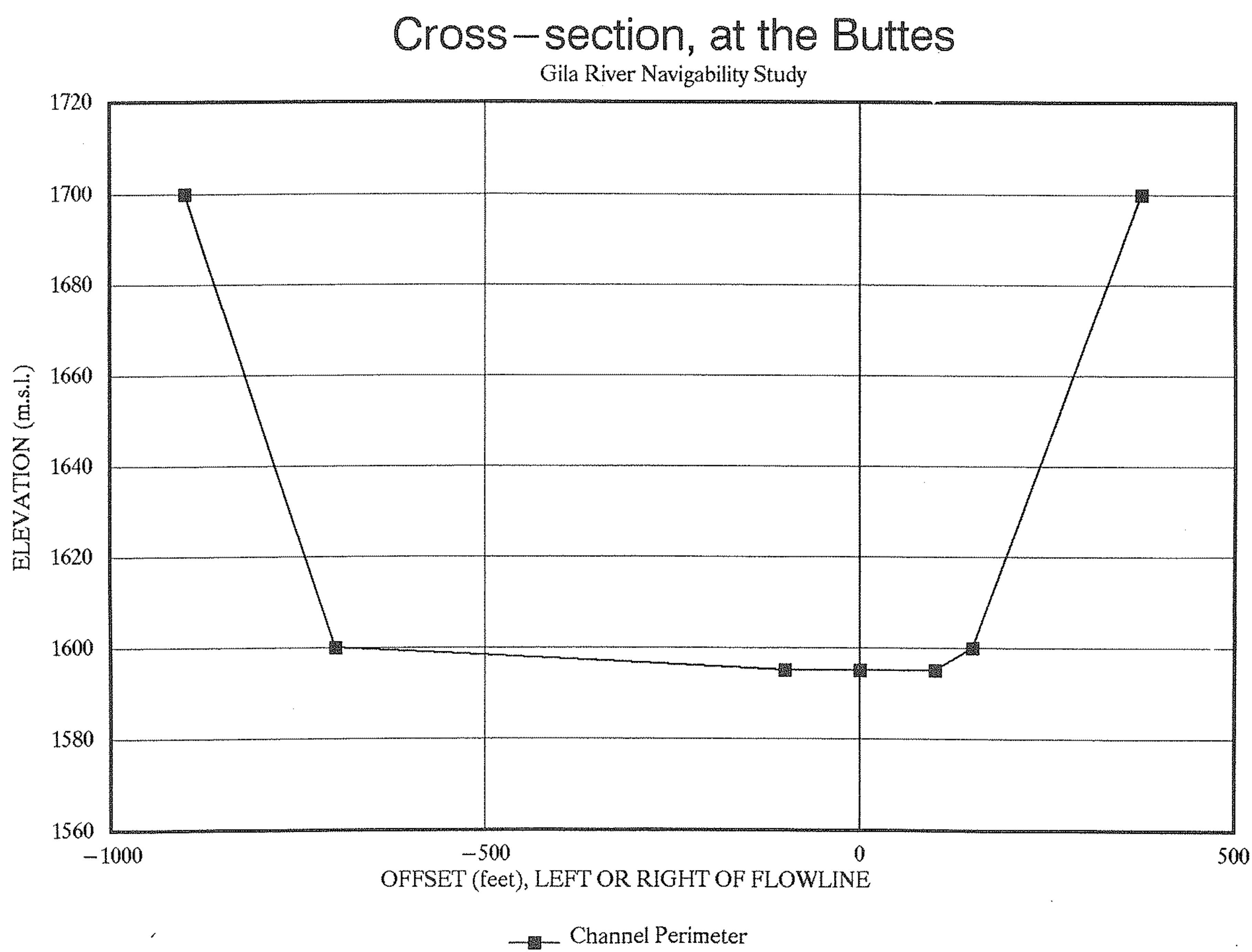
channel slope = 0.001351
roughness, n = 0.035

Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
16.00	1611.00	0.50	12232.1	901.95	0.0013510	13.56	8.87	108557
15.50	1610.50	0.50	11784.3	899.60	0.0013510	13.10	8.67	102192
15.00	1610.00	0.50	11337.5	897.25	0.0013510	12.64	8.47	95984
14.50	1609.50	0.50	10891.8	894.90	0.0013510	12.17	8.26	89934
14.00	1609.00	0.50	10447.1	892.55	0.0013510	11.70	8.04	84046
13.50	1608.50	0.50	10003.5	890.21	0.0013510	11.24	7.83	78320
13.00	1608.00	0.50	9561.0	887.86	0.0013510	10.77	7.61	72759
12.50	1607.50	0.50	9119.5	885.51	0.0013510	10.30	7.39	67366
12.00	1607.00	0.46	8679.1	883.16	0.0013510	9.83	7.16	62141
11.54	1606.54	0.04	8276.6	881.01	0.0013510	9.39	6.95	57506
11.50	1606.50	0.50	8239.8	880.81	0.0013510	9.35	6.93	57089
11.00	1606.00	0.50	7801.5	878.46	0.0013510	8.88	6.69	52211
10.50	1605.50	0.50	7364.3	876.11	0.0013510	8.41	6.45	47511
10.00	1605.00	0.50	6928.1	873.76	0.0013510	7.93	6.21	42991
9.50	1604.50	0.50	6493.0	871.41	0.0013510	7.45	5.95	38655
9.00	1604.00	0.50	6059.0	869.06	0.0013510	6.97	5.70	34507
8.50	1603.50	0.38	5626.0	866.71	0.0013510	6.49	5.43	30551
8.12	1603.12	0.12	5295.1	864.91	0.0013510	6.122	5.22	27654
8.00	1603.00	0.50	5194.1	864.37	0.0013510	6.009	5.16	26792
7.50	1602.50	0.50	4763.3	862.02	0.0013510	5.526	4.88	23233
7.00	1602.00	0.50	4333.5	859.67	0.0013510	5.041	4.59	19882
6.50	1601.50	0.50	3904.8	857.32	0.0013510	4.555	4.29	16743
6.00	1601.00	0.50	3477.1	854.97	0.0013510	4.067	3.98	13825
5.50	1600.50	0.39	3050.5	852.62	0.0013510	3.578	3.65	11136
5.11	1600.11	0.11	2716.8	850.78	0.0013510	3.193	3.38	9194
5.00	1600.00	0.50	2625.0	850.27	0.0013510	3.087	3.31	8685
4.50	1599.50	0.50	2216.3	785.24	0.0013510	2.822	3.12	6907
4.00	1599.00	0.50	1840.0	720.22	0.0013510	2.555	2.92	5366
3.50	1598.50	0.50	1496.3	655.19	0.0013510	2.284	2.71	4049
3.00	1598.00	0.50	1185.0	590.16	0.0013510	2.008	2.48	2943
2.50	1597.50	0.50	906.3	525.14	0.0013510	1.726	2.25	2035
2.00	1597.00	0.50	660.0	460.11	0.0013510	1.434	1.98	1310
1.50	1596.50	0.50	446.3	395.08	0.0013510	1.130	1.69	755
1.00	1596.00	0.50	265.0	330.05	0.0013510	0.803	1.35	357
0.50	1595.50	0.50	116.3	265.03	0.0013510	0.439	0.90	105
0.00	1595.00			200.00			0.00	0

Rating Curves, near Buttes

Gila River Navigability Study




Cross–section, at the Buttes
Gila River Navigability Study
ELEVATION (m.s.l.)
1720
1700
1680
1660
1640
1620
1600
1580
1560
–1000
–500
0
500
OFFSET (feet), LEFT OR RIGHT OF FLOWLINE
Channel Perimeter

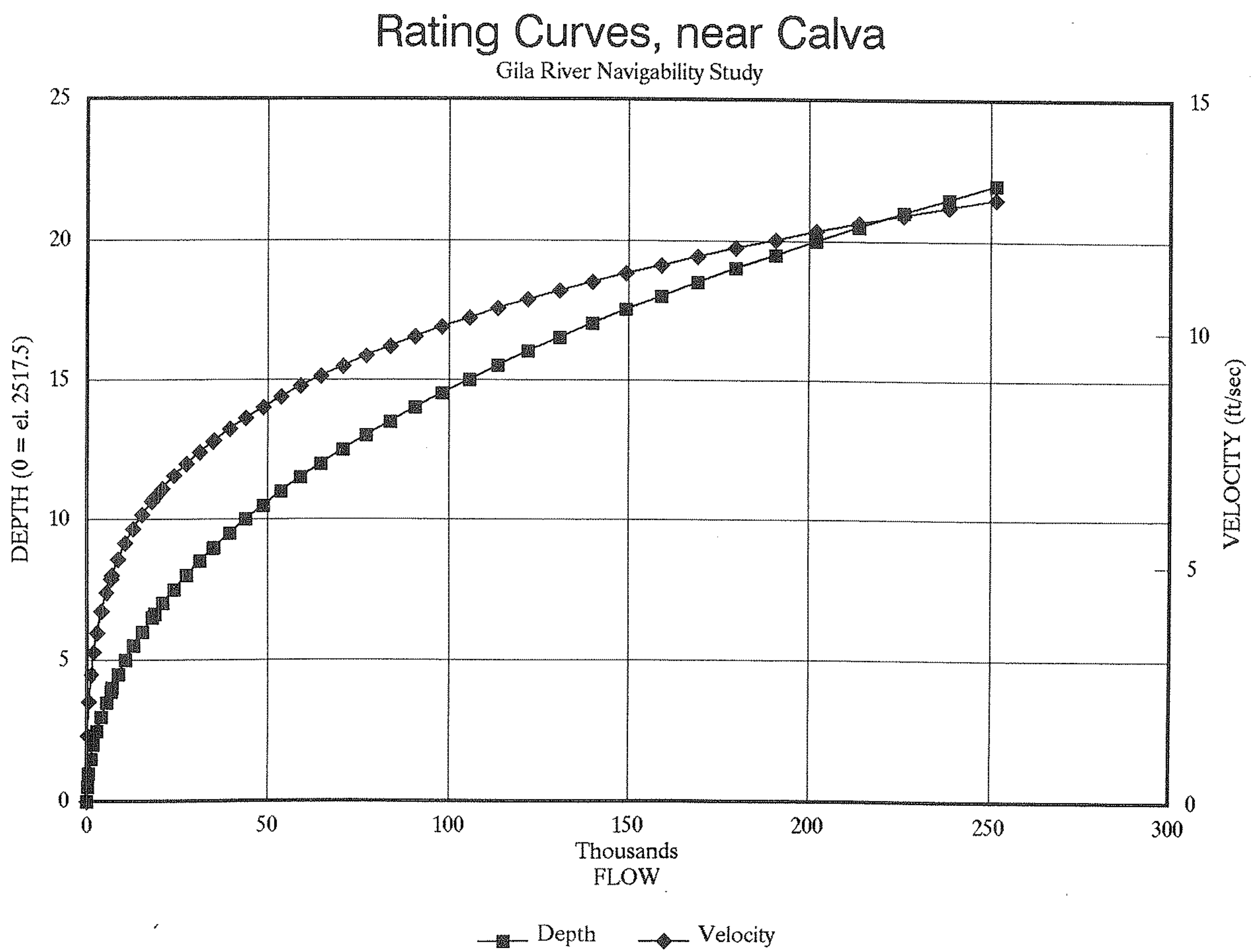
Gila River Navigability Study 08/29/96

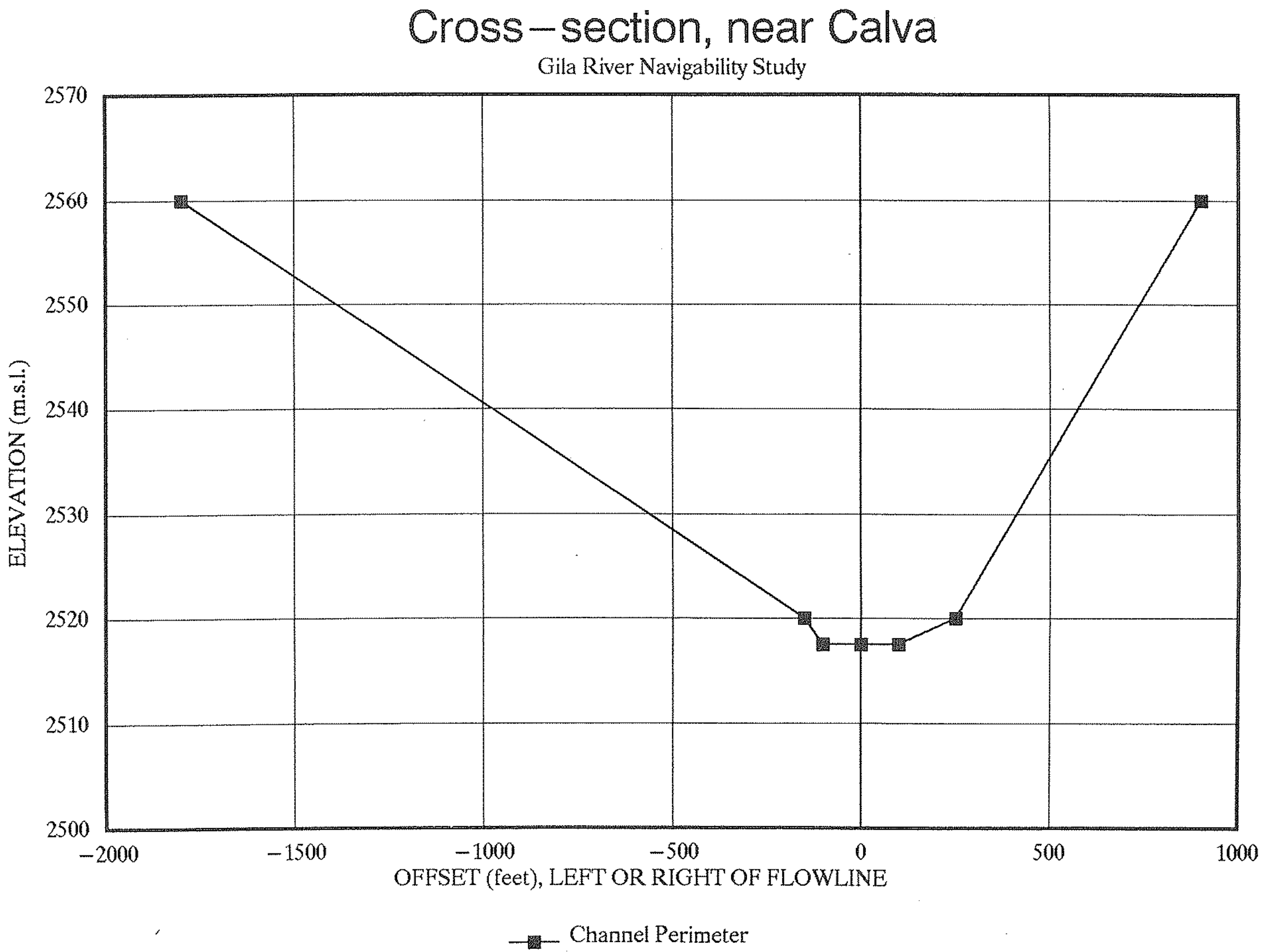
near Calva, rating curve & cross section information

channel slope = 0.003085

roughness, n = 0.035

Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
42.50	2560.00	20.50	62750.0	2701.80	0.0030850	23.225	19.20	1204572
22.00	2539.50	0.50	19482.2	1522.17	0.0030850	12.799	12.90	251381
21.50	2539.00	0.50	18728.8	1493.40	0.0030850	12.541	12.73	238402
21.00	2538.50	0.50	17989.7	1464.63	0.0030850	12.283	12.55	225839
20.50	2538.00	0.50	17265.0	1435.85	0.0030850	12.024	12.38	213689
20.00	2537.50	0.50	16554.7	1407.08	0.0030850	11.765	12.20	201945
19.50	2537.00	0.50	15858.8	1378.31	0.0030850	11.506	12.02	190602
19.00	2536.50	0.50	15177.2	1349.54	0.0030850	11.246	11.84	179655
18.50	2536.00	0.50	14510.0	1320.77	0.0030850	10.986	11.65	169098
18.00	2535.50	0.50	13857.2	1292.00	0.0030850	10.725	11.47	158926
17.50	2535.00	0.50	13218.8	1263.23	0.0030850	10.464	11.28	149133
17.00	2534.50	0.50	12594.7	1234.45	0.0030850	10.203	11.09	139714
16.50	2534.00	0.50	11985.0	1205.68	0.0030850	9.940	10.90	130663
16.00	2533.50	0.50	11389.7	1176.91	0.0030850	9.678	10.71	121974
15.50	2533.00	0.50	10808.8	1148.14	0.0030850	9.414	10.51	113643
15.00	2532.50	0.50	10242.2	1119.37	0.0030850	9.150	10.32	105662
14.50	2532.00	0.50	9690.0	1090.60	0.0030850	8.885	10.12	98026
14.00	2531.50	0.50	9152.2	1061.83	0.0030850	8.619	9.91	90730
13.50	2531.00	0.50	8628.8	1033.05	0.0030850	8.353	9.71	83768
13.00	2530.50	0.50	8119.7	1004.28	0.0030850	8.085	9.50	77133
12.50	2530.00	0.50	7625.0	975.51	0.0030850	7.816	9.29	70820
12.00	2529.50	0.50	7144.7	946.74	0.0030850	7.547	9.07	64823
11.50	2529.00	0.50	6678.8	917.97	0.0030850	7.276	8.85	59136
11.00	2528.50	0.50	6227.2	889.20	0.0030850	7.003	8.63	53753
10.50	2528.00	0.50	5790.0	860.43	0.0030850	6.729	8.41	48667
10.00	2527.50	0.50	5367.2	831.65	0.0030850	6.454	8.17	43873
9.50	2527.00	0.50	4958.8	802.88	0.0030850	6.176	7.94	39364
9.00	2526.50	0.05	4564.7	774.11	0.0030850	5.897	7.70	35134
8.95	2526.45	0.45	4527.6	771.35	0.0030850	5.870	7.67	34742
8.50	2526.00	0.50	4185.0	745.34	0.0030850	5.615	7.45	31177
8.00	2525.50	0.50	3819.7	716.57	0.0030850	5.331	7.20	27486
7.50	2525.00	0.50	3468.8	687.80	0.0030850	5.043	6.94	24056
7.00	2524.50	0.38	3132.2	659.03	0.0030850	4.753	6.67	20880
6.62	2524.12	0.12	2887.9	637.33	0.0030850	4.531	6.46	18649
6.50	2524.00	0.50	2810.0	630.25	0.0030850	4.459	6.39	17951
6.00	2523.50	0.50	2502.2	601.48	0.0030850	4.160	6.10	15263
5.50	2523.00	0.50	2208.8	572.71	0.0030850	3.857	5.80	12809
5.00	2522.50	0.50	1929.7	543.94	0.0030850	3.548	5.49	10585
4.50	2522.00	0.50	1665.0	515.17	0.0030850	3.232	5.15	8583
4.00	2521.50	0.10	1414.7	486.40	0.0030850	2.909	4.80	6798
3.90	2521.40	0.40	1366.3	480.64	0.0030850	2.843	4.73	6466
3.50	2521.00	0.50	1178.8	457.63	0.0030850	2.576	4.43	5223
3.00	2520.50	0.50	957.2	428.85	0.0030850	2.232	4.03	3855
2.50	2520.00	0.50	750.0	400.08	0.0030850	1.875	3.59	2689
2.00	2519.50	0.50	560.0	360.07	0.0030850	1.555	3.17	1773
1.50	2519.00	0.50	390.0	320.05	0.0030850	1.219	2.69	1049
1.00	2518.50	0.50	240.0	280.03	0.0030850	0.857	2.13	511
0.50	2518.00	0.50	110.0	240.02	0.0030850	0.458	1.40	154
0.00	2517.50		0.0	200.00			0.00	0


Rating Curves, near Calva
Gila River Navigability Study
DEPTH (0 = el. 2517.5)
VELOCITY (ft/sec)
0
5
10
15
20
25
0
5
10
15
0
50
100
150
200
250
300
Thousands
FLOW
Depth
Velocity



Cross—section, near Calva
Gila River Navigability Study
ELEVATION (m.s.l.)
2570
2560
2550
2540
2530
2520
2510
2500
−2000
−1500
−1000
−500
0
500
1000
OFFSET (feet), LEFT OR RIGHT OF FLOWLINE
Channel Perimeter

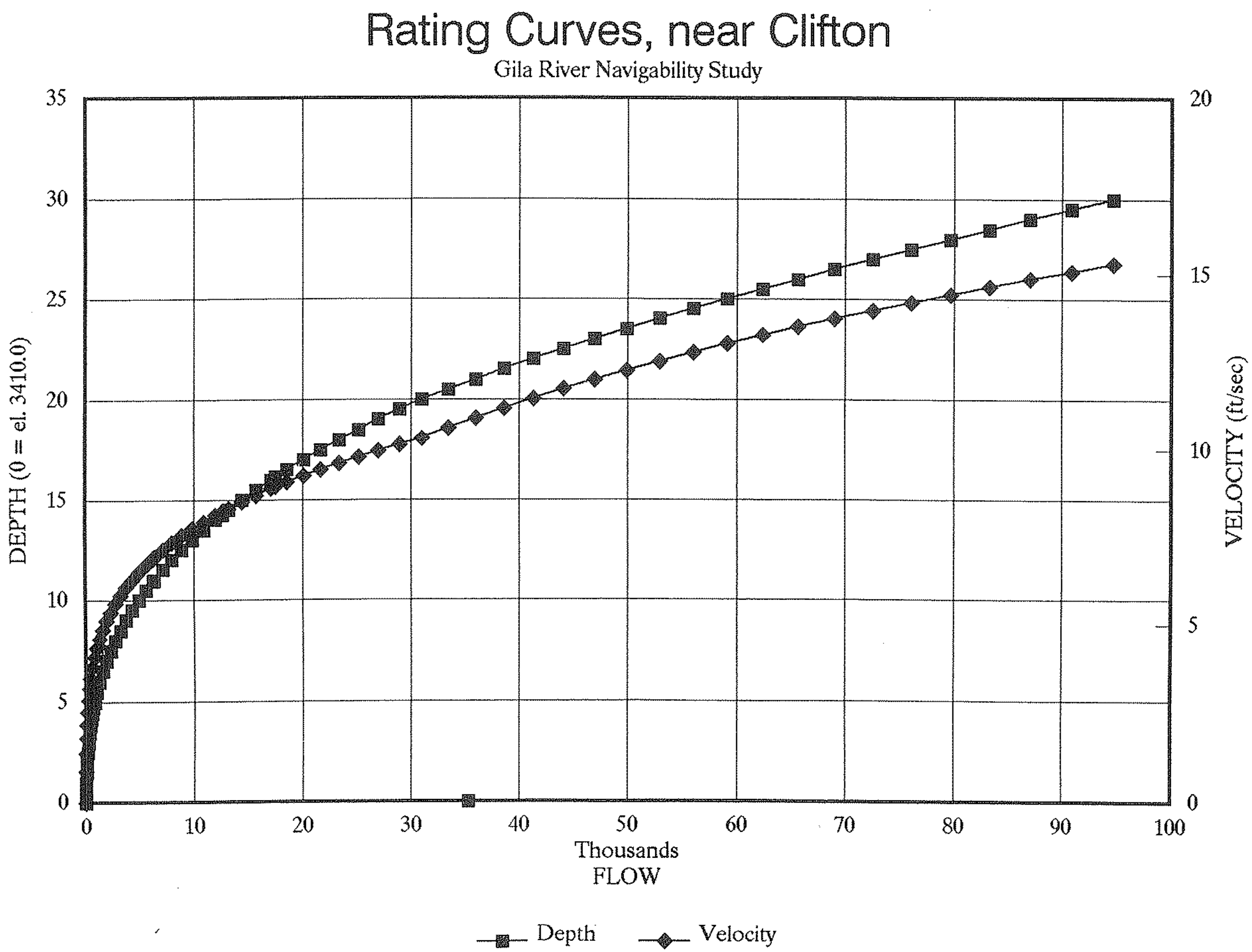
channel slope = 0.002778
roughness, n = 0.035

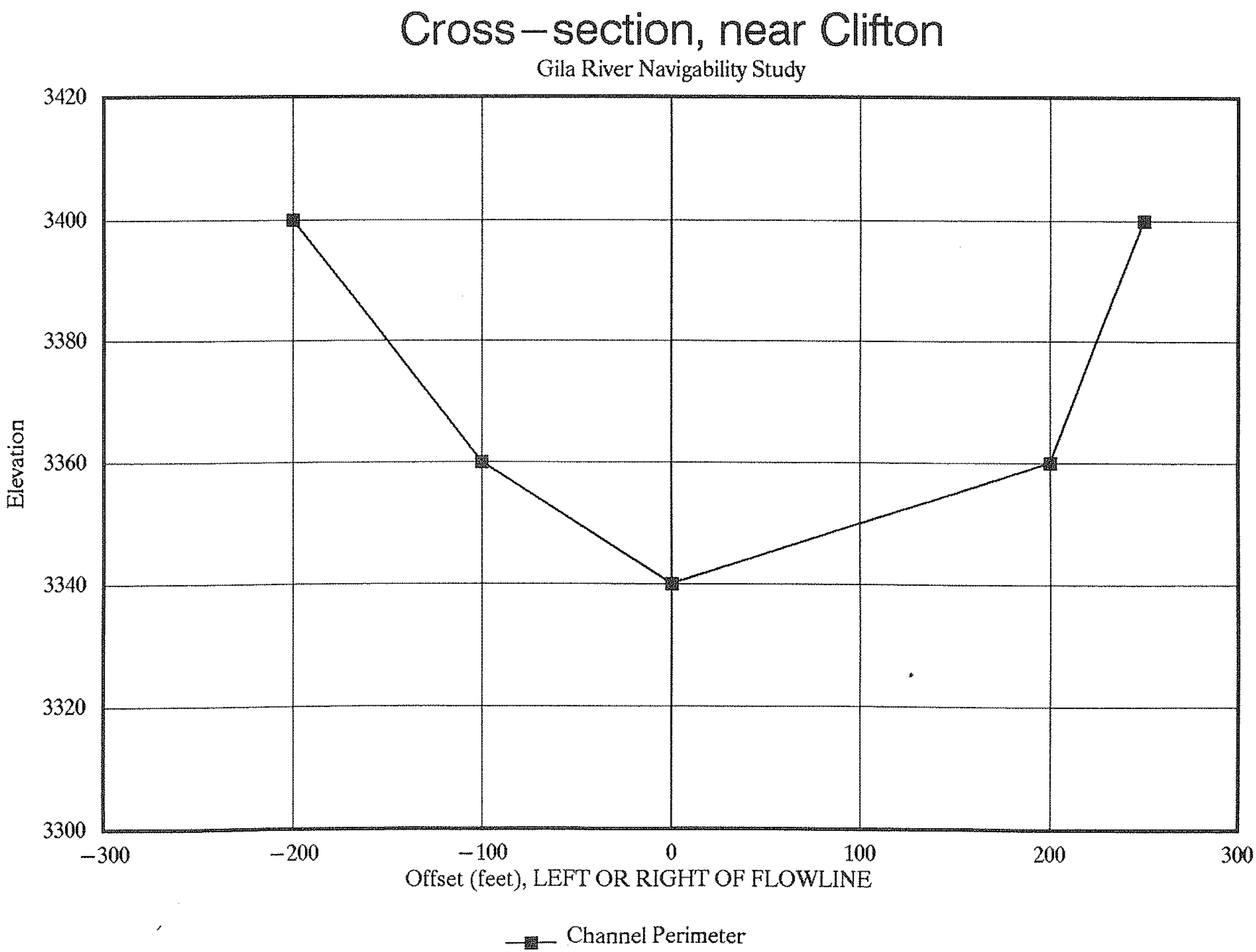
Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
60.00	3400.00	30.00	18000.0	474.71	0.0027780	37.918	25.26	454622
30.00	3370.00	0.50	6187.5	345.91	0.0027780	17.888	15.31	94703
29.50	3369.50	0.50	6019.2	343.76	0.0027780	17.510	15.09	90826
29.00	3369.00	0.50	5851.9	341.62	0.0027780	17.130	14.87	87019
28.50	3368.50	0.50	5685.5	339.47	0.0027780	16.748	14.65	83283
28.00	3368.00	0.50	5520.0	337.32	0.0027780	16.364	14.42	79619
27.50	3367.50	0.50	5355.5	335.18	0.0027780	15.978	14.20	76026
27.00	3367.00	0.50	5191.9	333.03	0.0027780	15.590	13.97	72505
26.50	3366.50	0.50	5029.2	330.88	0.0027780	15.199	13.73	69056
26.00	3366.00	0.50	4867.5	328.74	0.0027780	14.807	13.49	65679
25.50	3365.50	0.50	4706.7	326.59	0.0027780	14.412	13.25	62375
25.00	3365.00	0.50	4546.9	324.44	0.0027780	14.014	13.01	59144
24.50	3364.50	0.50	4388.0	322.30	0.0027780	13.615	12.76	55987
24.00	3364.00	0.50	4230.0	320.15	0.0027780	13.213	12.51	52903
23.50	3363.50	0.50	4073.0	318.00	0.0027780	12.808	12.25	49894
23.00	3363.00	0.50	3916.9	315.86	0.0027780	12.401	11.99	46959
22.50	3362.50	0.50	3761.7	313.71	0.0027780	11.991	11.72	44100
22.00	3362.00	0.50	3607.5	311.56	0.0027780	11.579	11.45	41317
21.50	3361.50	0.50	3454.2	309.42	0.0027780	11.164	11.18	38610
21.00	3361.00	0.50	3301.9	307.27	0.0027780	10.746	10.90	35981
20.50	3360.50	0.50	3150.5	305.12	0.0027780	10.325	10.61	33429
20.00	3360.00	0.50	3000.0	302.98	0.0027780	9.902	10.32	30956
19.50	3359.50	0.50	2851.9	295.40	0.0027780	9.654	10.15	28935
19.00	3359.00	0.50	2707.5	287.83	0.0027780	9.407	9.97	26999
18.50	3358.50	0.50	2566.9	280.25	0.0027780	9.159	9.80	25145
18.00	3358.00	0.50	2430.0	272.68	0.0027780	8.912	9.62	23374
17.50	3357.50	0.50	2296.9	265.11	0.0027780	8.664	9.44	21682
17.00	3357.00	0.50	2167.5	257.53	0.0027780	8.416	9.26	20069
16.50	3356.50	0.35	2041.9	249.96	0.0027780	8.169	9.08	18533
16.15	3356.15	0.15	1955.2	244.59	0.0027780	7.994	8.95	17492
16.00	3356.00	0.50	1920.0	242.38	0.0027780	7.921	8.89	17073
15.50	3355.50	0.50	1801.9	234.81	0.0027780	7.674	8.71	15687
15.00	3355.00	0.50	1687.5	227.23	0.0027780	7.426	8.52	14374
14.50	3354.50	0.25	1576.9	219.66	0.0027780	7.179	8.33	13131
14.25	3354.25	0.25	1523.6	215.92	0.0027780	7.056	8.23	12543
14.00	3354.00	0.50	1470.0	212.08	0.0027780	6.931	8.13	11958
13.50	3353.50	0.50	1366.9	204.51	0.0027780	6.684	7.94	10853
13.00	3353.00	0.50	1267.5	196.94	0.0027780	6.436	7.74	9814
12.50	3352.50	0.50	1171.9	189.36	0.0027780	6.189	7.54	8839
12.00	3352.00	0.50	1080.0	181.79	0.0027780	5.941	7.34	7928
11.50	3351.50	0.50	991.9	174.21	0.0027780	5.693	7.14	7077
11.00	3351.00	0.08	907.5	166.64	0.0027780	5.446	6.93	6286
10.92	3350.92	0.42	895.0	165.49	0.0027780	5.408	6.89	6171
10.50	3350.50	0.50	826.9	159.06	0.0027780	5.198	6.72	5553
10.00	3350.00	0.50	750.0	151.49	0.0027780	4.951	6.50	4875
9.50	3349.50	0.50	676.9	143.91	0.0027780	4.703	6.28	4252
9.00	3349.00	0.50	607.5	136.34	0.0027780	4.456	6.06	3681
8.50	3348.50	0.50	541.9	128.77	0.0027780	4.208	5.83	3161
8.00	3348.00	0.50	480.0	121.19	0.0027780	3.961	5.60	2689
7.50	3347.50	0.50	421.9	113.62	0.0027780	3.713	5.37	2264

Gila River Navigability Study 08/29/96
near Clifton (Guthrie), rating curve & cross section information (continued) Page 2

channel slope = 0.002778
roughness, n = 0.035

Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
7.00	3347.00	0.50	367.5	106.04	0.0027780	3.466	5.12	1883
6.50	3346.50	0.50	316.9	98.47	0.0027780	3.218	4.88	1546
6.00	3346.00	0.50	270.0	90.89	0.0027780	2.971	4.62	1249
5.50	3345.50	0.50	226.9	83.32	0.0027780	2.723	4.36	990
5.00	3345.00	0.50	187.5	75.74	0.0027780	2.475	4.09	768
4.50	3344.50	0.50	151.9	68.17	0.0027780	2.228	3.82	580
4.00	3344.00	0.50	120.0	60.60	0.0027780	1.980	3.53	423
3.50	3343.50	0.50	91.9	53.02	0.0027780	1.733	3.23	297
3.00	3343.00	0.50	67.5	45.45	0.0027780	1.485	2.91	197
2.50	3342.50	0.50	46.9	37.87	0.0027780	1.238	2.58	121
2.00	3342.00	0.50	30.0	30.30	0.0027780	0.990	2.22	67
1.50	3341.50	0.50	16.9	22.72	0.0027780	0.743	1.84	31
1.00	3341.00	0.50	7.5	15.15	0.0027780	0.495	1.40	11
0.50	3340.50	0.50	1.9	7.57	0.0027780	0.248	0.88	2
0.00	3340.00			0.0			0.00	0


Rating Curves, near Clifton
Gila River Navigability Study
DEPTH (0 = el. 3410.0)
VELOCITY (ft/sec)
Thousands
FLOW
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
100
15
10
5
Depth
Velocity


Cross – section, near Clifton
Gila River Navigability Study
3420
3400
3380
3360
3340
3320
3300
Elevation
–300
–200
–100
0
100
200
300
Offset (feet), LEFT OR RIGHT OF FLOWLINE
Channel Perimeter

channel slope = 0.002941
roughness, n = 0.035

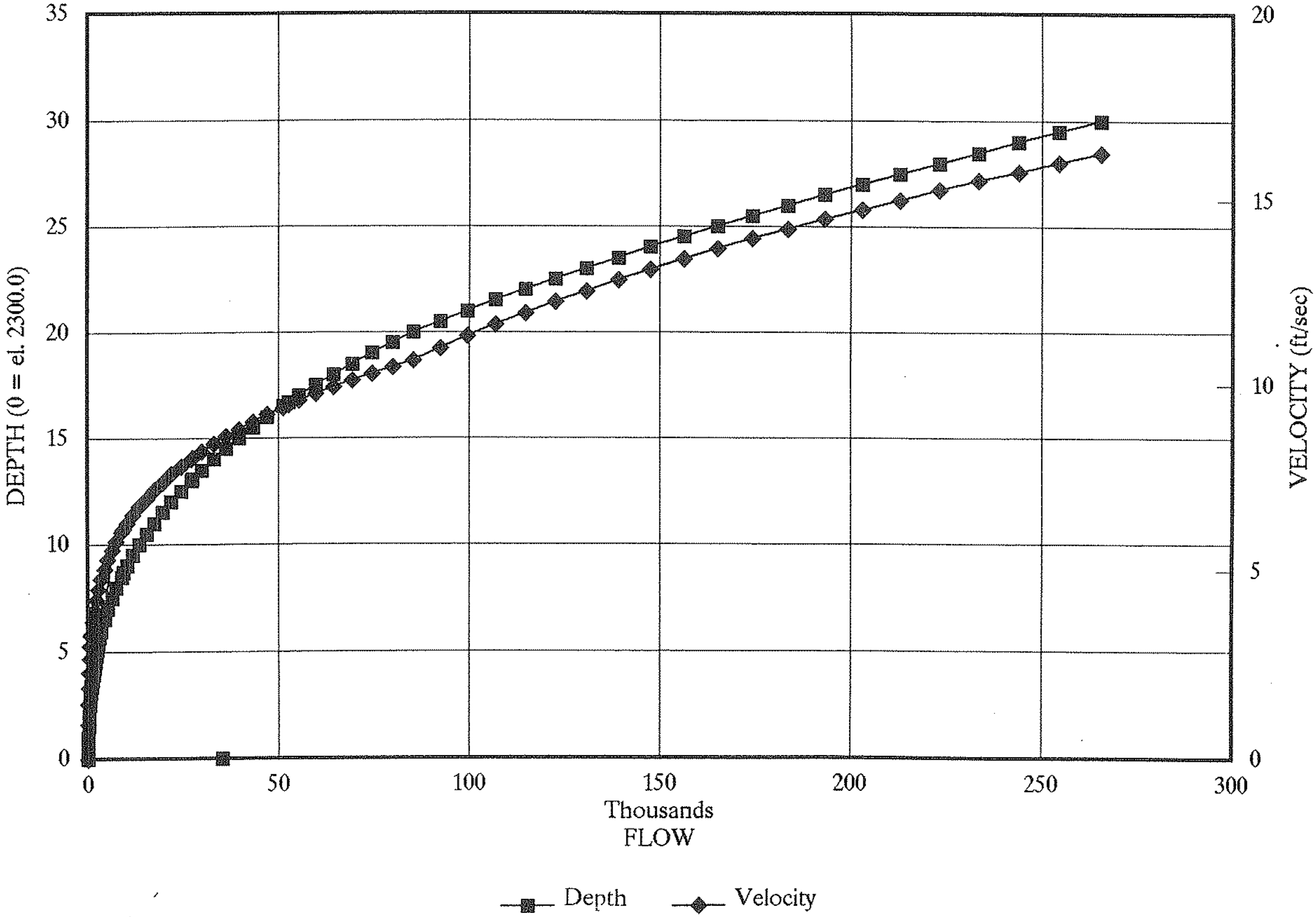
Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope S (ft/ft)	Hydr. Radius A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
100.00	2400.0	40.0	92000.0	1337.31	0.0029410	68.795	38.66	3556495
60.00	2360.0	30.0	45000.0	1069.32	0.0029410	42.083	27.86	1253564
30.00	2330.0	0.5	16312.5	868.33	0.0029410	18.786	16.27	265426
29.50	2329.5	0.5	15882.0	864.98	0.0029410	18.361	16.03	254510
29.00	2329.0	0.5	15453.1	861.63	0.0029410	17.935	15.78	243788
28.50	2328.5	0.5	15025.8	858.28	0.0029410	17.507	15.52	233260
28.00	2328.0	0.5	14600.0	854.93	0.0029410	17.077	15.27	222929
27.50	2327.5	0.5	14175.8	851.58	0.0029410	16.646	15.01	212794
27.00	2327.0	0.5	13753.1	848.23	0.0029410	16.214	14.75	202858
26.50	2326.5	0.5	13332.0	844.88	0.0029410	15.780	14.49	193121
26.00	2326.0	0.5	12912.5	841.53	0.0029410	15.344	14.22	183584
25.50	2325.5	0.5	12494.5	838.18	0.0029410	14.907	13.95	174250
25.00	2325.0	0.5	12078.1	834.83	0.0029410	14.468	13.67	165120
24.50	2324.5	0.5	11663.3	831.48	0.0029410	14.027	13.39	156194
24.00	2324.0	0.5	11250.0	828.13	0.0029410	13.585	13.11	147476
23.50	2323.5	0.5	10838.3	824.78	0.0029410	13.141	12.82	138965
23.00	2323.0	0.5	10428.1	821.43	0.0029410	12.695	12.53	130666
22.50	2322.5	0.5	10019.5	818.08	0.0029410	12.248	12.23	122578
22.00	2322.0	0.5	9612.5	814.73	0.0029410	11.798	11.93	114705
21.50	2321.5	0.5	9207.0	811.38	0.0029410	11.347	11.63	107049
21.00	2321.0	0.5	8803.1	808.03	0.0029410	10.895	11.32	99611
20.50	2320.5	0.5	8400.8	804.68	0.0029410	10.440	11.00	92395
20.00	2320.0	0.5	8000.0	801.33	0.0029410	9.983	10.68	85403
19.50	2319.5	0.5	7605.0	781.30	0.0029410	9.734	10.50	79828
19.00	2319.0	0.5	7220.0	761.26	0.0029410	9.484	10.32	74485
18.50	2318.5	0.5	6845.0	741.23	0.0029410	9.235	10.13	69372
18.00	2318.0	0.5	6480.0	721.20	0.0029410	8.985	9.95	64484
17.50	2317.5	0.5	6125.0	701.16	0.0029410	8.735	9.77	59818
17.00	2317.0	0.3	5780.0	681.13	0.0029410	8.486	9.58	55368
16.68	2316.7	0.2	5567.1	668.47	0.0029410	8.328	9.46	52666
16.50	2316.5	0.5	5445.0	661.10	0.0029410	8.236	9.39	51131
16.00	2316.0	0.5	5120.0	641.06	0.0029410	7.987	9.20	47103
15.50	2315.5	0.5	4805.0	621.03	0.0029410	7.737	9.01	43279
15.00	2315.0	0.5	4500.0	601.00	0.0029410	7.488	8.81	39656
14.50	2314.5	0.5	4205.0	580.96	0.0029410	7.238	8.62	36228
14.00	2314.0	0.5	3920.0	560.93	0.0029410	6.988	8.42	32991
13.50	2313.5	0.4	3645.0	540.90	0.0029410	6.739	8.21	29942
13.07	2313.1	0.1	3414.4	523.51	0.0029410	6.522	8.04	27444
13.00	2313.0	0.5	3380.0	520.86	0.0029410	6.489	8.01	27075
12.50	2312.5	0.5	3125.0	500.83	0.0029410	6.240	7.80	24387
12.00	2312.0	0.5	2880.0	480.80	0.0029410	5.990	7.59	21871
11.50	2311.5	0.5	2645.0	460.77	0.0029410	5.740	7.38	19525
11.00	2311.0	0.5	2420.0	440.73	0.0029410	5.491	7.17	17342
10.50	2310.5	0.5	2205.0	420.70	0.0029410	5.241	6.95	15319
10.00	2310.0	0.5	2000.0	400.67	0.0029410	4.992	6.73	13450
9.50	2309.5	0.5	1805.0	380.63	0.0029410	4.742	6.50	11731
9.00	2309.0	0.3	1620.0	360.60	0.0029410	4.493	6.27	10156
8.71	2308.7	0.2	1516.9	348.94	0.0029410	4.347	6.13	9303
8.50	2308.5	0.5	1445.0	340.57	0.0029410	4.243	6.03	8720
8.00	2308.0	0.5	1280.0	320.53	0.0029410	3.993	5.80	7418

channel slope = 0.002941
roughness, n = 0.035

Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope S (ft/ft)	Hydr. Radius A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
7.50	2307.5	0.5	1125.0	300.50	0.0029410	3.744	5.55	6245
7.00	2307.0	0.5	980.0	280.47	0.0029410	3.494	5.30	5196
6.50	2306.5	0.5	845.0	260.43	0.0029410	3.245	5.05	4264
6.00	2306.0	0.5	720.0	240.40	0.0029410	2.995	4.78	3445
5.50	2305.5	0.5	605.0	220.37	0.0029410	2.745	4.51	2731
5.00	2305.0	0.0	500.0	200.33	0.0029410	2.496	4.24	2118
4.99	2305.0	0.5	498.8	200.09	0.0029410	2.493	4.23	2111
4.50	2304.5	0.0	405.0	180.30	0.0029410	2.246	3.95	1599
4.47	2304.5	0.5	399.6	179.10	0.0029410	2.231	3.93	1571
4.00	2304.0	0.5	320.0	160.27	0.0029410	1.997	3.65	1168
3.50	2303.5	0.1	245.0	140.23	0.0029410	1.747	3.34	818
3.41	2303.4	0.4	232.4	136.59	0.0029410	1.702	3.28	763
3.00	2303.0	0.5	180.0	120.20	0.0029410	1.498	3.01	542
2.50	2302.5	0.5	125.0	100.17	0.0029410	1.248	2.67	334
2.00	2302.0	0.5	80.0	80.13	0.0029410	0.998	2.30	184
1.50	2301.5	0.5	45.0	60.10	0.0029410	0.749	1.90	85
1.00	2301.0	0.5	20.0	40.07	0.0029410	0.499	1.45	29
0.50	2300.5	0.5	5.0	20.03	0.0029410	0.250	0.91	5
0.00	2300.0			0.00			0.00	0

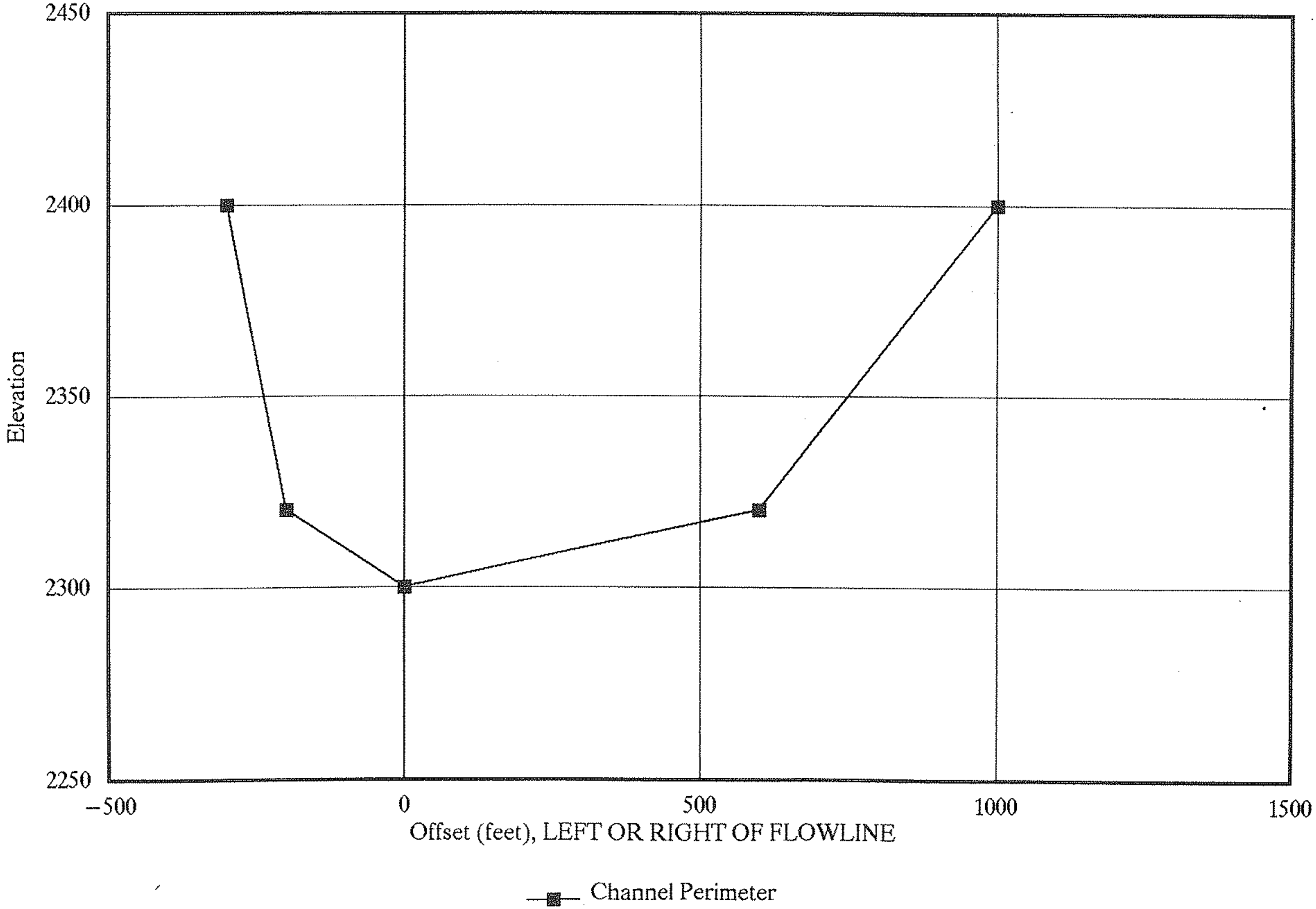
Rating Curves, below Coolidge Dam

Gila River Navigability Study



Cross—section, below Coolidge Dam

Gila River Navigability Study



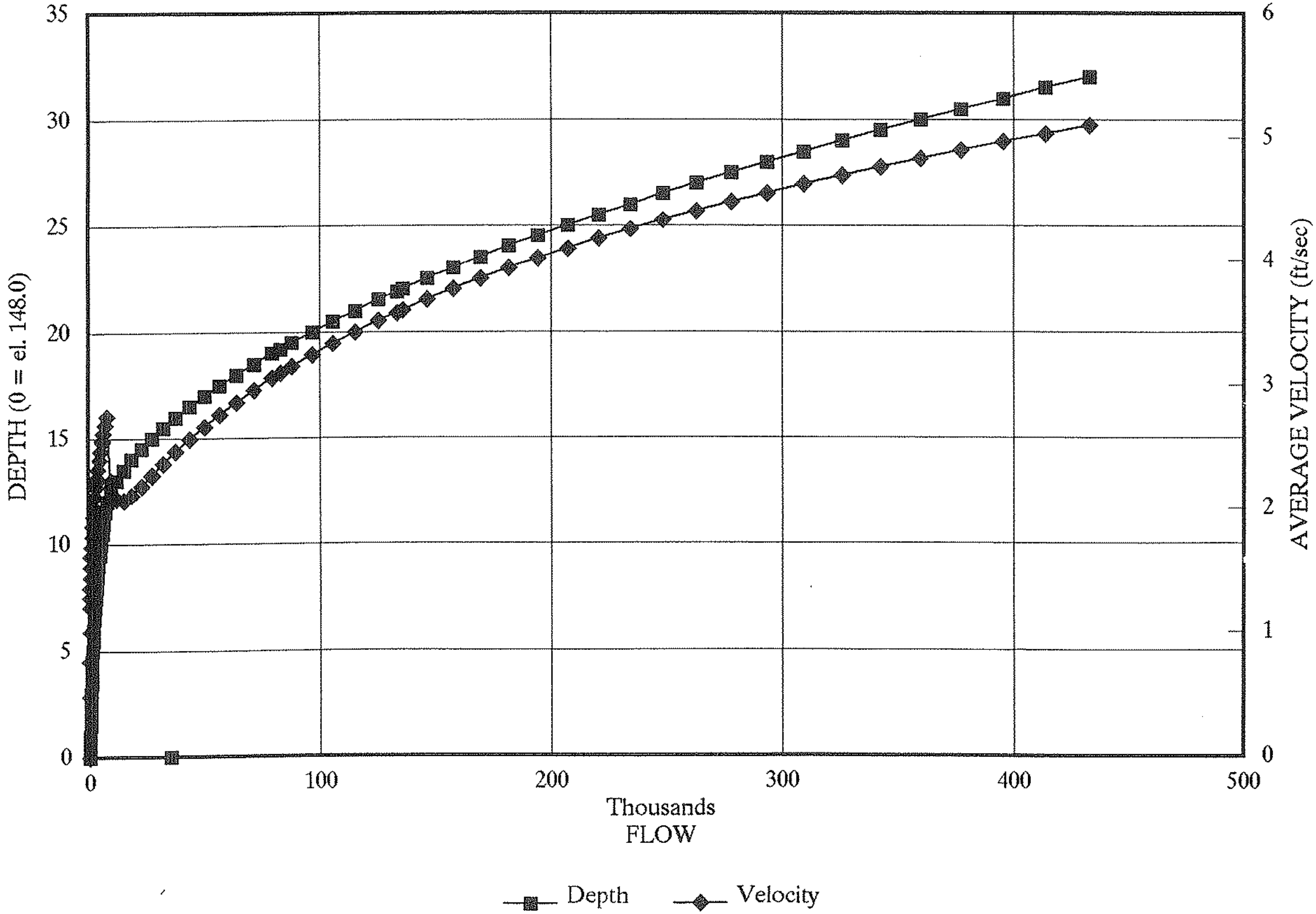
			roughness, n =		0.035			
			channel slope =		0.0003448			
Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope S (ft/ft)	Hydr. Radius A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
32.00	180.00	0.50	84942.0	5351.87	0.0003448	16.442	5.10	433008
31.50	179.50	0.50	82282.6	5289.36	0.0003448	16.124	5.03	414029
31.00	179.00	0.50	79654.5	5226.85	0.0003448	15.805	4.97	395497
30.50	178.50	0.50	77057.6	5164.34	0.0003448	15.485	4.90	377411
30.00	178.00	0.50	74492.0	5101.83	0.0003448	15.162	4.83	359768
29.50	177.50	0.50	71957.6	5039.32	0.0003448	14.839	4.76	342565
29.00	177.00	0.50	69454.5	4976.82	0.0003448	14.514	4.69	325799
28.50	176.50	0.50	66982.6	4914.31	0.0003448	14.187	4.62	309469
28.00	176.00	0.50	64542.0	4851.80	0.0003448	13.858	4.55	293573
27.50	175.50	0.50	62132.6	4789.29	0.0003448	13.528	4.48	278107
27.00	175.00	0.50	59754.5	4726.78	0.0003448	13.196	4.40	263070
26.50	174.50	0.50	57407.6	4664.27	0.0003448	12.863	4.33	248460
26.00	174.00	0.50	55092.0	4601.76	0.0003448	12.527	4.25	234274
25.50	173.50	0.50	52807.6	4539.26	0.0003448	12.190	4.18	220512
25.00	173.00	0.50	50554.5	4476.75	0.0003448	11.851	4.10	207169
24.50	172.50	0.50	48332.6	4414.24	0.0003448	11.510	4.02	194246
24.00	172.00	0.50	46142.0	4351.73	0.0003448	11.167	3.94	181740
23.50	171.50	0.50	43982.6	4289.22	0.0003448	10.822	3.86	169650
23.00	171.00	0.50	41854.5	4226.71	0.0003448	10.475	3.77	157974
22.50	170.50	0.50	39757.6	4164.21	0.0003448	10.127	3.69	146711
22.00	170.00	0.11	37692.0	4101.70	0.0003448	9.776	3.60	135860
21.89	169.89	0.39	37225.4	4087.44	0.0003448	9.696	3.58	133444
21.50	169.50	0.50	35657.6	4039.19	0.0003448	9.424	3.52	125420
21.00	169.00	0.50	33654.5	3976.68	0.0003448	9.070	3.43	115390
20.50	168.50	0.50	31682.6	3914.17	0.0003448	8.714	3.34	105771
20.00	168.00	0.50	29742.0	3851.66	0.0003448	8.357	3.25	96561
19.50	167.50	0.29	27832.6	3789.15	0.0003448	7.999	3.15	87761
19.21	167.21	0.21	26732.0	3752.65	0.0003448	7.789	3.10	82811
19.00	167.00	0.50	25954.5	3726.65	0.0003448	7.640	3.06	79372
18.50	166.50	0.50	24107.6	3664.14	0.0003448	7.280	2.96	71394
18.00	166.00	0.50	22292.0	3601.63	0.0003448	6.922	2.86	63830
17.50	165.50	0.50	20507.6	3539.12	0.0003448	6.564	2.76	56682
17.00	165.00	0.50	18754.5	3476.61	0.0003448	6.210	2.66	49954
16.50	164.50	0.50	17032.6	3414.10	0.0003448	5.860	2.56	43649
16.00	164.00	0.50	15342.0	3351.59	0.0003448	5.519	2.46	37772
15.50	163.50	0.49	13682.6	3289.09	0.0003448	5.189	2.36	32333
15.01	163.01	0.01	12073.9	3227.33	0.0003448	4.883	2.27	27396
15.00	163.00	0.50	12054.5	3226.58	0.0003448	4.879	2.27	27339
14.50	162.50	0.50	10457.6	3164.07	0.0003448	4.600	2.18	22804
14.00	162.00	0.50	8892.0	3101.56	0.0003448	4.373	2.11	18745
13.50	161.50	0.50	7357.6	3039.05	0.0003448	4.237	2.06	15187
13.00	161.00	0.50	5854.5	2976.54	0.0003448	4.280	2.08	12167
12.50	160.50	0.50	4382.6	2914.04	0.0003448	4.738	2.22	9747
12.00	160.00	0.50	2942.0	2851.53	0.0003448	6.516	2.75	8091
11.50	159.50	0.50	2721.4	434.00	0.0003448	6.270	2.68	7296
11.00	159.00	0.38	2509.5	416.47	0.0003448	6.026	2.61	6551
10.62	158.62	0.12	2352.7	403.01	0.0003448	5.838	2.56	6014
10.50	158.50	0.50	2306.4	398.94	0.0003448	5.781	2.54	5857
10.00	158.00	0.50	2112.0	381.41	0.0003448	5.537	2.47	5211

roughness, n = 0.035
channel slope = 0.0003448

Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope S (ft/ft)	Hydr. Radius A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
9.50	157.50	0.50	1926.4	363.88	0.0003448	5.294	2.39	4613
9.00	157.00	0.50	1749.5	346.35	0.0003448	5.051	2.32	4060
8.50	156.50	0.23	1581.4	328.82	0.0003448	4.809	2.25	3552
8.27	156.27	0.27	1506.0	320.65	0.0003448	4.697	2.21	3330
8.00	156.00	0.50	1422.0	311.29	0.0003448	4.568	2.17	3086
7.50	155.50	0.50	1271.4	293.76	0.0003448	4.328	2.09	2662
7.00	155.00	0.50	1129.5	276.24	0.0003448	4.089	2.02	2277
6.50	154.50	0.50	996.4	258.71	0.0003448	3.851	1.94	1930
6.00	154.00	0.50	872.0	241.18	0.0003448	3.616	1.86	1619
5.50	153.50	0.50	756.4	223.65	0.0003448	3.382	1.78	1344
5.00	153.00	0.49	649.5	206.12	0.0003448	3.151	1.69	1101
4.51	152.51	0.01	553.6	189.01	0.0003448	2.929	1.61	894
4.50	152.50	0.50	551.4	188.59	0.0003448	2.924	1.61	889
4.00	152.00	0.50	462.0	171.06	0.0003448	2.701	1.53	706
3.50	151.50	0.50	381.4	153.53	0.0003448	2.484	1.45	551
3.00	151.00	0.50	309.5	136.00	0.0003448	2.276	1.36	422
2.50	150.50	0.50	246.4	118.47	0.0003448	2.080	1.28	316
2.00	150.00	0.50	192.0	100.94	0.0003448	1.902	1.21	232
1.50	149.50	0.50	142.5	98.71	0.0003448	1.444	1.01	144
1.00	149.00	0.50	94.0	96.47	0.0003448	0.974	0.77	73
0.50	148.50	0.50	46.5	94.24	0.0003448	0.493	0.49	23
0.00	148.00						0.00	0

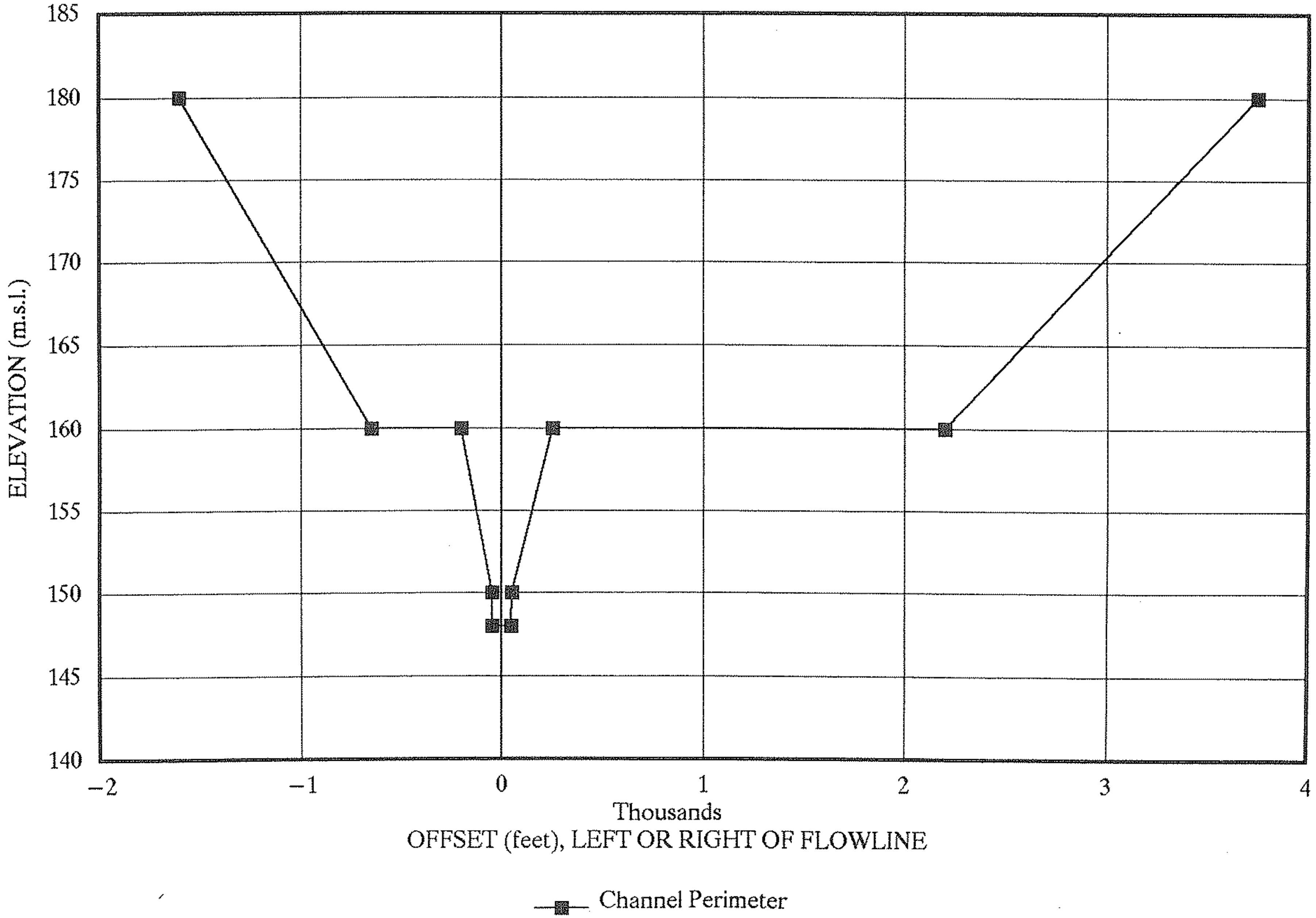
Rating Curves, near Dome

Gila River Navigability Study



Cross—section, near Dome

Gila River Navigability Study

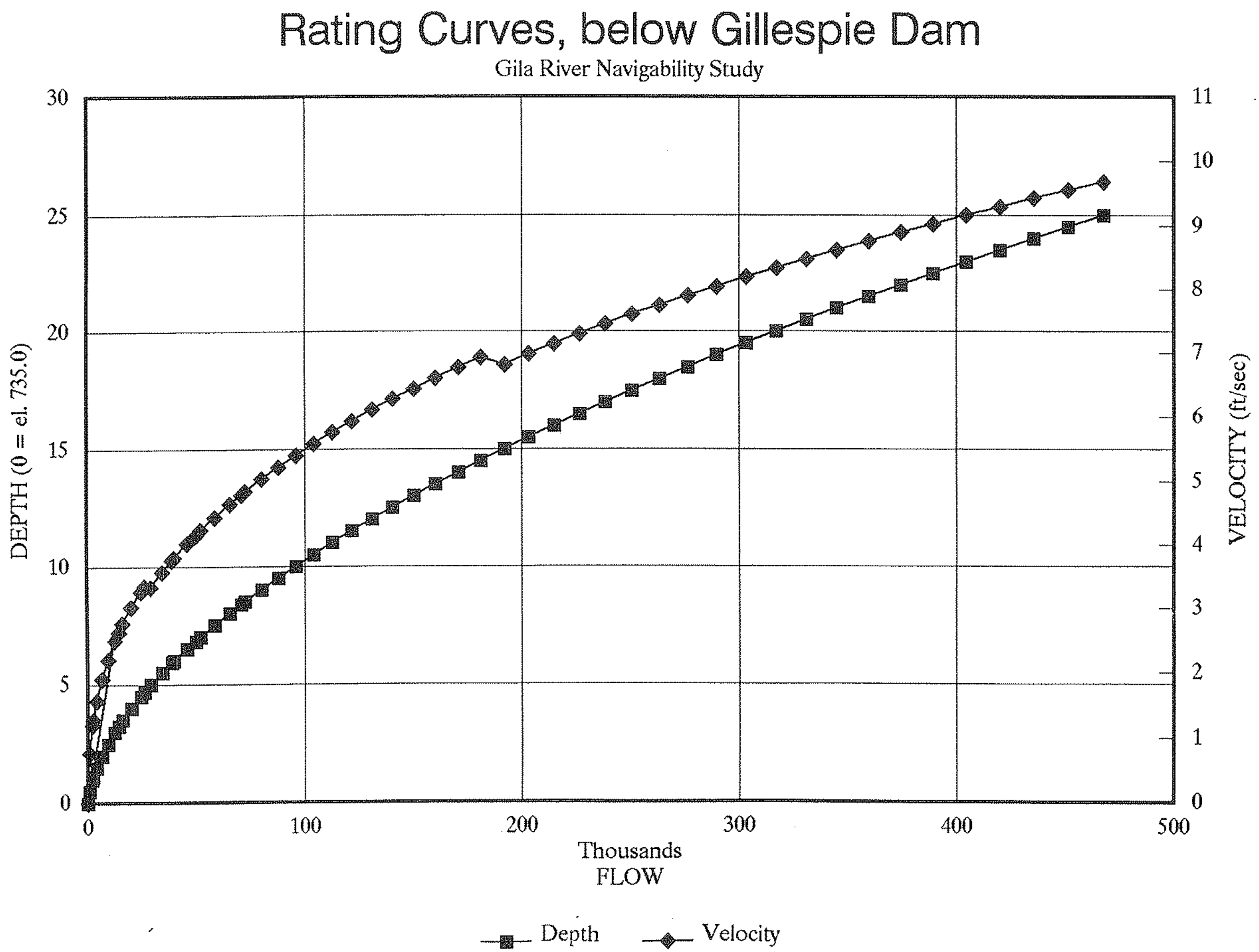


roughness, n = 0.035
channel slope = 0.0008197

Depth of Flow (ft)	Elev Y	Delta Elev (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope S (ft/ft)	Hydr. Rad. R=A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
65.00	800.00	40.00	133625.0	2395.49	0.0008197	55.782	17.75	2408513
25.00	760.00	0.50	47325.0	2103.40	0.0008197	22.499	9.69	467582
24.50	759.50	0.50	46293.2	2099.54	0.0008197	22.049	9.56	451462
24.00	759.00	0.50	45262.6	2095.68	0.0008197	21.598	9.43	435575
23.50	758.50	0.50	44233.4	2091.81	0.0008197	21.146	9.30	419924
23.00	758.00	0.50	43205.5	2087.95	0.0008197	20.693	9.16	404509
22.50	757.50	0.50	42178.9	2084.09	0.0008197	20.239	9.03	389333
22.00	757.00	0.50	41153.6	2080.23	0.0008197	19.783	8.89	374398
21.50	756.50	0.50	40129.7	2076.37	0.0008197	19.327	8.75	359706
21.00	756.00	0.50	39107.0	2072.50	0.0008197	18.869	8.62	345259
20.50	755.50	0.50	38085.7	2068.64	0.0008197	18.411	8.48	331060
20.00	755.00	0.50	37065.6	2064.78	0.0008197	17.951	8.33	317111
19.50	754.50	0.50	36046.9	2060.92	0.0008197	17.491	8.19	303415
19.00	754.00	0.50	35029.5	2057.06	0.0008197	17.029	8.05	289975
18.50	753.50	0.50	34013.4	2053.19	0.0008197	16.566	7.90	276793
18.00	753.00	0.50	32998.6	2049.33	0.0008197	16.102	7.75	263873
17.50	752.50	0.50	31985.2	2045.47	0.0008197	15.637	7.60	251219
17.00	752.00	0.50	30973.0	2041.61	0.0008197	15.171	7.45	238834
16.50	751.50	0.50	29962.2	2037.75	0.0008197	14.704	7.30	226724
16.00	751.00	0.50	28952.6	2033.88	0.0008197	14.235	7.14	214893
15.50	750.50	0.50	27944.4	2030.02	0.0008197	13.766	6.98	203351
15.00	750.00	0.50	26937.5	2026.16	0.0008197	13.295	6.82	192110
14.50	749.50	0.50	25988.4	1909.26	0.0008197	13.612	6.93	181289
14.00	749.00	0.50	25041.3	1904.87	0.0008197	13.146	6.77	170724
13.50	748.50	0.50	24095.9	1900.47	0.0008197	12.679	6.61	160419
13.00	748.00	0.50	23152.5	1896.08	0.0008197	12.211	6.45	150378
12.50	747.50	0.50	22210.9	1891.68	0.0008197	11.741	6.28	140603
12.00	747.00	0.50	21271.3	1887.29	0.0008197	11.271	6.11	131097
11.50	746.50	0.50	20333.4	1882.89	0.0008197	10.799	5.94	121865
11.00	746.00	0.50	19397.5	1878.49	0.0008197	10.326	5.76	112911
10.50	745.50	0.50	18463.4	1874.10	0.0008197	9.852	5.59	104238
10.00	745.00	0.50	17531.3	1869.70	0.0008197	9.376	5.41	95852
9.50	744.50	0.50	16600.9	1865.31	0.0008197	8.900	5.22	87756
9.00	744.00	0.50	15672.5	1860.91	0.0008197	8.422	5.03	79957
8.50	743.50	0.13	14745.9	1856.52	0.0008197	7.943	4.84	72460
8.37	743.37	0.37	14497.9	1855.34	0.0008197	7.814	4.79	70503
8.00	743.00	0.50	13821.3	1852.12	0.0008197	7.462	4.64	65271
7.50	742.50	0.50	12898.4	1847.72	0.0008197	6.981	4.44	58398
7.00	742.00	0.17	11977.5	1843.33	0.0008197	6.498	4.23	51848
6.83	741.83	0.33	11655.6	1841.79	0.0008197	6.328	4.16	49633
6.50	741.50	0.50	11058.4	1838.93	0.0008197	6.014	4.02	45630
6.00	741.00	0.08	10141.3	1834.54	0.0008197	5.528	3.80	39756
5.92	740.92	0.42	9996.5	1833.84	0.0008197	5.451	3.77	38860
5.50	740.50	0.50	9225.9	1830.14	0.0008197	5.041	3.57	34238
5.00	740.00	0.31	8312.5	1825.74	0.0008197	4.553	3.34	29101
4.69	739.69	0.19	7787.9	1696.06	0.0008197	4.592	3.36	26153
4.50	739.50	0.50	7464.4	1693.17	0.0008197	4.409	3.27	24395
4.00	739.00	0.50	6620.0	1685.60	0.0008197	3.927	3.03	20031
3.50	738.50	0.25	5779.4	1678.02	0.0008197	3.444	2.77	16022
3.25	738.25	0.25	5367.2	1674.29	0.0008197	3.206	2.64	14184

roughness, n = 0.035
channel slope = 0.0008197

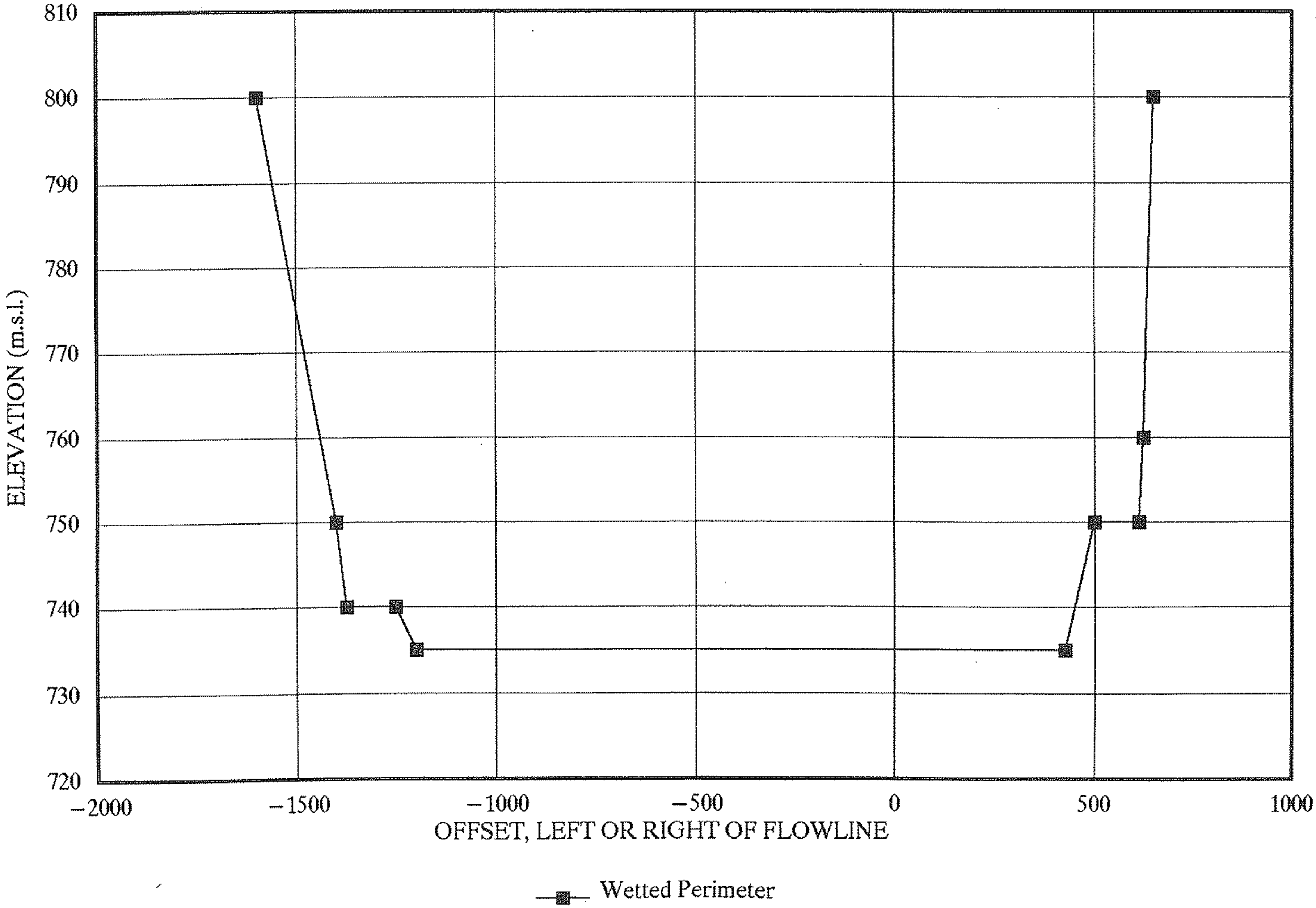
Depth of Flow (ft)	Elev Y	Delta Elev (ft)	Area A (sq ft)	Wetted Perim. P (ft)	Channel Slope S (ft/ft)	Hydr. Rad. R=A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
3.00	738.00	0.50	4942.5	1670.45	0.0008197	2.959	2.51	12382
2.50	737.50	0.50	4109.4	1662.87	0.0008197	2.471	2.22	9131
2.00	737.00	0.50	3280.0	1655.30	0.0008197	1.982	1.92	6290
1.50	736.50	0.39	2454.4	1647.72	0.0008197	1.490	1.59	3891
1.11	736.11	0.11	1808.1	1641.77	0.0008197	1.101	1.30	2344
1.00	736.00	0.50	1632.5	1640.15	0.0008197	0.995	1.21	1978
0.50	735.50	0.50	814.4	1632.57	0.0008197	0.499	0.76	623
0.00	735.00		0.0	1625.00	0.0008197	0.000	0.00	0



Rating Curves, below Gillespie Dam
Gila River Navigability Study
DEPTH (0 = el. 735.0)
VELOCITY (ft/sec)
0
5
10
15
20
25
30
0
1
2
3
4
5
6
7
8
9
10
11
0
100
200
300
400
500
Thousands
FLOW
Depth
Velocity

Cross Section, below Gillespie Dam

Gila River Navigability Study

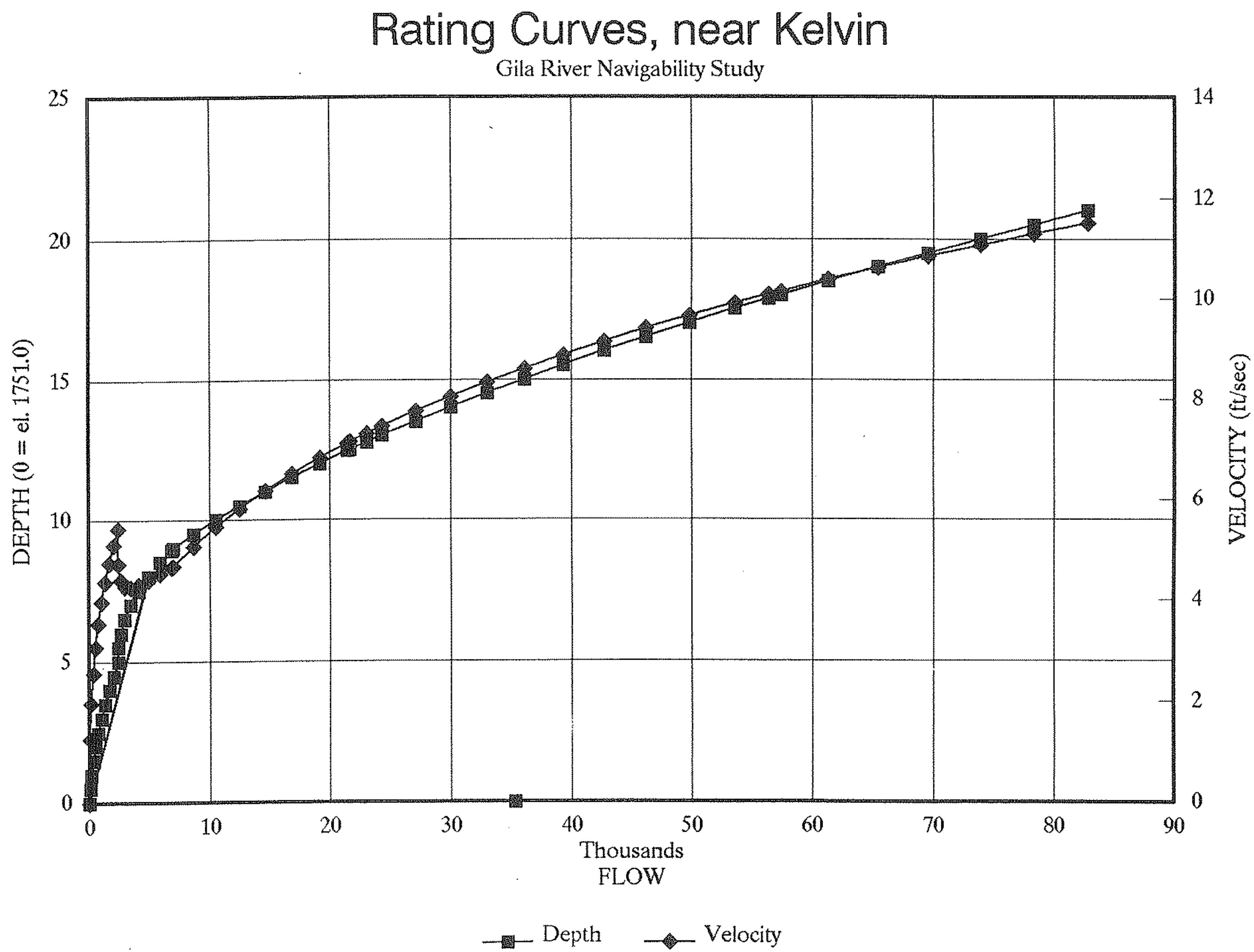


channel slope = 0.002273
roughness, n = 0.035

Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow (cfs)
49.00	1800.00	20.00	25000	765.68	0.0022730	32.651	20.68	516955
29.00	1780.00	0.50	11625	596.59	0.0022730	19.486	14.66	170394
28.50	1779.50	0.50	11332	592.36	0.0022730	19.131	14.48	164079
28.00	1779.00	0.50	11042	588.13	0.0022730	18.774	14.30	157876
27.50	1778.50	0.50	10753	583.91	0.0022730	18.415	14.12	151785
27.00	1778.00	0.50	10466	579.68	0.0022730	18.055	13.93	145806
26.50	1777.50	0.50	10182	575.45	0.0022730	17.693	13.74	139939
26.00	1777.00	0.50	9899	571.23	0.0022730	17.330	13.56	134184
25.50	1776.50	0.50	9619	567.00	0.0022730	16.964	13.36	128541
25.00	1776.00	0.50	9340	562.77	0.0022730	16.596	13.17	123010
24.50	1775.50	0.50	9064	558.54	0.0022730	16.227	12.97	117591
24.00	1775.00	0.50	8789	554.32	0.0022730	15.856	12.78	112284
23.50	1774.50	0.50	8517	550.09	0.0022730	15.482	12.57	107088
23.00	1774.00	0.50	8246	545.86	0.0022730	15.107	12.37	102005
22.50	1773.50	0.10	7978	541.63	0.0022730	14.729	12.16	97034
22.40	1773.40	0.40	7922	540.75	0.0022730	14.650	12.12	96005
22.00	1773.00	0.50	7712	537.41	0.0022730	14.350	11.95	92176
21.50	1772.50	0.50	7447	533.18	0.0022730	13.968	11.74	87430
21.00	1772.00	0.50	7185	528.95	0.0022730	13.583	11.52	82797
20.50	1771.50	0.50	6925	524.73	0.0022730	13.197	11.30	78278
20.00	1771.00	0.50	6667	520.50	0.0022730	12.808	11.08	73871
19.50	1770.50	0.50	6410	516.27	0.0022730	12.417	10.85	69578
19.00	1770.00	0.50	6156	512.04	0.0022730	12.023	10.62	65399
18.50	1769.50	0.50	5904	507.82	0.0022730	11.627	10.39	61335
18.00	1769.00	0.13	5654	503.59	0.0022730	11.228	10.15	57385
17.87	1768.87	0.37	5589	502.48	0.0022730	11.123	10.09	56370
17.50	1768.50	0.50	5406	499.36	0.0022730	10.826	9.91	53551
17.00	1768.00	0.50	5160	495.14	0.0022730	10.421	9.66	49833
16.50	1767.50	0.50	4916	490.91	0.0022730	10.014	9.40	46232
16.00	1767.00	0.50	4674	486.68	0.0022730	9.604	9.15	42748
15.50	1766.50	0.50	4434	482.45	0.0022730	9.191	8.88	39382
15.00	1766.00	0.50	4196	478.23	0.0022730	8.775	8.61	36135
14.50	1765.50	0.50	3960	474.00	0.0022730	8.355	8.33	33009
14.00	1765.00	0.50	3727	469.77	0.0022730	7.933	8.05	30004
13.50	1764.50	0.50	3495	465.54	0.0022730	7.507	7.76	27121
13.00	1764.00	0.24	3265	461.32	0.0022730	7.078	7.46	24363
12.76	1763.76	0.26	3156	459.30	0.0022730	6.871	7.32	23088
12.50	1763.50	0.05	3037	457.09	0.0022730	6.645	7.15	21730
12.45	1763.45	0.45	3016	456.70	0.0022730	6.605	7.13	21494
12.00	1763.00	0.50	2812	452.86	0.0022730	6.208	6.84	19224
11.50	1762.50	0.49	2588	448.64	0.0022730	5.768	6.51	16849
11.01	1762.01	0.01	2370	444.48	0.0022730	5.332	6.18	14640
11.00	1762.00	0.50	2366	444.41	0.0022730	5.324	6.17	14605
10.50	1761.50	0.50	2147	440.18	0.0022730	4.877	5.82	12496
10.00	1761.00	0.50	1929	435.95	0.0022730	4.425	5.46	10524
9.50	1760.50	0.50	1714	431.73	0.0022730	3.969	5.07	8695
9.00	1760.00	0.07	1500	427.50	0.0022730	3.509	4.67	7011
8.93	1759.93	0.43	1468	421.40	0.0022730	3.484	4.65	6831
8.50	1759.50	0.50	1298	386.86	0.0022730	3.354	4.54	5886

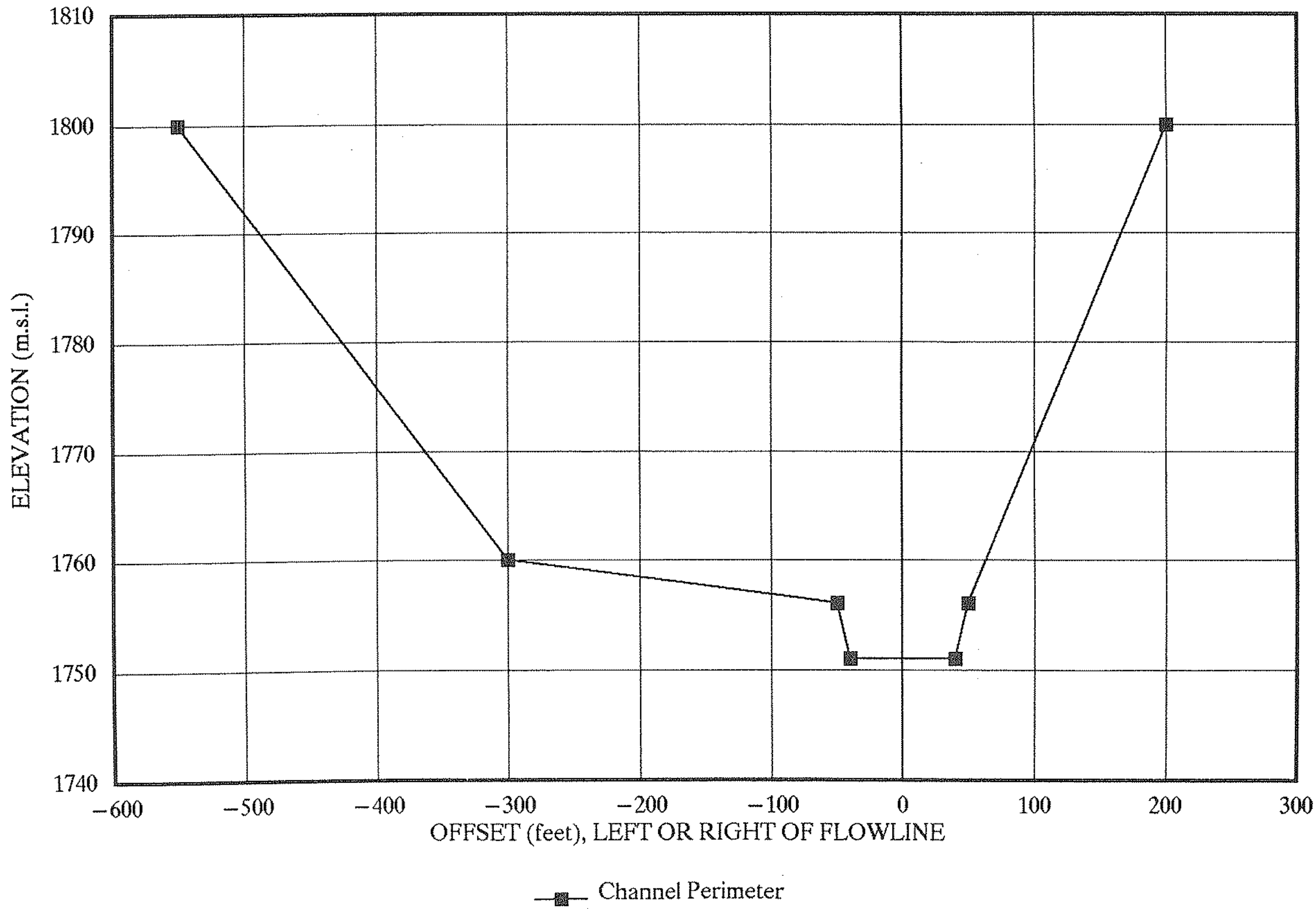
channel slope = 0.002273
roughness, n = 0.035

Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow (cfs)
8.00	1759.00	0.50	1116	346.21	0.0022730	3.222	4.42	4927
7.50	1758.50	0.50	954	305.57	0.0022730	3.122	4.32	4124
7.00	1758.00	0.50	813	264.93	0.0022730	3.067	4.27	3472
6.50	1757.50	0.50	691	224.29	0.0022730	3.083	4.29	2964
6.00	1757.00	0.50	591	183.65	0.0022730	3.216	4.41	2605
5.50	1756.50	0.50	510	143.00	0.0022730	3.567	4.73	2411
5.00	1756.00	0.50	450	102.36	0.0022730	4.396	5.43	2444
4.50	1755.50	0.50	401	100.12	0.0022730	4.000	5.10	2043
4.00	1755.00	0.50	352	97.89	0.0022730	3.596	4.75	1672
3.50	1754.50	0.50	305	95.65	0.0022730	3.183	4.38	1334
3.00	1754.00	0.50	258	93.42	0.0022730	2.762	3.98	1028
2.50	1753.50	0.50	213	91.18	0.0022730	2.331	3.56	756
2.00	1753.00	0.50	168	88.94	0.0022730	1.889	3.09	520
1.50	1752.50	0.50	125	86.71	0.0022730	1.436	2.58	321
1.00	1752.00	0.50	82	84.47	0.0022730	0.971	1.98	163
0.50	1751.50	0.50	41	82.24	0.0022730	0.492	1.26	51
0.00	1751.00		0	80.00	0.0022730	0.000	0.00	0


Rating Curves, near Kelvin
Gila River Navigability Study
DEPTH (0 = el. 1751.0)
25
20
15
10
5
0
VELOCITY (ft/sec)
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
80
90
Thousands
FLOW
Depth
Velocity

Cross—section, near Kelvin

Gila River Navigability Study



Gila River Navigability Study 08/29/96

near Laveen, rating curve & cross section information

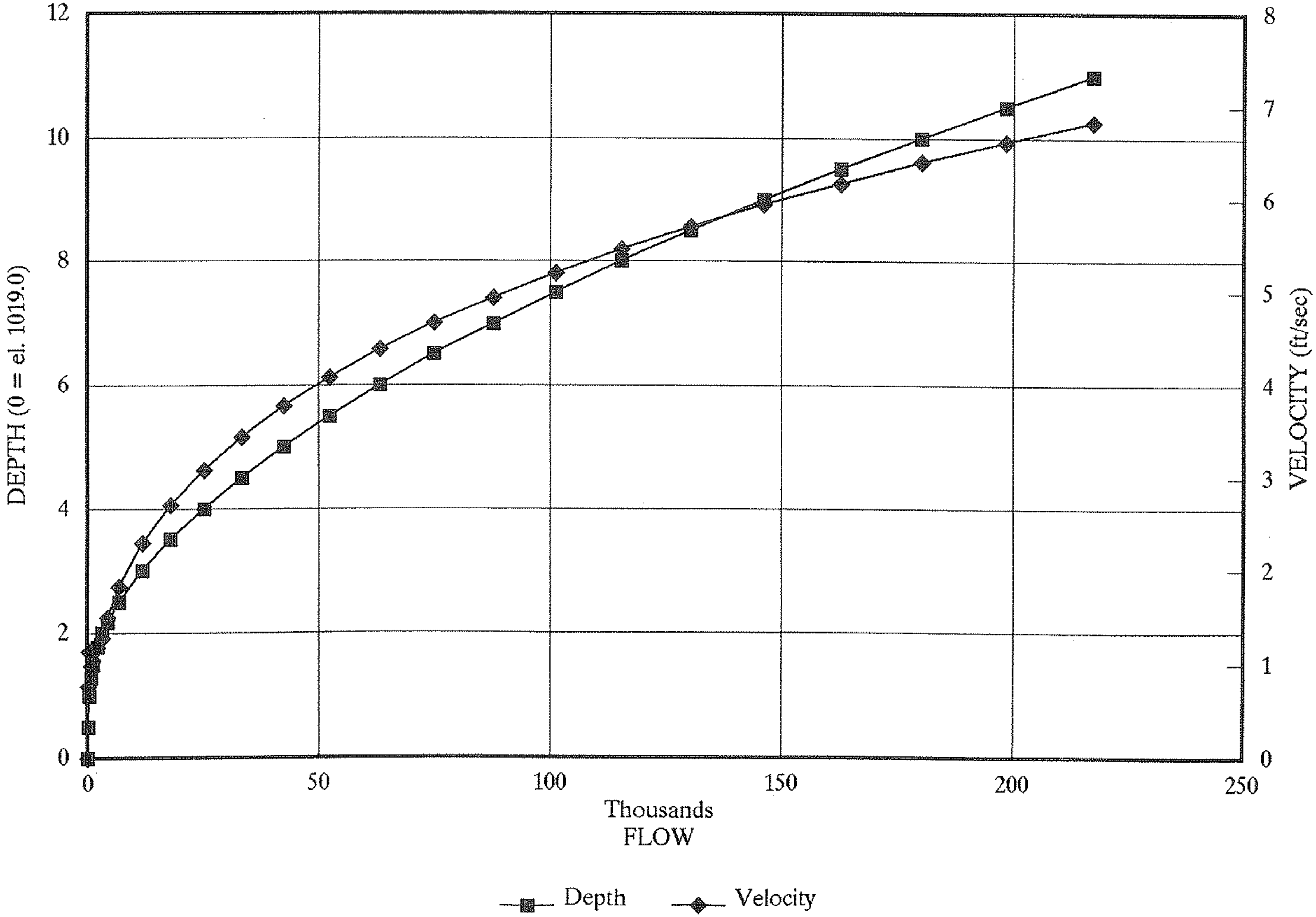
roughness, n = 0.035

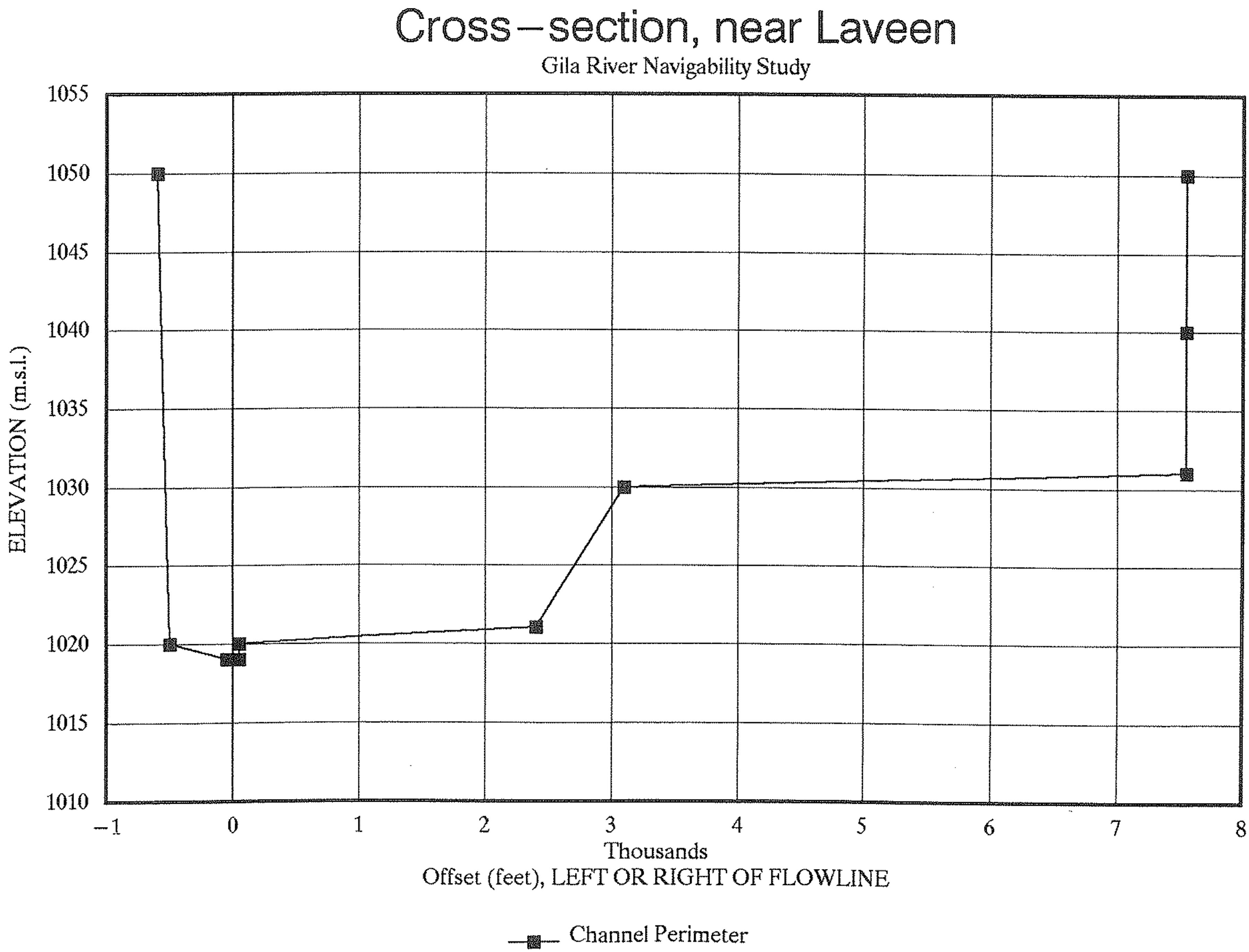
channel slope = 0.001471

Depth of Flow (ft)	Elev. Y	Delta Elev (ft)	Area A (s.f.)	Wetted Perim. (ft)	Slope S (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
31.00	1050.0	10.0	184848.0	3746.70	0.0014710	49.336	21.90	4184859
21.00	1040.0	5.0	103764.7	3701.90	0.0014710	28.030	15.03	1589104
16.00	1035.0	0.5	65139.7	3679.50	0.0014710	17.703	11.06	727629
15.50	1034.5	0.5	61465.1	3677.26	0.0014710	16.715	10.65	660222
15.00	1034.0	0.5	57824.7	3675.02	0.0014710	15.735	10.22	596117
14.50	1033.5	0.5	54218.4	3672.78	0.0014710	14.762	9.80	535296
14.00	1033.0	0.5	50646.3	3670.54	0.0014710	13.798	9.37	477741
13.50	1032.5	0.5	47108.4	3668.30	0.0014710	12.842	8.93	423436
13.00	1032.0	0.5	43604.7	3666.06	0.0014710	11.894	8.48	372371
12.50	1031.5	0.5	40135.1	3663.82	0.0014710	10.954	8.03	324540
12.00	1031.0	0.5	36699.7	3661.58	0.0014710	10.023	7.57	279940
11.50	1030.5	0.5	33681.8	3659.34	0.0014710	9.204	7.15	243050
11.00	1030.0	0.5	31464.7	3657.10	0.0014710	8.604	6.84	217245
10.50	1029.5	0.5	29658.1	3615.46	0.0014710	8.203	6.62	198340
10.00	1029.0	0.5	27871.9	3573.83	0.0014710	7.799	6.40	180198
9.50	1028.5	0.5	26105.9	3532.20	0.0014710	7.391	6.18	162826
9.00	1028.0	0.5	24360.2	3490.57	0.0014710	6.979	5.95	146229
8.50	1027.5	0.5	22634.8	3448.94	0.0014710	6.563	5.71	130414
8.00	1027.0	0.5	20929.7	3407.30	0.0014710	6.143	5.46	115388
7.50	1026.5	0.5	19244.8	3365.67	0.0014710	5.718	5.21	101161
7.00	1026.0	0.5	17580.2	3324.04	0.0014710	5.289	4.94	87745
6.50	1025.5	0.5	15935.9	3282.41	0.0014710	4.855	4.67	75151
6.00	1025.0	0.5	14311.9	3240.77	0.0014710	4.416	4.38	63395
5.50	1024.5	0.5	12708.1	3199.14	0.0014710	3.972	4.08	52497
5.00	1024.0	0.5	11124.7	3157.51	0.0014710	3.523	3.77	42477
4.50	1023.5	0.5	9561.5	3115.88	0.0014710	3.069	3.44	33365
4.00	1023.0	0.5	8018.6	3074.25	0.0014710	2.608	3.09	25194
3.50	1022.5	0.5	6495.9	3032.61	0.0014710	2.142	2.71	18010
3.00	1022.0	0.5	4993.6	2990.98	0.0014710	1.670	2.29	11872
2.50	1021.5	0.3	3511.5	2949.35	0.0014710	1.191	1.83	6868
2.18	1021.2	0.2	2573.6	2922.71	0.0014710	0.881	1.50	4322
2.00	1021.0	0.2	2049.7	2907.72	0.0014710	0.705	1.29	3141
1.79	1020.8	0.3	1484.6	2406.00	0.0014710	0.617	1.18	2158
1.50	1020.5	0.2	892.2	1729.98	0.0014710	0.516	1.05	1219
1.29	1020.3	0.3	580.2	1232.97	0.0014710	0.471	0.99	763
1.00	1020.0	0.5	323.0	552.24	0.0014710	0.585	1.14	369
0.50	1019.5	0.5	104.8	324.12	0.0014710	0.323	0.77	80
0.00	1019.0		0.0	96.00	0.0014710	0.000	0.00	0

Rating Curves, near Laveen

Gila River Navigability Study





Cross–section, near Laveen
Gila River Navigability Study
1055
1050
1045
1040
1035
1030
1025
1020
1015
1010
ELEVATION (m.s.l.)
–1
0
1
2
3
4
5
6
7
8
Thousands
Offset (feet), LEFT OR RIGHT OF FLOWLINE
Channel Perimeter

Gila River Navigability Study
near Lone Butte Ranch, rating curve & cross section

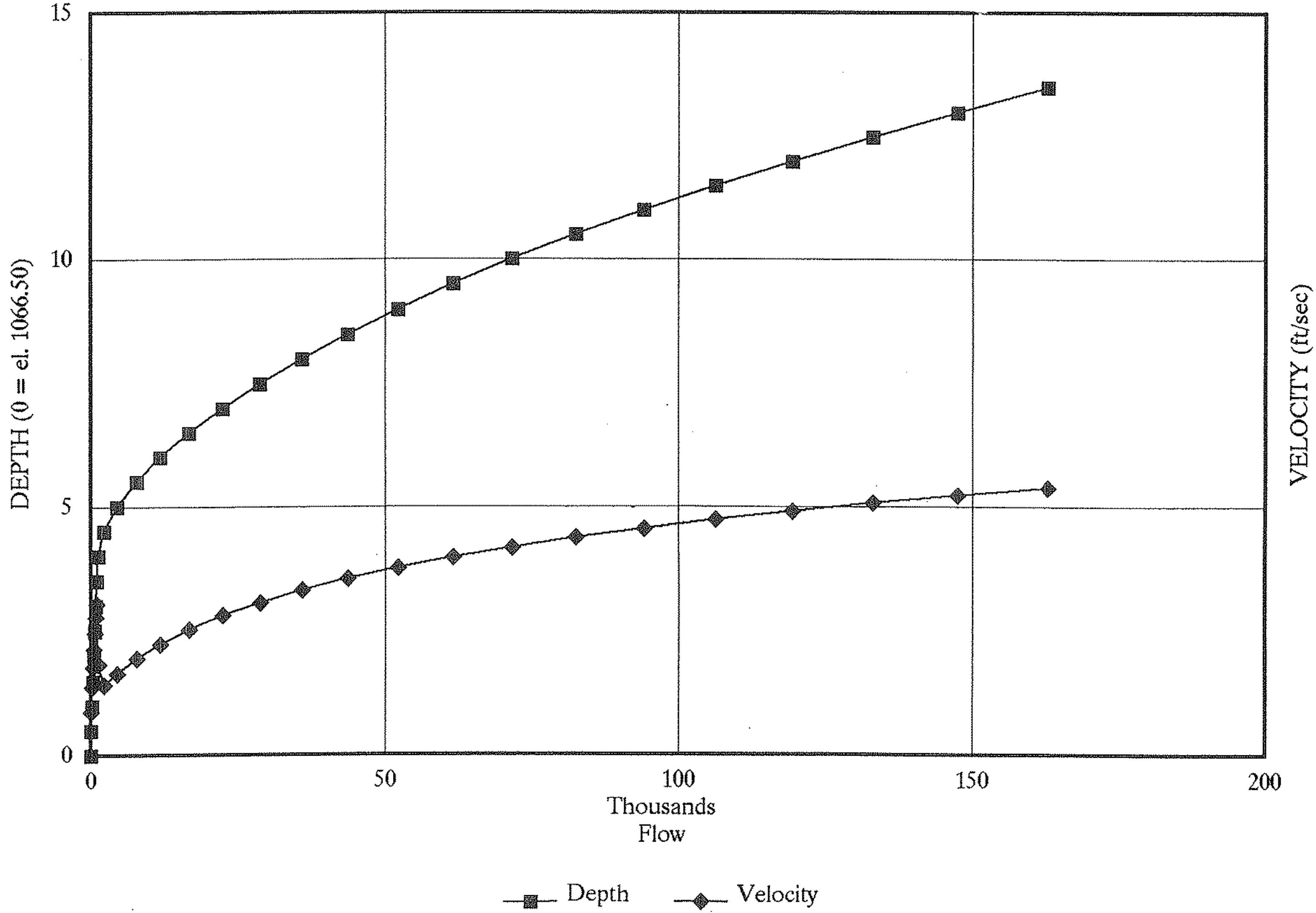
08/29/96

channel slope = 0.001089
roughness, n = 0.035

Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area (sq ft)	Wetted Perim. (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
13.50	1080.00	0.50	30250.5	4061.76	0.0010890	7.448	5.38	162870
13.00	1079.50	0.50	28249.4	3965.69	0.0010890	7.123	5.22	147589
12.50	1079.00	0.50	26296.1	3869.63	0.0010890	6.795	5.06	133074
12.00	1078.50	0.50	24390.5	3773.57	0.0010890	6.464	4.89	119315
11.50	1078.00	0.50	22532.7	3677.51	0.0010890	6.127	4.72	106308
11.00	1077.50	0.50	20722.7	3581.45	0.0010890	5.786	4.54	94046
10.50	1077.00	0.50	18960.5	3485.39	0.0010890	5.440	4.35	82524
10.00	1076.50	0.50	17246.1	3389.33	0.0010890	5.088	4.16	71736
9.50	1076.00	0.50	15579.4	3293.27	0.0010890	4.731	3.96	61680
9.00	1075.50	0.50	13960.5	3197.21	0.0010890	4.366	3.75	52352
8.50	1075.00	0.50	12389.4	3101.15	0.0010890	3.995	3.53	43751
8.00	1074.50	0.50	10866.1	3005.09	0.0010890	3.616	3.30	35879
7.50	1074.00	0.50	9390.5	2909.02	0.0010890	3.228	3.06	28738
7.00	1073.50	0.50	7962.7	2812.96	0.0010890	2.831	2.80	22334
6.50	1073.00	0.50	6582.7	2716.90	0.0010890	2.423	2.53	16680
6.00	1072.50	0.50	5250.5	2620.84	0.0010890	2.003	2.25	11795
5.50	1072.00	0.50	3966.1	2524.78	0.0010890	1.571	1.94	7707
5.00	1071.50	0.50	2729.4	2428.72	0.0010890	1.124	1.64	4466
4.50	1071.00	0.50	1540.5	2332.66	0.0010890	0.660	1.41	2166
4.00	1070.50	0.50	654.3	1217.16	0.0010890	0.538	1.83	1200
3.50	1070.00	0.50	325.5	101.65	0.0010890	3.202	3.04	991
3.00	1069.50	0.50	276.0	99.42	0.0010890	2.776	2.77	764
2.50	1069.00	0.50	227.5	97.18	0.0010890	2.341	2.47	562
2.00	1068.50	0.50	180.0	94.94	0.0010890	1.896	2.15	386
1.50	1068.00	0.50	133.5	92.71	0.0010890	1.440	1.79	239
1.00	1067.50	0.50	88.0	90.47	0.0010890	0.973	1.38	121
0.50	1067.00	0.50	43.5	88.24	0.0010890	0.493	0.87	38
0.00	1066.50		0.0					0

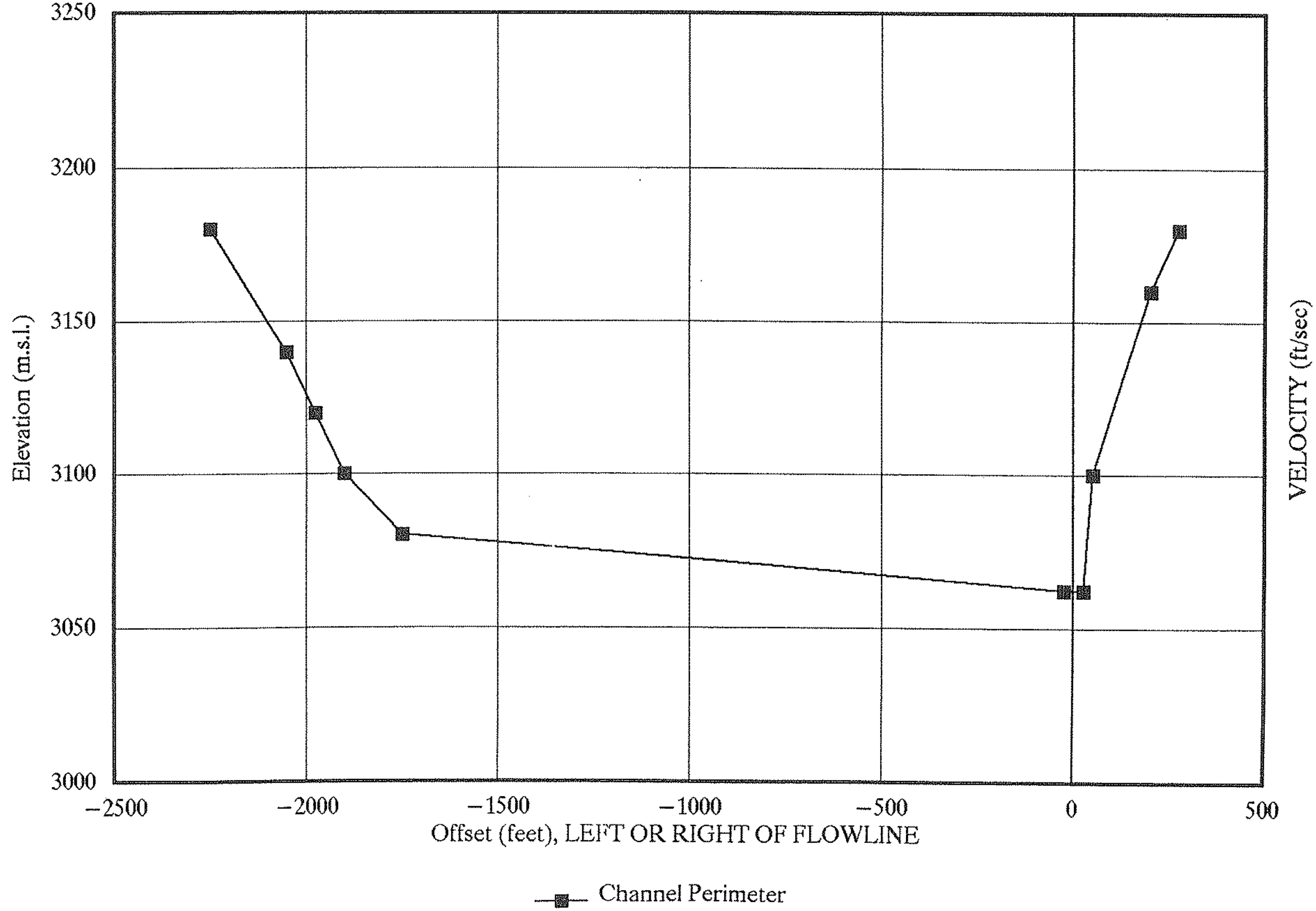
Rating Curves, near Lone Butte Ranch

Gila River Navigability Study



Cross—section, near Lone Butte Ranch

Gila River Navigability Study



Gila River Navigability Study 08/29/96

near Olberg, rating curve & cross section information

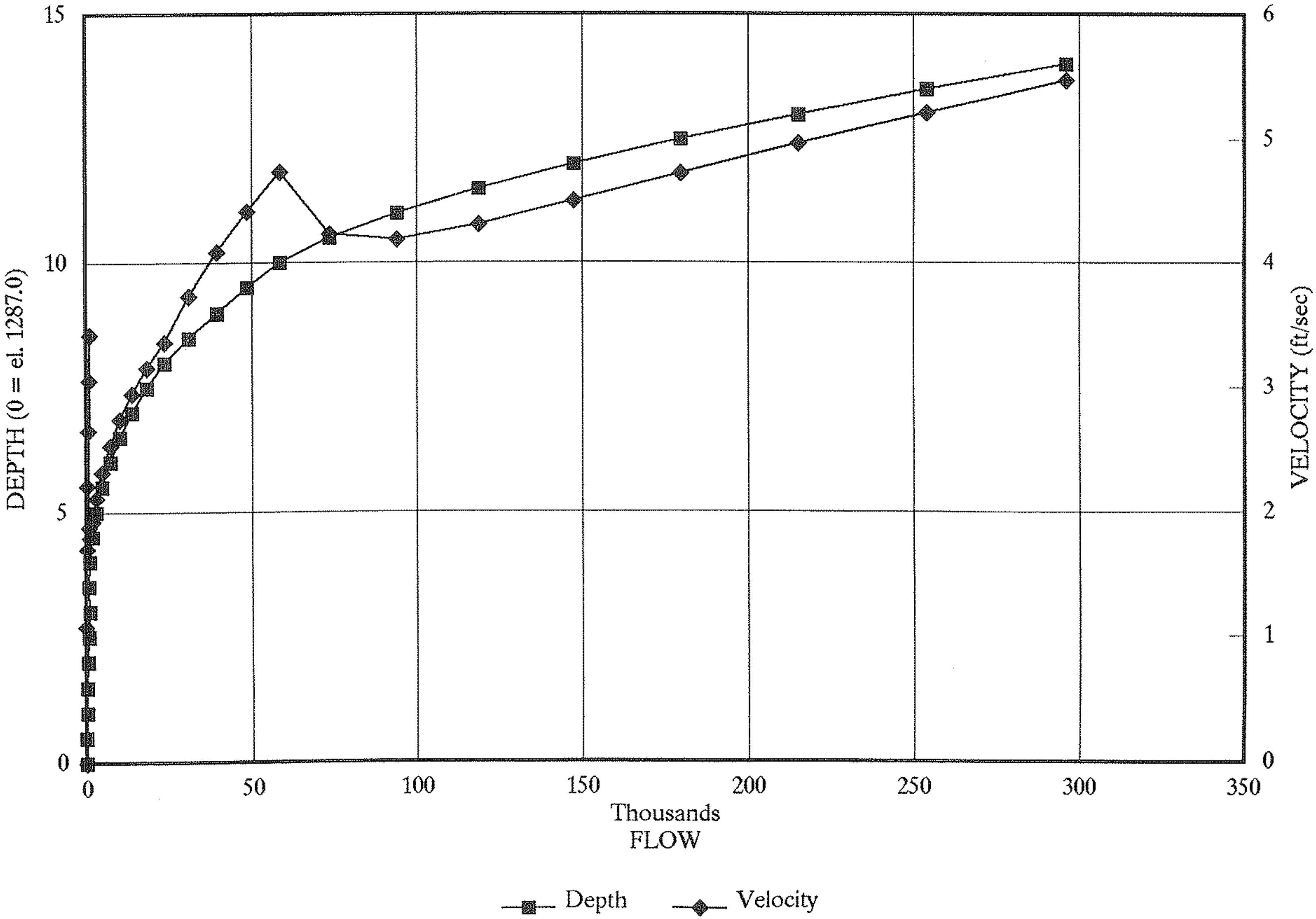
channel slope = 0.001667

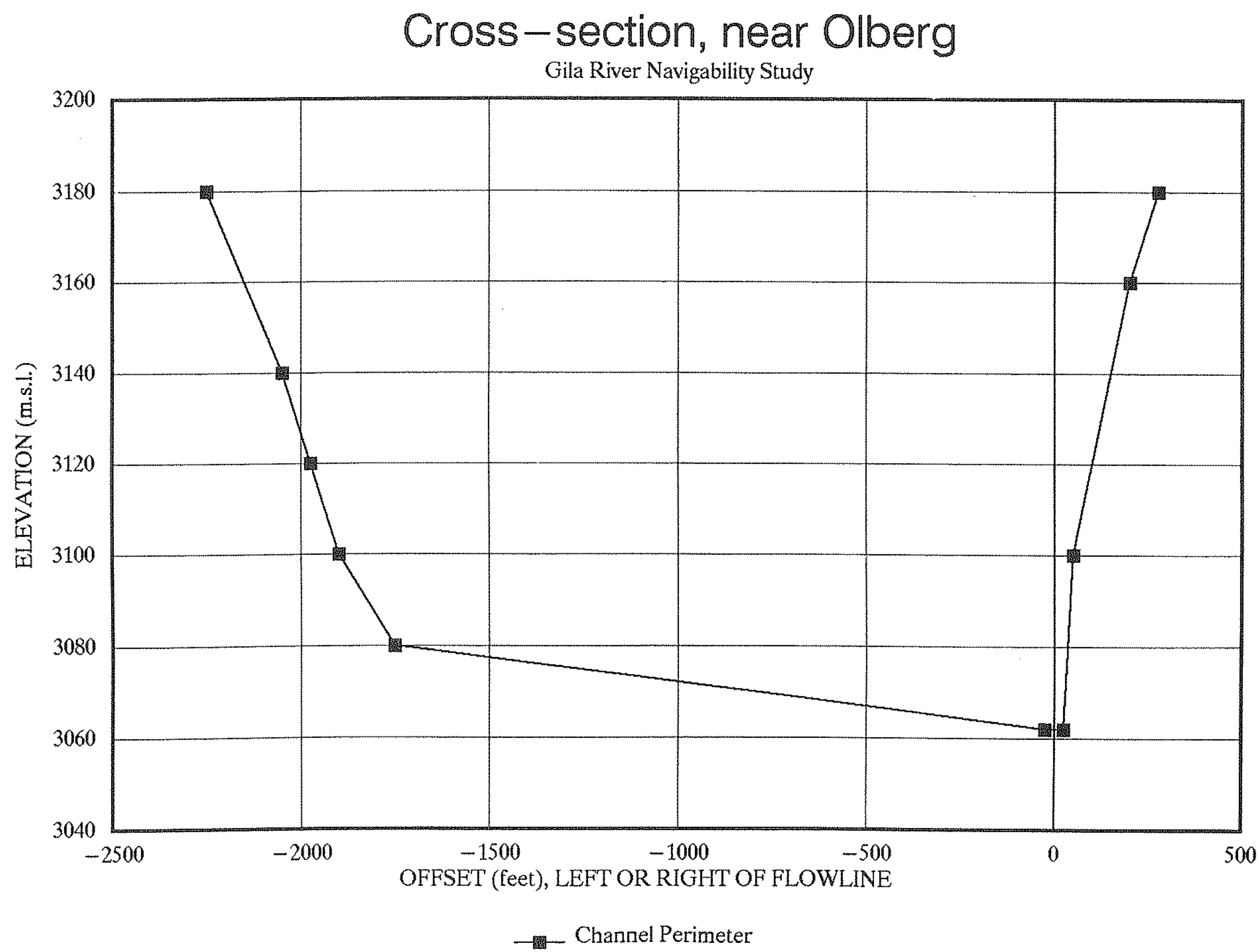
roughness, n = 0.035

Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Flow Q (cfs)
23.00	1310.00	0.50	158332	12301.7	0.001667	12.871	9.60	1520045
22.50	1309.50	0.50	152202	12221.7	0.001667	12.453	9.40	1430553
22.00	1309.00	0.50	146112	12141.7	0.001667	12.034	9.19	1343471
21.50	1308.50	0.50	140062	12061.7	0.001667	11.612	8.99	1258814
21.00	1308.00	0.50	134052	11981.7	0.001667	11.188	8.78	1176599
20.50	1307.50	0.50	128082	11901.7	0.001667	10.762	8.56	1096842
20.00	1307.00	0.50	122152	11821.7	0.001667	10.333	8.35	1019564
19.50	1306.50	0.50	116262	11741.7	0.001667	9.902	8.13	944784
19.00	1306.00	0.50	110412	11661.7	0.001667	9.468	7.90	872525
18.50	1305.50	0.50	104602	11581.7	0.001667	9.032	7.67	802814
18.00	1305.00	0.50	98832	11501.7	0.001667	8.593	7.44	735678
17.50	1304.50	0.50	93102	11421.7	0.001667	8.151	7.21	671149
17.00	1304.00	0.50	87412	11341.7	0.001667	7.707	6.97	609261
16.50	1303.50	0.50	81762	11261.6	0.001667	7.260	6.73	550052
16.00	1303.00	0.50	76152	11181.6	0.001667	6.810	6.48	493567
15.50	1302.50	0.50	70582	11101.6	0.001667	6.358	6.23	439853
15.00	1302.00	0.50	65052	11021.6	0.001667	5.902	5.98	388968
14.50	1301.50	0.50	59562	10941.6	0.001667	5.444	5.72	340975
14.00	1301.00	0.50	54112	10861.6	0.001667	4.982	5.47	295949
13.50	1300.50	0.50	48702	10781.6	0.001667	4.517	5.21	253978
13.00	1300.00	0.50	43332	10701.6	0.001667	4.049	4.97	215167
12.50	1299.50	0.50	38014	10574.9	0.001667	3.595	4.72	179555
12.00	1299.00	0.50	32759	10448.2	0.001667	3.135	4.50	147348
11.50	1298.50	0.50	27567	10321.6	0.001667	2.671	4.31	118734
11.00	1298.00	0.50	22439	10194.9	0.001667	2.201	4.19	93989
10.50	1297.50	0.50	17374	10068.2	0.001667	1.726	4.23	73565
10.00	1297.00	0.50	12372	9941.5	0.001667	1.244	4.73	58568
9.50	1296.50	0.50	11011	2706.5	0.001667	4.068	4.42	48642
9.00	1296.00	0.50	9667	2671.5	0.001667	3.619	4.09	39498
8.50	1295.50	0.50	8341	2636.5	0.001667	3.164	3.74	31159
8.00	1295.00	0.50	7032	2601.4	0.001667	2.703	3.36	23654
7.50	1294.50	0.50	5795	2351.4	0.001667	2.464	3.16	18326
7.00	1294.00	0.50	4682	2101.4	0.001667	2.228	2.96	13845
6.50	1293.50	0.50	3695	1851.4	0.001667	1.995	2.75	10151
6.00	1293.00	0.50	2832	1601.4	0.001667	1.768	2.53	7179
5.50	1292.50	0.50	2095	1351.4	0.001667	1.550	2.32	4862
5.00	1292.00	0.50	1482	1101.4	0.001667	1.346	2.11	3131
4.50	1291.50	0.50	995	851.4	0.001667	1.168	1.92	1912
4.00	1291.00	0.50	632	601.4	0.001667	1.051	1.79	1132
3.50	1290.50	0.50	395	351.4	0.001667	1.123	1.87	739
3.00	1290.00	0.50	282	101.4	0.001667	2.781	3.43	967
2.50	1289.50	0.50	233	99.2	0.001667	2.344	3.06	711
2.00	1289.00	0.50	184	96.9	0.001667	1.898	2.66	489
1.50	1288.50	0.50	137	94.7	0.001667	1.441	2.21	302
1.00	1288.00	0.50	90	92.5	0.001667	0.973	1.70	153
0.50	1287.50	0.50	45	90.2	0.001667	0.493	1.08	48
0.00	1287.00		0	88.0		0.000	0.00	0

Rating Curves, near Olberg

Gila River Navigability Study




Cross—section, near Olberg
Gila River Navigability Study
ELEVATION (m.s.l.)
3200
3180
3160
3140
3120
3100
3080
3060
3040
−2500
−2000
−1500
−1000
−500
0
500
OFFSET (feet), LEFT OR RIGHT OF FLOWLINE
Channel Perimeter

Gila River Navigability Study 08/29/96

near Rocky Point, rating curve & cross section information

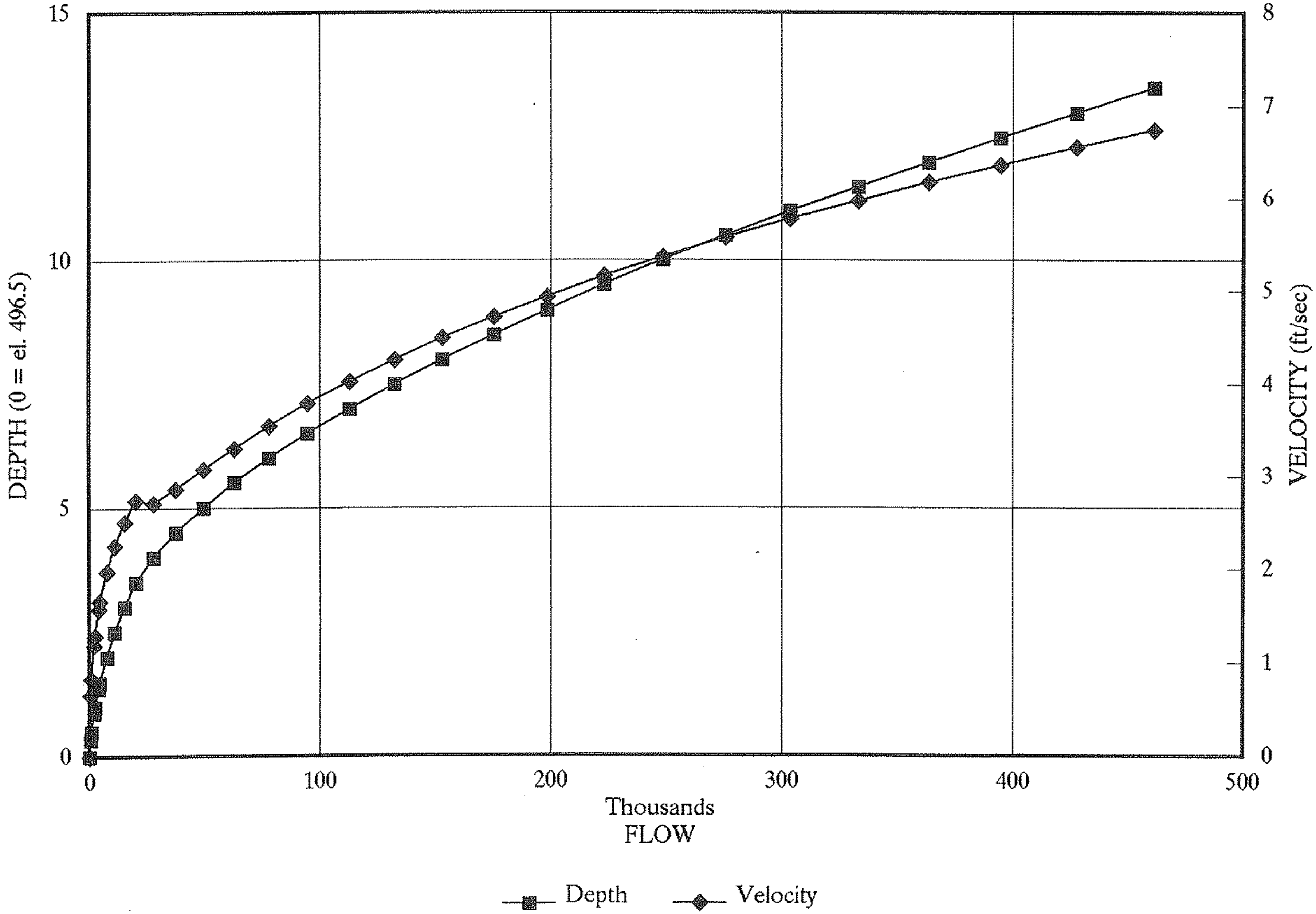
roughness, n = 0.035

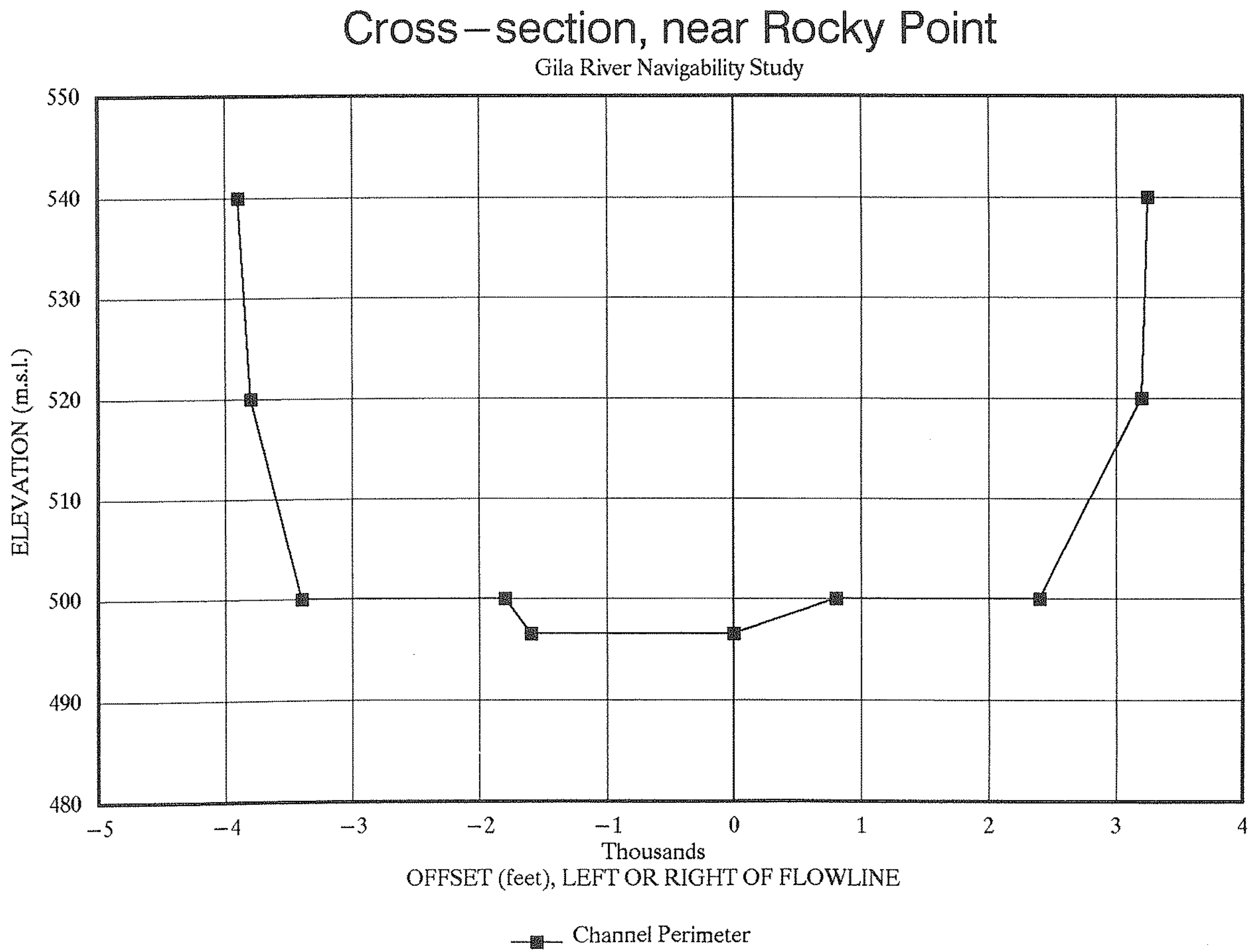
channel slope = 0.001042

Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area (sq ft)	Wetted Perim. (ft)	Channel Slope (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Vel. V (fps)	Combined Flow Q (cfs)
43.50	540.00	20.0	276850	7156.62	0.0010420	38.684	15.71	4348264
23.50	520.00	0.50	135350	7000.79	0.0010420	19.334	9.98	1351018
23.00	519.50	0.50	131858	6970.77	0.0010420	18.916	9.84	1297152
22.50	519.00	0.50	128380	6940.75	0.0010420	18.497	9.69	1244246
22.00	518.50	0.50	124918	6910.73	0.0010420	18.076	9.54	1192305
21.50	518.00	0.50	121470	6880.71	0.0010420	17.654	9.40	1141332
21.00	517.50	0.50	118038	6850.69	0.0010420	17.230	9.25	1091331
20.50	517.00	0.50	114620	6820.68	0.0010420	16.805	9.09	1042305
20.00	516.50	0.50	111218	6790.66	0.0010420	16.378	8.94	994258
19.50	516.00	0.50	107830	6760.64	0.0010420	15.950	8.78	947196
19.00	515.50	0.50	104458	6730.62	0.0010420	15.520	8.63	901122
18.50	515.00	0.50	101100	6700.60	0.0010420	15.088	8.47	856042
18.00	514.50	0.50	97758	6670.58	0.0010420	14.655	8.31	811961
17.50	514.00	0.50	94430	6640.56	0.0010420	14.220	8.14	768884
17.00	513.50	0.50	91118	6610.54	0.0010420	13.784	7.98	726819
16.50	513.00	0.50	87820	6580.53	0.0010420	13.345	7.81	685771
16.00	512.50	0.50	84538	6550.51	0.0010420	12.905	7.64	645747
15.50	512.00	0.50	81270	6520.49	0.0010420	12.464	7.47	606755
15.00	511.50	0.50	78018	6490.47	0.0010420	12.020	7.29	568803
14.50	511.00	0.50	74780	6460.45	0.0010420	11.575	7.11	531900
14.00	510.50	0.50	71558	6430.43	0.0010420	11.128	6.93	496054
13.50	510.00	0.50	68350	6400.41	0.0010420	10.679	6.75	461276
13.00	509.50	0.50	65158	6370.39	0.0010420	10.228	6.56	427576
12.50	509.00	0.50	61980	6340.38	0.0010420	9.775	6.37	394967
12.00	508.50	0.50	58818	6310.36	0.0010420	9.321	6.18	363460
11.50	508.00	0.50	55670	6280.34	0.0010420	8.864	5.98	333070
11.00	507.50	0.50	52538	6250.32	0.0010420	8.406	5.78	303812
10.50	507.00	0.50	49420	6220.30	0.0010420	7.945	5.58	275702
10.00	506.50	0.50	46318	6190.28	0.0010420	7.482	5.37	248759
9.50	506.00	0.50	43230	6160.26	0.0010420	7.018	5.16	223002
9.00	505.50	0.50	40158	6130.24	0.0010420	6.551	4.94	198454
8.50	505.00	0.50	37100	6100.23	0.0010420	6.082	4.72	175141
8.00	504.50	0.50	34058	6070.21	0.0010420	5.611	4.50	153091
7.50	504.00	0.50	31030	6040.19	0.0010420	5.137	4.26	132336
7.00	503.50	0.50	28018	6010.17	0.0010420	4.662	4.03	112914
6.50	503.00	0.50	25020	5980.15	0.0010420	4.184	3.79	94870
6.00	502.50	0.50	22038	5950.13	0.0010420	3.704	3.55	78256
5.50	502.00	0.50	19070	5920.11	0.0010420	3.221	3.31	63139
5.00	501.50	0.50	16118	5890.09	0.0010420	2.736	3.08	49602
4.50	501.00	0.50	13180	5860.08	0.0010420	2.249	2.87	37763
4.00	500.50	0.50	10258	5830.06	0.0010420	1.759	2.71	27803
3.50	500.00	0.50	7350	5800.04	0.0010420	1.267	2.74	20139
3.00	499.50	0.50	6086	2457.18	0.0010420	2.477	2.51	15268
2.50	499.00	0.50	4893	2314.31	0.0010420	2.114	2.26	11046
2.00	498.50	0.50	3771	2171.45	0.0010420	1.737	1.98	7468
1.50	498.00	0.12	2721	2028.59	0.0010420	1.342	1.67	4537
1.38	497.88	0.38	2480	1994.30	0.0010420	1.244	1.58	3931
1.00	497.50	0.12	1743	1885.73	0.0010420	0.924	1.30	2266
0.88	497.38	0.38	1513	1850.58	0.0010420	0.818	1.20	1813
0.50	497.00	0.15	836	1742.86	0.0010420	0.480	0.84	702
0.35	496.85	0.35	569	1698.58	0.0010420	0.335	0.66	376
0.00	496.50		0	1600.00	0.0010420	0.000	0.00	0

Rating Curves, near Rocky Point (Mtn.)

Gila River Navigability Study

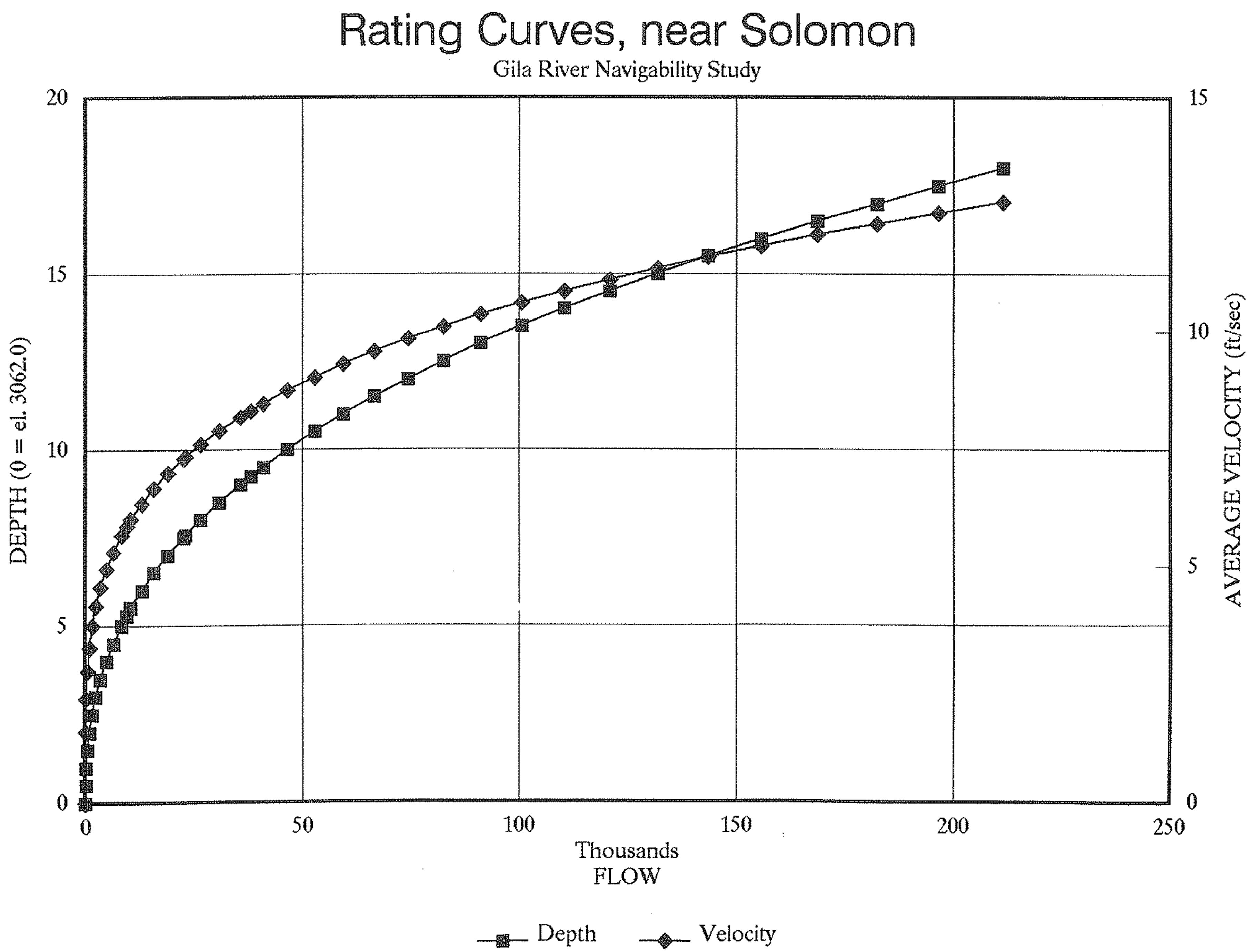



Cross–section, near Rocky Point
Gila River Navigability Study
550
540
530
520
510
500
490
480
ELEVATION (m.s.l.)
–5
–4
–3
–2
–1
0
1
2
3
4
Thousands
OFFSET (feet), LEFT OR RIGHT OF FLOWLINE
Channel Perimeter

Gila River Navigability Study 08/29/96
near Solomon, rating curve & cross section information

channel slope = 0.0047059
roughness, n = 0.035

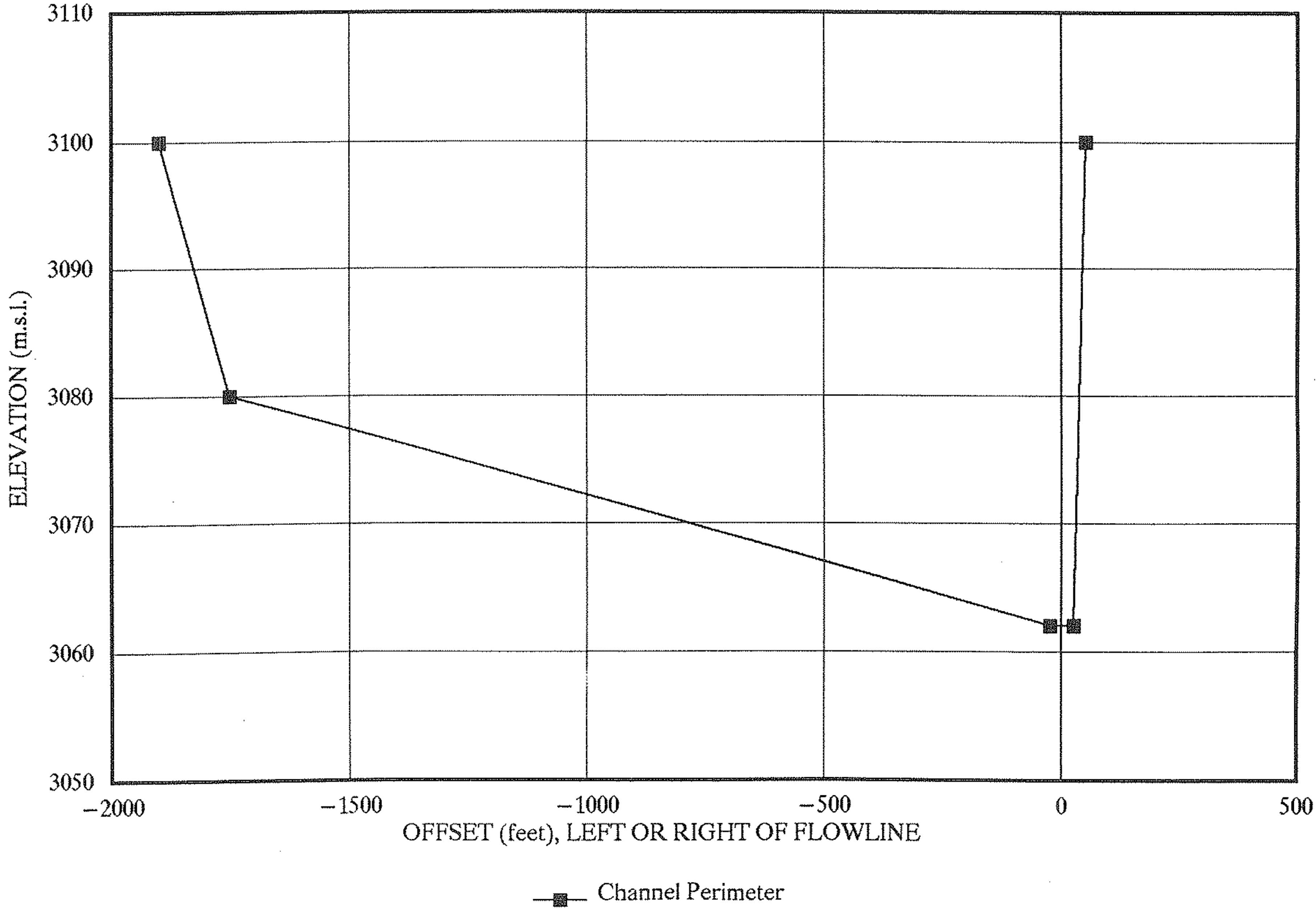
Flow Depth (ft)	Elev. Y	Delta Elev. (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope S (ft/ft)	Hydr. Rad. A/P (ft)	Avg. Velocity V (fps)	Flow (cfs)
118.00	3180.00	20.00	231150.0	2570.29	0.0047059	89.932	58.46	13513676
98.00	3160.00	20.00	182400.0	2390.68	0.0047059	76.296	52.39	9556477
78.00	3140.00	40.00	136900.0	2234.85	0.0047059	61.257	45.26	6195996
38.00	3100.00	18.00	53900.0	1971.91	0.0047059	27.334	26.43	1424497
20.00	3082.00	0.50	20121.6	1814.17	0.0047059	11.091	14.49	291467
19.50	3081.50	0.50	19221.0	1809.79	0.0047059	10.621	14.07	270488
19.00	3081.00	0.50	18322.5	1805.40	0.0047059	10.149	13.65	250148
18.50	3080.50	0.50	17426.0	1801.02	0.0047059	9.676	13.22	230457
18.00	3080.00	0.50	16531.6	1796.64	0.0047059	9.201	12.79	211424
17.50	3079.50	0.50	15650.2	1748.12	0.0047059	8.953	12.56	196528
17.00	3079.00	0.50	14793.0	1699.60	0.0047059	8.704	12.32	182305
16.50	3078.50	0.50	13959.9	1651.09	0.0047059	8.455	12.09	168743
16.00	3078.00	0.50	13150.9	1602.57	0.0047059	8.206	11.85	155830
15.50	3077.50	0.50	12366.0	1554.05	0.0047059	7.957	11.61	143552
15.00	3077.00	0.50	11605.3	1505.53	0.0047059	7.708	11.37	131897
14.50	3076.50	0.50	10868.6	1457.02	0.0047059	7.460	11.12	120852
14.00	3076.00	0.50	10156.1	1408.50	0.0047059	7.211	10.87	110403
13.50	3075.50	0.50	9467.8	1359.98	0.0047059	6.962	10.62	100538
13.00	3075.00	0.50	8803.5	1311.46	0.0047059	6.713	10.36	91242
12.50	3074.50	0.50	8163.4	1262.94	0.0047059	6.464	10.11	82502
12.00	3074.00	0.50	7547.4	1214.43	0.0047059	6.215	9.85	74305
11.50	3073.50	0.50	6955.5	1165.91	0.0047059	5.966	9.58	66636
11.00	3073.00	0.50	6387.7	1117.39	0.0047059	5.717	9.31	59481
10.50	3072.50	0.50	5844.1	1068.87	0.0047059	5.468	9.04	52826
10.00	3072.00	0.50	5324.6	1020.36	0.0047059	5.218	8.76	46656
9.50	3071.50	0.27	4829.2	971.84	0.0047059	4.969	8.48	40957
9.23	3071.23	0.23	4575.4	946.03	0.0047059	4.836	8.33	38112
9.00	3071.00	0.50	4357.9	923.32	0.0047059	4.720	8.20	35713
8.50	3070.50	0.50	3910.7	874.80	0.0047059	4.470	7.90	30910
8.00	3070.00	0.42	3487.7	826.28	0.0047059	4.221	7.61	26531
7.58	3069.58	0.08	3147.9	785.14	0.0047059	4.009	7.35	23139
7.50	3069.50	0.50	3088.8	777.77	0.0047059	3.971	7.30	22561
7.00	3069.00	0.50	2714.0	729.25	0.0047059	3.722	6.99	18984
6.50	3068.50	0.50	2363.4	680.73	0.0047059	3.472	6.68	15783
6.00	3068.00	0.50	2036.8	632.21	0.0047059	3.222	6.35	12941
5.50	3067.50	0.21	1734.4	583.70	0.0047059	2.971	6.02	10441
5.29	3067.29	0.29	1612.4	562.93	0.0047059	2.864	5.87	9471
5.00	3067.00	0.50	1456.1	535.18	0.0047059	2.721	5.68	8266
4.50	3066.50	0.50	1202.0	486.66	0.0047059	2.470	5.32	6397
4.00	3066.00	0.50	971.9	438.14	0.0047059	2.218	4.95	4815
3.50	3065.50	0.50	766.0	389.62	0.0047059	1.966	4.57	3501
3.00	3065.00	0.50	584.2	341.11	0.0047059	1.713	4.17	2436
2.50	3064.50	0.50	426.5	292.59	0.0047059	1.458	3.74	1597
2.00	3064.00	0.50	293.0	244.07	0.0047059	1.200	3.29	964
1.50	3063.50	0.50	183.6	195.55	0.0047059	0.939	2.79	513
1.00	3063.00	0.50	98.2	147.04	0.0047059	0.668	2.23	219
0.50	3062.50	0.50	37.1	98.52	0.0047059	0.376	1.52	56
0.00	3062.00			50.00	0.0047059	0.000	0.00	0



Rating Curves, near Solomon
Gila River Navigability Study
DEPTH (0 = el. 3062.0)
AVERAGE VELOCITY (ft/sec)
20
15
10
5
0
0
50
100
150
200
250
Thousands
FLOW
Depth
Velocity

Cross—section, near Solomon

Gila River Navigability Study



Gila River Navigability Study 08/29/96

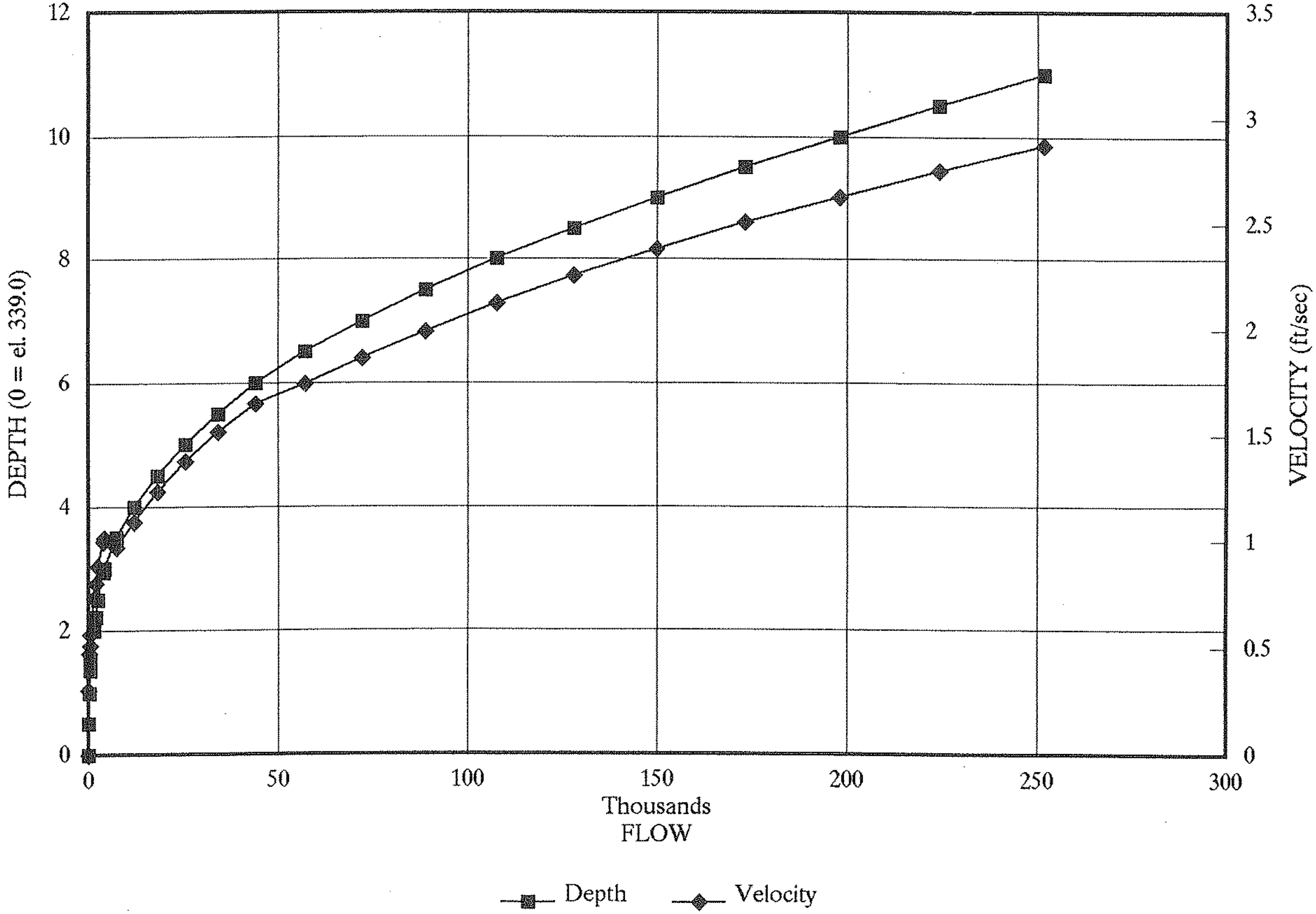
near Texas Hill, rating curve & cross section information

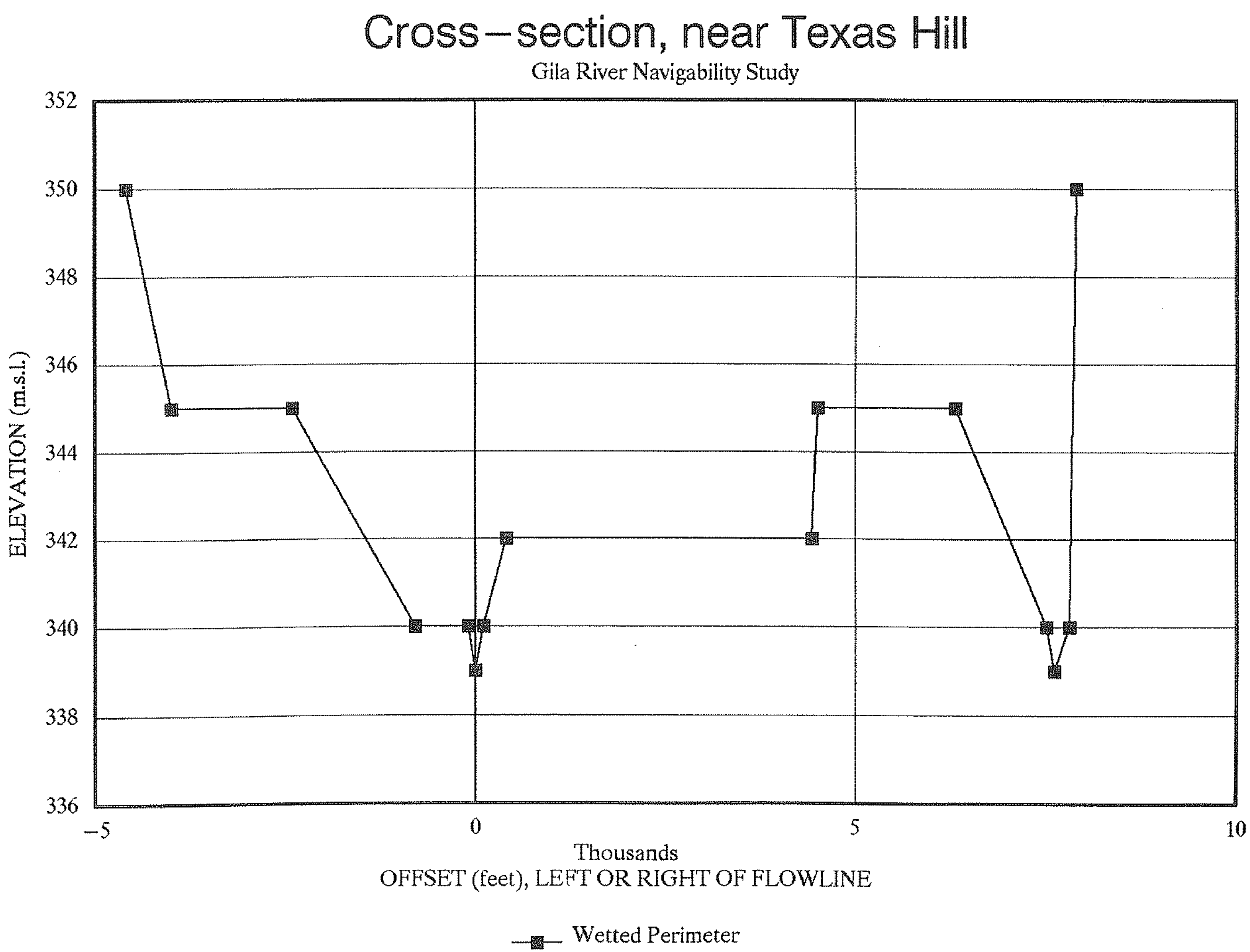
roughness, n = 0.035
channel slope = 0.0003205

Flow Depth (ft)	El. Y	Delta Elev. (ft)	Total Area (s.f.)	Wetted Perim. (ft)	Channel Slope (ft/ft)	Hydr. Radius A/P (ft)	Avg. Vel. V (fps)	Combined Flow Q (fps)
11.0	350.0	0.50	87637.50	12510.62	0.0003205	7.005	2.87	251786
10.5	349.5	0.50	81403.75	12444.59	0.0003205	6.541	2.75	224140
10.0	349.0	0.50	75202.50	12378.57	0.0003205	6.075	2.63	197898
9.5	348.5	0.50	69033.75	12312.54	0.0003205	5.607	2.51	173090
9.0	348.0	0.50	62897.50	12246.51	0.0003205	5.136	2.38	149754
8.5	347.5	0.50	56793.75	12180.49	0.0003205	4.663	2.25	127934
8.0	347.0	0.50	50722.50	12114.46	0.0003205	4.187	2.12	107682
7.5	346.5	0.50	44683.75	12048.43	0.0003205	3.709	1.99	89065
7.0	346.0	0.50	38677.50	11982.41	0.0003205	3.228	1.87	72169
6.5	345.5	0.50	32703.75	11916.38	0.0003205	2.744	1.75	57125
6.0	345.0	0.50	26762.50	11850.35	0.0003205	2.258	1.65	44205
5.5	344.5	0.50	22611.88	8152.81	0.0003205	2.774	1.52	34316
5.0	344.0	0.50	18610.00	7855.28	0.0003205	2.369	1.38	25646
4.5	343.5	0.50	14756.88	7557.74	0.0003205	1.953	1.23	18217
4.0	343.0	0.50	11052.50	7260.20	0.0003205	1.522	1.09	12075
3.5	342.5	0.50	7496.88	6962.67	0.0003205	1.077	0.97	7307
3.0	342.0	0.06	4090.00	6665.13	0.0003205	0.614	1.02	4163
2.9	341.9	0.44	3922.51	2594.05	0.0003205	1.512	1.00	3929
2.5	341.5	0.28	2860.00	2280.10	0.0003205	1.254	0.89	2532
2.2	341.2	0.22	2253.98	2079.93	0.0003205	1.084	0.80	1814
2.0	341.0	0.50	1810.00	1920.07	0.0003205	0.943	0.74	1332
1.5	340.5	0.14	940.00	1560.05	0.0003205	0.603	0.56	531
1.4	340.4	0.36	730.12	1459.96	0.0003205	0.500	0.52	376
1.0	340.0	0.50	250.00	1200.02	0.0003205	0.208	0.48	120
0.5	339.5	0.50	62.50	250.01	0.0003205	0.250	0.30	19
0.0	339.0		0.00	0.00			0.00	0

Rating Curves, near Texas Hill

Gila River Navigability Study



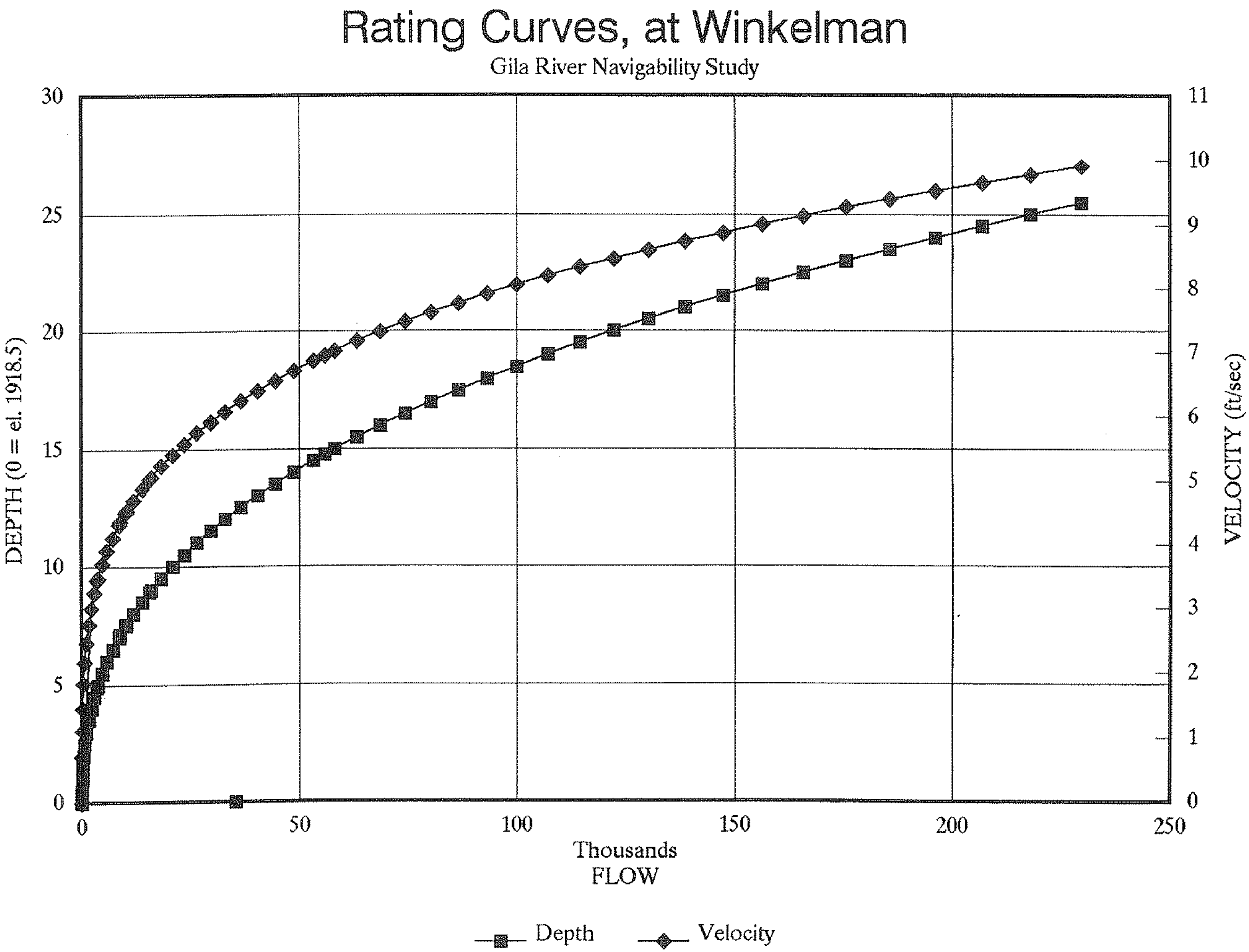

Cross—section, near Texas Hill
Gila River Navigability Study
352
350
348
346
344
342
340
338
336
ELEVATION (m.s.l.)
−5
0
5
10
Thousands
OFFSET (feet), LEFT OR RIGHT OF FLOWLINE
Wetted Perimeter

channel slope = 0.00177
roughness, n = 0.035

Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. R=A/P (ft)	Avg. Vel. V (fps)	Flow (cfs)
41.50	1960.0	16.0	60113	2851.37	0.0017700	21.082	13.63	819427
25.50	1944.0	0.5	23153	1770.83	0.0017700	13.074	9.91	229517
25.00	1943.5	0.5	22276	1737.07	0.0017700	12.824	9.79	217998
24.50	1943.0	0.5	21416	1703.30	0.0017700	12.573	9.66	206847
24.00	1942.5	0.5	20573	1669.53	0.0017700	12.323	9.53	196058
23.50	1942.0	0.5	19748	1635.77	0.0017700	12.072	9.40	185628
23.00	1941.5	0.5	18938	1602.00	0.0017700	11.822	9.27	175551
22.50	1941.0	0.5	18146	1568.23	0.0017700	11.571	9.14	165822
22.00	1940.5	0.5	17371	1534.47	0.0017700	11.321	9.01	156436
21.50	1940.0	0.5	16613	1500.70	0.0017700	11.070	8.87	147389
21.00	1939.5	0.5	15871	1466.93	0.0017700	10.819	8.74	138676
20.50	1939.0	0.5	15146	1433.17	0.0017700	10.568	8.60	130291
20.00	1938.5	0.5	14438	1399.40	0.0017700	10.318	8.47	122230
19.50	1938.0	0.5	13748	1365.63	0.0017700	10.067	8.33	114486
19.00	1937.5	0.5	13073	1331.87	0.0017700	9.816	8.19	107057
18.50	1937.0	0.5	12416	1298.10	0.0017700	9.565	8.05	99935
18.00	1936.5	0.5	11776	1264.33	0.0017700	9.314	7.91	93116
17.50	1936.0	0.5	11153	1230.57	0.0017700	9.063	7.76	86594
17.00	1935.5	0.5	10546	1196.80	0.0017700	8.812	7.62	80365
16.50	1935.0	0.5	9956	1163.03	0.0017700	8.561	7.47	74422
16.00	1934.5	0.5	9383	1129.27	0.0017700	8.309	7.33	68761
15.50	1934.0	0.5	8828	1095.50	0.0017700	8.058	7.18	63376
15.00	1933.5	0.2	8288	1061.73	0.0017700	7.807	7.03	58261
14.76	1933.3	0.3	8036	1045.53	0.0017700	7.686	6.96	55901
14.50	1933.0	0.5	7766	1027.97	0.0017700	7.555	6.88	53412
14.00	1932.5	0.5	7261	994.20	0.0017700	7.303	6.72	48821
13.50	1932.0	0.5	6773	960.43	0.0017700	7.052	6.57	44484
13.00	1931.5	0.5	6301	926.67	0.0017700	6.800	6.41	40395
12.50	1931.0	0.5	5846	892.90	0.0017700	6.547	6.25	36548
12.00	1930.5	0.5	5408	859.13	0.0017700	6.295	6.09	32937
11.51	1930.0	0.0	4993	825.84	0.0017700	6.046	5.93	29602
11.50	1930.0	0.5	4988	825.37	0.0017700	6.043	5.93	29556
11.00	1929.5	0.5	4583	791.60	0.0017700	5.790	5.76	26399
10.50	1929.0	0.5	4196	757.83	0.0017700	5.537	5.59	23460
10.00	1928.5	0.5	3826	724.07	0.0017700	5.284	5.42	20732
9.50	1928.0	0.5	3473	690.30	0.0017700	5.030	5.24	18210
9.00	1927.5	0.1	3136	656.53	0.0017700	4.777	5.07	15887
8.91	1927.4	0.4	3078	650.59	0.0017700	4.732	5.03	15498
8.50	1927.0	0.5	2816	622.77	0.0017700	4.522	4.88	13756
8.00	1926.5	0.4	2513	589.00	0.0017700	4.267	4.70	11812
7.55	1926.1	0.1	2255	558.61	0.0017700	4.037	4.53	10214
7.50	1926.0	0.4	2228	555.23	0.0017700	4.012	4.51	10046
7.12	1925.6	0.1	2023	529.71	0.0017700	3.818	4.36	8826
7.00	1925.5	0.5	1958	521.47	0.0017700	3.756	4.32	8452
6.50	1925.0	0.5	1706	487.70	0.0017700	3.499	4.12	7024
6.00	1924.5	0.5	1471	453.93	0.0017700	3.240	3.91	5754
5.50	1924.0	0.5	1253	420.17	0.0017700	2.981	3.70	4634
5.00	1923.5	0.1	1051	386.40	0.0017700	2.720	3.48	3658
4.92	1923.4	0.4	1020	381.00	0.0017700	2.678	3.44	3514
4.50	1923.0	0.5	866	352.63	0.0017700	2.457	3.25	2817

channel slope = 0.00177
roughness, n = 0.035

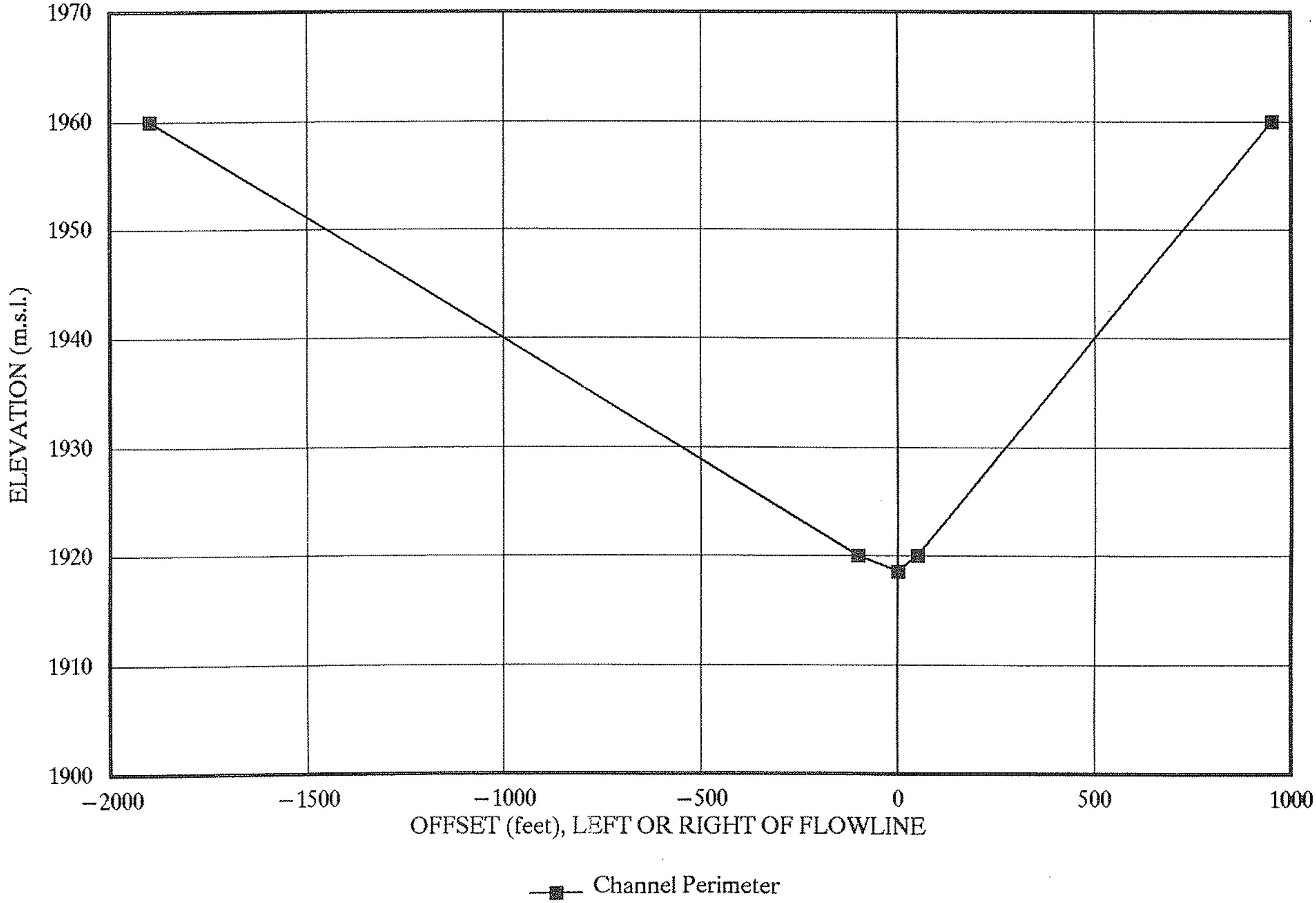
Flow Depth (ft)	Elev Y	Delta Elev (ft)	Area A (s.f.)	Wetted Perim. P (ft)	Channel Slope (ft/ft)	Hydr. Rad. R=A/P (ft)	Avg. Vel. V (fps)	Flow (cfs)
4.00	1922.5	0.5	698	318.87	0.0017700	2.190	3.01	2104
3.50	1922.0	0.5	548	285.10	0.0017700	1.920	2.76	1511
3.00	1921.5	0.5	413	251.33	0.0017700	1.645	2.49	1029
2.50	1921.0	0.5	296	217.57	0.0017700	1.362	2.19	650
2.00	1920.5	0.5	196	183.80	0.0017700	1.066	1.86	365
1.50	1920.0	0.5	113	150.03	0.0017700	0.750	1.47	166
1.00	1919.5	0.5	50	100.02	0.0017700	0.500	1.13	56
0.50	1919.0	0.5	13	50.01	0.0017700	0.250	0.71	9
0.00	1918.5		0	0.00	0.0017700		0.00	0



Rating Curves, at Winkelman
Gila River Navigability Study
DEPTH (0 = el. 1918.5)
VELOCITY (ft/sec)
Thousands
FLOW
Depth
Velocity

Cross–section, near Winkelman

Gila River Navigability Study



Appendix G

Flood Frequency Analyses

Gila River Navigability Study

Flood Frequency Analysis, log–Pierson Type III

09/02/96

Location: the Buttes

Data sources: WSP 33, 81, 1313

References: "Water–Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110–134, McGraw–Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380–415, McGraw–Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^ 2	$(\log X - \overline{\log X})$ ^ 3
1891	102000	102.00	1	7.0	77.847	6060.104	2.009	1.070	0.938	0.881	0.827
1897	11793	11.79	2	3.0	−12.360	152.778	1.072	1.070	0.001	0.000	0.000
1896	11708	11.71	3	2.0	−12.445	154.886	1.068	1.070	−0.002	0.000	0.000
1899	10187	10.19	4	1.5	−13.966	195.058	1.008	1.070	−0.062	0.000	−0.000
1890	6330	6.33	5	1.2	−17.823	317.671	0.801	1.070	−0.269	0.004	−0.000
1898	2902	2.90	6	1.0	−21.251	451.619	0.463	1.070	−0.607	0.072	−0.019
										0.369	−0.224
	Sum	144.92					6.421	6.421		1.326	0.583
	Mean	24.15					1.070	1.070		0.221	0.097

K(i) = frequency factor, varies

S.D.(log X) = standard deviation = 0.5149

S.C.(log X) = skew coefficient = 1.2803

K(2) = −0.2070 ,	'log X(2) =	0.964 ,	X(2) = 9.195 ,	Q(2) =	9195 cfs
K(5) = 0.7216 ,	log X(5) =	1.442 ,	X(5) = 27.651 ,	Q(5) =	27651 cfs
K(10) = 1.3392 ,	log X(10) =	1.760 ,	X(10) = 57.509 ,	Q(10) =	57509 cfs
K(25) = 2.1039 ,	log X(25) =	2.154 ,	X(25) = 142.399 ,	Q(25) =	142399 cfs
K(50) = 2.6581 ,	log X(50) =	2.439 ,	X(50) = 274.715 ,	Q(50) =	274715 cfs
K(100) = 3.1988 ,	log X(100) =	2.717 ,	X(100) = 521.562 ,	Q(100) =	521562 cfs

buttes.wk3

Gila River Navigability Study
Flood Frequency Analysis, log–Pierson Type III, total period
Location: near Calva
Data sources: various U.S.G.S. Water Supply Papers
References: "Water–Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110–134, McGraw–Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380–415, McGraw–Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^ 2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^ 2	$(\log X - \overline{\log X})$ ^ 3
1984	150000	150.000	1	64.00	133.966	17947.004	2.176	0.861	1.315	1.729	2.273
1916	100000	100.000	2	32.00	83.966	7050.361	2.000	0.861	1.139	1.297	1.476
1979	100000	100.000	3	21.33	83.966	7050.361	2.000	0.861	1.139	1.297	1.476
1973	80000	80.000	4	16.00	63.966	4091.704	1.903	0.861	1.042	1.085	1.131
1985	53700	53.700	5	12.80	37.666	1418.760	1.730	0.861	0.869	0.755	0.655
1991	46400	46.400	6	10.67	30.366	922.120	1.667	0.861	0.805	0.648	0.522
1967	40000	40.000	7	9.14	23.966	574.390	1.602	0.861	0.741	0.549	0.406
1966	39000	39.000	8	8.00	22.966	527.457	1.591	0.861	0.730	0.533	0.389
1942	27900	27.900	9	7.11	11.866	140.812	1.446	0.861	0.584	0.341	0.199
1932	21500	21.500	10	6.40	5.466	29.882	1.332	0.861	0.471	0.222	0.105
1980	20600	20.600	11	5.82	4.566	20.852	1.314	0.861	0.453	0.205	0.093
1949	19400	19.400	12	5.33	3.366	11.333	1.288	0.861	0.426	0.182	0.078
1978	19000	19.000	13	4.92	2.966	8.800	1.279	0.861	0.417	0.174	0.073
1934	18000	18.000	14	4.57	1.966	3.867	1.255	0.861	0.394	0.155	0.061
1975	15800	15.800	15	4.27	−0.234	0.055	1.199	0.861	0.337	0.114	0.038
1941	14300	14.300	16	4.00	−1.734	3.005	1.155	0.861	0.294	0.086	0.025
1952	13200	13.200	17	3.76	−2.834	8.029	1.121	0.861	0.259	0.067	0.017
1937	12800	12.800	18	3.56	−3.234	10.456	1.107	0.861	0.246	0.060	0.015
1944	12800	12.800	19	3.37	−3.234	10.456	1.107	0.861	0.246	0.060	0.015
1983	10260	10.260	20	3.20	−5.774	33.334	1.011	0.861	0.150	0.022	0.003
1931	9900	9.900	21	3.05	−6.134	37.621	0.996	0.861	0.134	0.018	0.002
1930	9600	9.600	22	2.91	−6.434	41.391	0.982	0.861	0.121	0.015	0.002
1960	9090	9.090	23	2.78	−6.944	48.213	0.959	0.861	0.097	0.009	0.001
1962	9000	9.000	24	2.67	−7.034	49.471	0.954	0.861	0.093	0.009	0.001
1968	8960	8.960	25	2.56	−7.074	50.035	0.952	0.861	0.091	0.008	0.001
1988	7820	7.820	26	2.46	−8.214	67.463	0.893	0.861	0.032	0.001	0.000
1971	7470	7.470	27	2.37	−8.564	73.335	0.873	0.861	0.012	0.000	0.000
1972	7160	7.160	28	2.29	−8.874	78.740	0.855	0.861	−0.006	0.000	−0.000
1986	6720	6.720	29	2.21	−9.314	86.743	0.827	0.861	−0.034	0.001	−0.000
1958	6700	6.700	30	2.13	−9.334	87.116	0.826	0.861	−0.035	0.001	−0.000

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^ 2	log X	$\overline{\log X}$	logX − $\overline{\log X}$	(logX − $\overline{\log X}$) ^ 2	(logX − $\overline{\log X}$) ^ 3
1933	6560	6.560	31	2.06	−9.474	89.749	0.817	0.861	−0.044	0.002	−0.000
1977	6090	6.090	32	2.00	−9.944	98.875	0.785	0.861	−0.077	0.006	−0.000
1936	6000	6.000	33	1.94	−10.034	100.673	0.778	0.861	−0.083	0.007	−0.001
1940	5620	5.620	34	1.88	−10.414	108.442	0.750	0.861	−0.112	0.012	−0.001
1955	4950	4.950	35	1.83	−11.084	122.846	0.695	0.861	−0.167	0.028	−0.005
1965	4700	4.700	36	1.78	−11.334	128.450	0.672	0.861	−0.189	0.036	−0.007
1946	4680	4.680	37	1.73	−11.354	128.904	0.670	0.861	−0.191	0.037	−0.007
1935	4470	4.470	38	1.68	−11.564	133.716	0.650	0.861	−0.211	0.045	−0.009
1938	4310	4.310	39	1.64	−11.724	137.442	0.634	0.861	−0.227	0.051	−0.012
1939	4260	4.260	40	1.60	−11.774	138.617	0.629	0.861	−0.232	0.054	−0.012
1954	4260	4.260	41	1.56	−11.774	138.617	0.629	0.861	−0.232	0.054	−0.012
1956	4240	4.240	42	1.52	−11.794	139.088	0.627	0.861	−0.234	0.055	−0.013
1957	4220	4.220	43	1.49	−11.814	139.560	0.625	0.861	−0.236	0.056	−0.013
1959	3920	3.920	44	1.45	−12.114	146.739	0.593	0.861	−0.268	0.072	−0.019
1943	3710	3.710	45	1.42	−12.324	151.870	0.569	0.861	−0.292	0.085	−0.025
1945	3390	3.390	46	1.39	−12.644	159.860	0.530	0.861	−0.331	0.110	−0.036
1963	3240	3.240	47	1.36	−12.794	163.675	0.511	0.861	−0.351	0.123	−0.043
1950	3210	3.210	48	1.33	−12.824	164.444	0.507	0.861	−0.355	0.126	−0.045
1947	3200	3.200	49	1.31	−12.834	164.701	0.505	0.861	−0.356	0.127	−0.045
1961	3080	3.080	50	1.28	−12.954	167.795	0.489	0.861	−0.373	0.139	−0.052
1964	3060	3.060	51	1.25	−12.974	168.314	0.486	0.861	−0.376	0.141	−0.053
1951	2970	2.970	52	1.23	−13.064	170.657	0.473	0.861	−0.389	0.151	−0.059
1976	2600	2.600	53	1.21	−13.434	180.461	0.415	0.861	−0.446	0.199	−0.089
1948	2570	2.570	54	1.19	−13.464	181.268	0.410	0.861	−0.451	0.204	−0.092
1981	2200	2.200	55	1.16	−13.834	191.368	0.342	0.861	−0.519	0.269	−0.140
1987	2150	2.150	56	1.14	−13.884	192.754	0.332	0.861	−0.529	0.280	−0.148
1953	2040	2.040	57	1.12	−13.994	195.820	0.310	0.861	−0.552	0.304	−0.168
1982	2020	2.020	58	1.10	−14.014	196.380	0.305	0.861	−0.556	0.309	−0.172
1969	1160	1.160	59	1.08	−14.874	221.223	0.064	0.861	−0.797	0.635	−0.506
1974	1160	1.160	60	1.07	−14.874	221.223	0.064	0.861	−0.797	0.635	−0.506
1990	1110	1.110	61	1.05	−14.924	222.713	0.045	0.861	−0.816	0.666	−0.543
1970	982	0.982	62	1.03	−15.052	226.550	−0.008	0.861	−0.869	0.755	−0.657
1989	903	0.903	63	1.02	−15.131	228.934	−0.044	0.861	−0.906	0.820	−0.743
	Sum	1010.115				54.262	54.262			16.236	4.826
	Mean	16.034				0.861	0.861			0.258	0.077

Gila River Navigability Study
Flood Frequency Analysis, log−Pierson Type III, total period
Location: near Calva

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.5117
S.C.(log X) = skew coefficient = 0.5999

K(2) = −0.0990	log X(2) = 0.811	X(2) = 6.466 cfs,	Q(2) =	6466 cfs
K(5) = 0.8000	log X(5) = 1.271	X(5) = 18.650 cfs,	Q(5) =	18650 cfs
K(10) = 1.3280	log X(10) = 1.541	X(10) = 34.744 cfs,	Q(10) =	34744 cfs
K(25) = 1.9390	log X(25) = 1.854	X(25) = 71.376 cfs,	Q(25) =	71376 cfs
K(50) = 2.3590	log X(50) = 2.068	X(50) = 117.079 cfs,	Q(50) =	117079 cfs
K(100) = 2.7549	log X(100) = 2.271	X(100) = 186.670 cfs,	Q(100) :	186670 cfs

log = logarithm, base 10
N = total number of values, X
m = rank of particular value, X
X = particular value of peak flow
X(bar) = X(mean) = mean of all peak flow values
mean = average, or mean, of summed values in column
sum = total of values in column
S.D. = standard deviation = square root of sum of {[log X − log X(bar)]/(N − 1)}
S.C. = skew coefficient = N * sum of [log X − log X(bar)]cubed/[(N−1)(N−2)(S.D. of log X)]
K(i) = constant for recurrence period, function of skew coefficient
log X(i) = log of flow for recurrence period = log X(bar) + K(i)*(S.D. of log X)

Flood Frequency Analysis, log−Pierson Type III, total period of record
Gila River Navigability Study
Location: below Coolidge Dam
Data sources: various U.S.G.S. Water Supply Papers
References: "Water−Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110−134, McGraw−Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380−415, McGraw−Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})^2$	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})^2$	$(\log X - \overline{\log X})^3$
1906	150000	150.000	1	88.00	142.713	20367.11	2.176	0.216	1.960	3.841	7.529
1916	130000	130.000	2	44.00	122.713	15058.58	2.114	0.216	1.898	3.602	6.835
1917	74000	74.000	3	29.33	66.713	4450.68	1.869	0.216	1.653	2.733	4.518
1915	42000	42.000	4	22.00	34.713	1205.02	1.623	0.216	1.407	1.980	2.786
1920	23000	23.000	5	17.60	15.713	246.91	1.362	0.216	1.146	1.312	1.503
1919	16000	16.000	6	14.67	8.713	75.92	1.204	0.216	0.988	0.976	0.964
1924	15100	15.100	7	12.57	7.813	61.05	1.179	0.216	0.963	0.927	0.893
1925	14400	14.400	8	11.00	7.113	50.60	1.158	0.216	0.942	0.888	0.837
1921	14000	14.000	9	9.78	6.713	45.07	1.146	0.216	0.930	0.865	0.804
1923	13500	13.500	10	8.80	6.213	38.61	1.130	0.216	0.914	0.836	0.764
1926	9960	9.960	11	8.00	2.673	7.15	0.998	0.216	0.782	0.612	0.478
1927	9100	9.100	12	7.33	1.813	3.29	0.959	0.216	0.743	0.552	0.410
1918	8630	8.630	13	6.77	1.343	1.80	0.936	0.216	0.720	0.518	0.373
1899	8453	8.453	14	6.29	1.166	1.36	0.927	0.216	0.711	0.505	0.359
1901	8181	8.181	15	5.87	0.894	0.80	0.913	0.216	0.697	0.485	0.338
1914	7400	7.400	16	5.50	0.113	0.01	0.869	0.216	0.653	0.427	0.279
1928	7200	7.200	17	5.18	−0.087	0.01	0.857	0.216	0.641	0.411	0.264
1905	6043	6.043	18	4.89	−1.244	1.55	0.781	0.216	0.565	0.319	0.180
1984	4960	4.960	19	4.63	−2.327	5.41	0.695	0.216	0.479	0.230	0.110
1985	4310	4.310	20	4.40	−2.977	8.86	0.634	0.216	0.418	0.175	0.073
1904	3375	3.375	21	4.19	−3.912	15.30	0.528	0.216	0.312	0.097	0.030
1902	3118	3.118	22	4.00	−4.169	17.38	0.494	0.216	0.278	0.077	0.021
1900	2840	2.840	23	3.83	−4.447	19.77	0.453	0.216	0.237	0.056	0.013
1922	2800	2.800	24	3.67	−4.487	20.13	0.447	0.216	0.231	0.053	0.012
1980	2540	2.540	25	3.52	−4.747	22.53	0.405	0.216	0.189	0.036	0.007
1903	2485	2.485	26	3.38	−4.802	23.06	0.395	0.216	0.179	0.032	0.006
1910	1700	1.700	27	3.26	−5.587	31.21	0.230	0.216	0.014	0.000	0.000
1979	1460	1.460	28	3.14	−5.827	33.95	0.164	0.216	−0.052	0.003	−0.000
1988	1400	1.400	29	3.03	−5.887	34.65	0.146	0.216	−0.070	0.005	−0.000
1987	1370	1.370	30	2.93	−5.917	35.01	0.137	0.216	−0.079	0.006	−0.001
1952	1350	1.350	31	2.84	−5.937	35.24	0.130	0.216	−0.086	0.007	−0.001
1986	1330	1.330	32	2.75	−5.957	35.48	0.124	0.216	−0.092	0.009	−0.001
1981	1300	1.300	33	2.67	−5.987	35.84	0.114	0.216	−0.102	0.010	−0.001
1989	1280	1.280	34	2.59	−6.007	36.08	0.107	0.216	−0.109	0.012	−0.001
1937	1240	1.240	35	2.51	−6.047	36.56	0.093	0.216	−0.123	0.015	−0.002
1942	1130	1.130	36	2.44	−6.157	37.90	0.053	0.216	−0.163	0.027	−0.004
1941	1110	1.110	37	2.38	−6.177	38.15	0.045	0.216	−0.171	0.029	−0.005
1949	1090	1.090	38	2.32	−6.197	38.40	0.037	0.216	−0.179	0.032	−0.006
1991	1080	1.080	39	2.26	−6.207	38.52	0.033	0.216	−0.183	0.033	−0.006
1956	1070	1.070	40	2.20	−6.217	38.65	0.029	0.216	−0.187	0.035	−0.007

1933	1040	1.040	41	2.15	−6.247	39.02	0.017	0.216	−0.199	0.040	−0.008
1943	1040	1.040	42	2.10	−6.247	39.02	0.017	0.216	−0.199	0.040	−0.008
1931	1020	1.020	43	2.05	−6.267	39.27	0.009	0.216	−0.208	0.043	−0.009
1929	1000	1.000	44	2.00	−6.287	39.52	0.000	0.216	−0.216	0.047	−0.010
1974	1000	1.000	45	1.96	−6.287	39.52	0.000	0.216	−0.216	0.047	−0.010
1932	980	0.980	46	1.91	−6.307	39.77	−0.009	0.216	−0.225	0.051	−0.011
1936	980	0.980	47	1.87	−6.307	39.77	−0.009	0.216	−0.225	0.051	−0.011
1930	954	0.954	48	1.83	−6.333	40.10	−0.020	0.216	−0.237	0.056	−0.013
1966	954	0.954	49	1.80	−6.333	40.10	−0.020	0.216	−0.237	0.056	−0.013
1982	942	0.942	50	1.76	−6.345	40.25	−0.026	0.216	−0.242	0.059	−0.014
1983	937	0.937	51	1.73	−6.350	40.32	−0.028	0.216	−0.244	0.060	−0.015
1968	933	0.933	52	1.69	−6.354	40.37	−0.030	0.216	−0.246	0.061	−0.015
1958	924	0.924	53	1.66	−6.363	40.48	−0.034	0.216	−0.250	0.063	−0.016
1975	903	0.903	54	1.63	−6.384	40.75	−0.044	0.216	−0.260	0.068	−0.018
1973	882	0.882	55	1.60	−6.405	41.02	−0.055	0.216	−0.271	0.073	−0.020
1944	861	0.861	56	1.57	−6.426	41.29	−0.065	0.216	−0.281	0.079	−0.022
1960	861	0.861	57	1.54	−6.426	41.29	−0.065	0.216	−0.281	0.079	−0.022
1969	823	0.823	58	1.52	−6.464	41.78	−0.085	0.216	−0.301	0.090	−0.027
1962	811	0.811	59	1.49	−6.476	41.93	−0.091	0.216	−0.307	0.094	−0.029
1978	811	0.811	60	1.47	−6.476	41.93	−0.091	0.216	−0.307	0.094	−0.029
1935	767	0.767	61	1.44	−6.520	42.51	−0.115	0.216	−0.331	0.110	−0.036
1950	726	0.726	62	1.42	−6.561	43.04	−0.139	0.216	−0.355	0.126	−0.045
1970	697	0.697	63	1.40	−6.590	43.42	−0.157	0.216	−0.373	0.139	−0.052
1959	671	0.671	64	1.38	−6.616	43.77	−0.173	0.216	−0.389	0.152	−0.059
1976	668	0.668	65	1.35	−6.619	43.81	−0.175	0.216	−0.391	0.153	−0.060
1967	645	0.645	66	1.33	−6.642	44.11	−0.190	0.216	−0.407	0.165	−0.067
1940	634	0.634	67	1.31	−6.653	44.26	−0.198	0.216	−0.414	0.171	−0.071
1938	620	0.620	68	1.29	−6.667	44.44	−0.208	0.216	−0.424	0.180	−0.076
1939	620	0.620	69	1.28	−6.667	44.44	−0.208	0.216	−0.424	0.180	−0.076
1945	616	0.616	70	1.26	−6.671	44.50	−0.210	0.216	−0.427	0.182	−0.078
1955	611	0.611	71	1.24	−6.676	44.56	−0.214	0.216	−0.430	0.185	−0.080
1963	577	0.577	72	1.22	−6.710	45.02	−0.239	0.216	−0.455	0.207	−0.094
1972	567	0.567	73	1.21	−6.720	45.15	−0.246	0.216	−0.463	0.214	−0.099
1947	551	0.551	74	1.19	−6.736	45.37	−0.259	0.216	−0.475	0.226	−0.107
1954	545	0.545	75	1.17	−6.742	45.45	−0.264	0.216	−0.480	0.230	−0.110
1934	535	0.535	76	1.16	−6.752	45.58	−0.272	0.216	−0.488	0.238	−0.116
1957	509	0.509	77	1.14	−6.778	45.94	−0.293	0.216	−0.509	0.259	−0.132
1965	426	0.426	78	1.13	−6.861	47.07	−0.371	0.216	−0.587	0.344	−0.202
1990	389	0.389	79	1.11	−6.898	47.58	−0.410	0.216	−0.626	0.392	−0.246
1953	373	0.373	80	1.10	−6.914	47.80	−0.428	0.216	−0.644	0.415	−0.268
1948	362	0.362	81	1.09	−6.925	47.95	−0.441	0.216	−0.657	0.432	−0.284
1946	345	0.345	82	1.07	−6.942	48.19	−0.462	0.216	−0.678	0.460	−0.312
1964	335	0.335	83	1.06	−6.952	48.32	−0.475	0.216	−0.691	0.478	−0.330
1951	321	0.321	84	1.05	−6.966	48.52	−0.493	0.216	−0.710	0.504	−0.357
1961	311	0.311	85	1.04	−6.976	48.66	−0.507	0.216	−0.723	0.523	−0.379
1971	300	0.300	86	1.02	−6.987	48.81	−0.523	0.216	−0.739	0.546	−0.404
1977	253	0.253	87	1.01	−7.034	49.47	−0.597	0.216	−0.813	0.661	−0.537
	Sum	633.935				44298.85	18.80			31.89	25.36
	Mean	7.287				509.18	0.22			0.37	0.29

Flood Frequency Analysis, log–Pierson Type III, total period of record
Gila River Navigability Study
Location: below Coolidge Dam

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.6089
S.C.(log X) = skew coefficient = 1.3365

K(2) = −0.2155 ,	log X(2) = 0.085 ,	X(2) = 1.216 ,	Q(2) =	1216 cfs
K(5) = 0.7139 ,	log X(5) = 0.651 ,	X(5) = 4.476 ,	Q(5) =	4476 cfs
K(10) = 1.3383 ,	log X(10) = 1.031 ,	X(10) = 10.742 ,	Q(10) =	10742 cfs
K(25) = 2.1153 ,	log X(25) = 1.504 ,	X(25) = 31.933 ,	Q(25) =	31933 cfs
K(50) = 2.6806 ,	log X(50) = 1.848 ,	X(50) = 70.547 ,	Q(50) =	70547 cfs
K(100) = 3.2329 ,	log X(100) = 2.185 ,	X(100) = 153.039 ,	Q(100) :	153039 cfs

Flood Frequency Analysis, log-Pierson Type III, pre-Coolidge Dam construction

Gila River Navigability Study 09/02/96

Location: below Coolidge Dam

Data sources: various U.S.G.S. Water Supply Papers

References: "Water-Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110-134, McGraw-Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380-415, McGraw-Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \overline{X}$	$(X - \overline{X})$ ^ 2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^ 2	$(\log X - \overline{\log X})$ ^ 3
1906	150000	150.000	1	25.00	126.113	15904.520	2.176	1.031	1.145	1.311	1.500
1916	130000	130.000	2	12.50	106.113	11259.995	2.114	1.031	1.083	1.172	1.269
1917	74000	74.000	3	8.33	50.113	2511.325	1.869	1.031	0.838	0.702	0.588
1915	42000	42.000	4	6.25	18.113	328.085	1.623	1.031	0.592	0.350	0.207
1920	23000	23.000	5	5.00	-0.887	0.787	1.362	1.031	0.330	0.109	0.036
1919	16000	16.000	6	4.17	-7.887	62.203	1.204	1.031	0.173	0.030	0.005
1924	15100	15.100	7	3.57	-8.787	77.209	1.179	1.031	0.148	0.022	0.003
1925	14400	14.400	8	3.13	-9.487	90.001	1.158	1.031	0.127	0.016	0.002
1921	14000	14.000	9	2.78	-9.887	97.750	1.146	1.031	0.115	0.013	0.002
1923	13500	13.500	10	2.50	-10.387	107.887	1.130	1.031	0.099	0.010	0.001
1926	9960	9.960	11	2.27	-13.927	193.958	0.998	1.031	-0.033	0.001	-0.000
1927	9100	9.100	12	2.08	-14.787	218.652	0.959	1.031	-0.072	0.005	-0.000
1918	8630	8.630	13	1.92	-15.257	232.772	0.936	1.031	-0.095	0.009	-0.001
1899	8453	8.453	14	1.79	-15.434	238.204	0.927	1.031	-0.104	0.011	-0.001
1901	8181	8.181	15	1.67	-15.706	246.675	0.913	1.031	-0.119	0.014	-0.002
1914	7400	7.400	16	1.56	-16.487	271.817	0.869	1.031	-0.162	0.026	-0.004
1928	7200	7.200	17	1.47	-16.687	278.452	0.857	1.031	-0.174	0.030	-0.005
1905	6043	6.043	18	1.39	-17.844	318.404	0.781	1.031	-0.250	0.063	-0.016
1904	3375	3.375	19	1.32	-20.512	420.737	0.528	1.031	-0.503	0.253	-0.127
1902	3118	3.118	20	1.25	-20.769	431.346	0.494	1.031	-0.537	0.289	-0.155
1900	2840	2.840	21	1.19	-21.047	442.971	0.453	1.031	-0.578	0.334	-0.193
1922	2800	2.800	22	1.14	-21.087	444.656	0.447	1.031	-0.584	0.341	-0.199
1903	2485	2.485	23	1.09	-21.402	458.040	0.395	1.031	-0.636	0.404	-0.257
1910	1700	1.700	24	1.04	-22.187	492.257	0.230	1.031	-0.801	0.641	-0.514
	Sum	573.285				35128.705	24.752			6.158	2.139
	Mean	23.887				1463.696	1.031			0.257	0.089

K(i) = frequency factor, varies

S.D.(log X) = standard deviation = 0.5174

S.C.(log X) = skew coefficient = 0.7323

K(2) = -0.1212	log X(2) = 0.969	X(2) = 9.303 ,	Q(2) =	9303 cfs
K(5) = 0.7868	log X(5) = 1.438	X(5) = 27.442 ,	Q(2) =	27442 cfs
K(10) = 1.3340	log X(10) = 1.722	X(10) = 52.668 ,	Q(2) =	52668 cfs
K(25) = 1.9754	log X(25) = 2.053	X(25) = 113.088 ,	Q(2) =	113088 cfs
K(50) = 2.4219	log X(50) = 2.284	X(50) = 192.505 ,	Q(2) =	192505 cfs
K(100) = 2.8456	log X(100) = 2.504	X(100) = 318.911 ,	Q(2) =	318911 cfs

Flood Frequency Analysis, log – Pierson Type III, total period of record
Gila River Navigability Study
Location: Dome
Data sources: includes WSP 918 data
References: "Water – Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110 – 134, McGraw – Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380 – 415, McGraw – Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})^2$	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})^2$	$(\log X - \overline{\log X})^3$
1916	200000	200.000	1	81.0	184.884	34182.155	2.301	0.339	1.962	3.849	7.552
1920	95000	95.000	2	40.5	79.884	6381.480	1.978	0.339	1.639	2.685	4.400
1905	95000	95.000	3	27.0	79.884	6381.480	1.978	0.339	1.639	2.685	4.400
1906	95000	95.000	4	20.3	79.884	6381.480	1.978	0.339	1.639	2.685	4.400
1915	80000	80.000	5	16.2	64.884	4209.955	1.903	0.339	1.564	2.446	3.826
1909	62500	62.500	6	13.5	47.384	2245.259	1.796	0.339	1.457	2.122	3.092
1927	61000	61.000	7	11.6	45.884	2105.357	1.785	0.339	1.446	2.092	3.025
1907	50000	50.000	8	10.1	34.884	1216.905	1.699	0.339	1.360	1.849	2.515
1924	46500	46.500	9	9.0	31.384	984.966	1.667	0.339	1.328	1.765	2.344
1910	45000	45.000	10	8.1	29.884	893.063	1.653	0.339	1.314	1.727	2.269
1917	40000	40.000	11	7.4	24.884	619.222	1.602	0.339	1.263	1.595	2.015
1908	37500	37.500	12	6.8	22.384	501.051	1.574	0.339	1.235	1.525	1.883
1922	36800	36.800	13	6.2	21.684	470.203	1.566	0.339	1.227	1.505	1.846
1918	30900	30.900	14	5.8	15.784	249.140	1.490	0.339	1.151	1.325	1.524
1921	25000	25.000	15	5.4	9.884	97.697	1.398	0.339	1.059	1.121	1.187
1932	20700	20.700	16	5.1	5.584	31.183	1.316	0.339	0.977	0.954	0.932
1926	20000	20.000	17	4.8	4.884	23.855	1.301	0.339	0.962	0.925	0.890
1941	14000	14.000	18	4.5	−1.116	1.245	1.146	0.339	0.807	0.651	0.526
1931	11400	11.400	19	4.3	−3.716	13.807	1.057	0.339	0.718	0.515	0.370
1912	10000	10.000	20	4.1	−5.116	26.172	1.000	0.339	0.661	0.437	0.289
1938	8670	8.670	21	3.9	−6.446	41.549	0.938	0.339	0.599	0.359	0.215
1937	8530	8.530	22	3.7	−6.586	43.373	0.931	0.339	0.592	0.350	0.207
1923	8000	8.000	23	3.5	−7.116	50.635	0.903	0.339	0.564	0.318	0.179
1914	8000	8.000	24	3.4	−7.116	50.635	0.903	0.339	0.564	0.318	0.179
1925	6500	6.500	25	3.2	−8.616	74.233	0.813	0.339	0.474	0.225	0.106
1963	4820	4.820	26	3.1	−10.296	106.004	0.683	0.339	0.344	0.118	0.041
1904	4560	4.560	27	3.0	−10.556	111.426	0.659	0.339	0.320	0.102	0.033
1989	4290	4.290	28	2.9	−10.826	117.199	0.632	0.339	0.293	0.086	0.025
1980	4080	4.080	29	2.8	−11.036	121.790	0.611	0.339	0.272	0.074	0.020
1981	4050	4.050	30	2.7	−11.066	122.453	0.607	0.339	0.268	0.072	0.019
1930	3600	3.600	31	2.6	−11.516	132.614	0.556	0.339	0.217	0.047	0.010
1985	3590	3.590	32	2.5	−11.526	132.845	0.555	0.339	0.216	0.047	0.010
1911	3500	3.500	33	2.5	−11.616	134.928	0.544	0.339	0.205	0.042	0.009
1983	3360	3.360	34	2.4	−11.756	138.200	0.526	0.339	0.187	0.035	0.007
1979	3330	3.330	35	2.3	−11.786	138.906	0.522	0.339	0.183	0.034	0.006
1984	3330	3.330	36	2.3	−11.786	138.906	0.522	0.339	0.183	0.034	0.006
1919	3000	3.000	37	2.2	−12.116	146.793	0.477	0.339	0.138	0.019	0.003
1990	2840	2.840	38	2.1	−12.276	150.696	0.453	0.339	0.114	0.013	0.001
1913	2500	2.500	39	2.1	−12.616	159.159	0.398	0.339	0.059	0.003	0.000
1982	2320	2.320	40	2.0	−12.796	163.733	0.365	0.339	0.026	0.001	0.000
1960	2130	2.130	41	2.0	−12.986	168.632	0.328	0.339	−0.011	0.000	−0.000
1903	2000	2.000	42	1.9	−13.116	172.025	0.301	0.339	−0.038	0.001	−0.000
1977	1970	1.970	43	1.9	−13.146	172.813	0.294	0.339	−0.045	0.002	−0.000

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	X − $\bar{X}$	(X − $\bar{X}$)^2	log X	$\overline{\log X}$	logX − $\overline{\log X}$	(logX − $\overline{\log X}$)^2	(logX − $\overline{\log X}$)^3
1971	1870	1.870	44	1.8	−13.246	175.452	0.272	0.339	−0.067	0.005	−0.000
1929	1500	1.500	45	1.8	−13.616	185.391	0.176	0.339	−0.163	0.027	−0.004
1928	1400	1.400	46	1.8	−13.716	188.124	0.146	0.339	−0.193	0.037	−0.007
1973	1380	1.380	47	1.7	−13.736	188.673	0.140	0.339	−0.199	0.040	−0.008
1951	1100	1.100	48	1.7	−14.016	196.444	0.041	0.339	−0.298	0.089	−0.026
1955	1070	1.070	49	1.7	−14.046	197.285	0.029	0.339	−0.310	0.096	−0.030
1939	905	0.905	50	1.6	−14.211	201.948	−0.043	0.339	−0.382	0.146	−0.056
1959	802	0.802	51	1.6	−14.314	204.886	−0.096	0.339	−0.435	0.189	−0.082
1933	770	0.770	52	1.6	−14.346	205.803	−0.114	0.339	−0.453	0.205	−0.093
1935	757	0.757	53	1.5	−14.359	206.176	−0.121	0.339	−0.460	0.212	−0.097
1987	726	0.726	54	1.5	−14.390	207.067	−0.139	0.339	−0.478	0.229	−0.109
1958	719	0.719	55	1.5	−14.397	207.269	−0.143	0.339	−0.482	0.233	−0.112
1986	694	0.694	56	1.4	−14.422	207.989	−0.159	0.339	−0.498	0.248	−0.123
1991	671	0.671	57	1.4	−14.445	208.653	−0.173	0.339	−0.512	0.263	−0.134
1966	618	0.618	58	1.4	−14.498	210.187	−0.209	0.339	−0.548	0.300	−0.165
1976	418	0.418	59	1.4	−14.698	216.026	−0.379	0.339	−0.718	0.515	−0.370
1947	380	0.380	60	1.4	−14.736	217.145	−0.420	0.339	−0.759	0.577	−0.438
1974	334	0.334	61	1.3	−14.782	218.503	−0.476	0.339	−0.815	0.665	−0.542
1952	293	0.293	62	1.3	−14.823	219.716	−0.533	0.339	−0.872	0.761	−0.664
1968	285	0.285	63	1.3	−14.831	219.954	−0.545	0.339	−0.884	0.782	−0.691
1978	264	0.264	64	1.3	−14.852	220.577	−0.578	0.339	−0.917	0.842	−0.772
1988	238	0.238	65	1.2	−14.878	221.350	−0.623	0.339	−0.963	0.926	−0.892
1969	234	0.234	66	1.2	−14.882	221.469	−0.631	0.339	−0.970	0.941	−0.912
1965	213	0.213	67	1.2	−14.903	222.094	−0.672	0.339	−1.011	1.022	−1.032
1934	200	0.200	68	1.2	−14.916	222.482	−0.699	0.339	−1.038	1.078	−1.119
1970	187	0.187	69	1.2	−14.929	222.870	−0.728	0.339	−1.067	1.139	−1.216
1961	168	0.168	70	1.2	−14.948	223.438	−0.775	0.339	−1.114	1.240	−1.382
1967	130	0.130	71	1.1	−14.986	224.575	−0.886	0.339	−1.225	1.501	−1.839
1972	113	0.113	72	1.1	−15.003	225.085	−0.947	0.339	−1.286	1.654	−2.127
1962	100	0.100	73	1.1	−15.016	225.475	−1.000	0.339	−1.339	1.793	−2.401
1956	86	0.086	74	1.1	−15.030	225.896	−1.066	0.339	−1.405	1.973	−2.771
1975	85	0.085	75	1.1	−15.031	225.926	−1.071	0.339	−1.410	1.987	−2.801
1957	66	0.066	76	1.1	−15.050	226.497	−1.180	0.339	−1.520	2.309	−3.509
1954	56	0.056	77	1.1	−15.060	226.799	−1.252	0.339	−1.591	2.531	−4.026
1953	47	0.047	78	1.0	−15.069	227.070	−1.328	0.339	−1.667	2.779	−4.632
1964	1.8	0.002	79	1.0	−15.114	228.434	−2.745	0.339	−3.084	9.510	−29.327
1940	0		80								
1942	0		81								
1936	0		82								
1949	0		83								
1948	0		84								
1946	0		85								
1943	0		86								
1950	0		87								
1945	0		88								
1944	0		89								
	Sum	1194.151			0.000	77477.950	26.787			75.599	−14.147
	Mean	15.116			0.000	980.734	0.339			0.957	−0.179

Flood Frequency Analysis, log – Pierson Type III, total period of record
Gila River Navigability Study
Location: Dome

09/02/96

Flood Frequency Analysis, log – Pierson Type III, total period of record
Gila River Navigability Study
Location: Dome

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.9845
S.C.(log X) = skew coefficient = −0.1950

K(2) =	0.0322 , log X(2) =	0.371 , X(2) =	2.348 cfs,	Q(2) =	2348 cfs
K(5) =	0.8498 , log X(5) =	1.176 , X(5) =	14.987 cfs,	Q(5) =	14987 cfs
K(10) =	1.2586 , log X(10) =	1.578 , X(10) =	37.858 cfs,	Q(10) =	37858 cfs
K(25) =	1.6818 , log X(25) =	1.995 , X(25) =	98.809 cfs,	Q(25) =	98809 cfs
K(50) =	1.9478 , log X(50) =	2.257 , X(50) =	180.580 cfs,	Q(50) =	180580 cfs
K(100) =	2.1817 , log X(100) =	2.487 , X(100) =	306.862 cfs,	Q(100) :	306862 cfs

Flood Frequency Analysis, log−Pierson Type III, prior to Roosevelt Dam
Gila River Navigability Study
Location: Dome
Data sources: includes flow data published in U.S.G.S. Water Supply Paper 918
References: "Water−Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110−134, McGraw−Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380−415, McGraw−Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^ 2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^ 2	$(\log X - \overline{\log X})$ ^ 3
1905	95000	95.000	1	10.00	51.104	2611.664	1.978	1.354	0.624	0.390	0.243
1906	95000	95.000	2	5.00	51.104	2611.664	1.978	1.354	0.624	0.390	0.243
1909	62500	62.500	3	3.33	18.604	346.125	1.796	1.354	0.442	0.196	0.087
1907	50000	50.000	4	2.50	6.104	37.264	1.699	1.354	0.345	0.119	0.041
1910	45000	45.000	5	2.00	1.104	1.220	1.653	1.354	0.300	0.090	0.027
1908	37500	37.500	6	1.67	−6.396	40.903	1.574	1.354	0.221	0.049	0.011
1904	4560	4.560	7	1.43	−39.336	1547.286	0.659	1.354	−0.695	0.482	−0.335
1911	3500	3.500	8	1.25	−40.396	1631.801	0.544	1.354	−0.809	0.655	−0.530
1903	2000	2.000	9	1.11	−41.896	1755.238	0.301	1.354	−1.052	1.108	−1.166
	Sum	395.06					12.18			3.48	−1.38
	Mean	43.90					1.35			0.39	−0.15

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.6594
S.C.(log X) = skew coefficient = −0.7733

K(2) =	0.1277 ,	log X(2) =	1.438 ,	X(2) =	27.398 ,	Q(2) =	27398 cfs
K(5) =	0.8563 ,	log X(5) =	1.918 ,	X(5) =	82.818 ,	Q(5) =	82818 cfs
K(10) =	1.1705 ,	log X(10) =	2.125 ,	X(10) =	133.443 ,	Q(10) =	133443 cfs
K(25) =	1.4587 ,	log X(25) =	2.315 ,	X(25) =	206.692 ,	Q(25) =	206692 cfs
K(50) =	1.6189 ,	log X(50) =	2.421 ,	X(50) =	263.605 ,	Q(50) =	263605 cfs
K(100) =	1.7525 ,	log X(100) =	2.509 ,	X(100) =	322.883 ,	Q(100) :	322883 cfs

dome.wk3

Flood Frequency Analysis, log–Pierson Type III, post–Roosevelt Dam & pre–Coolidge Dam 09/02/96
Gila River Navigability Study
Location: Dome
Data sources: includes flow data published in WSP 918
References: "Water–Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110–134, McGraw–Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380–415, McGraw–Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})^2$	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})^2$	$(\log X - \overline{\log X})^3$
1916	200000	200.000	1	19.00	198.600	39442.0	2.301	1.232	1.069	1.143	1.222
1920	95000	95.000	2	9.50	93.600	8761.0	1.978	1.232	0.746	0.556	0.415
1915	80000	80.000	3	6.33	78.600	6178.0	1.903	1.232	0.671	0.450	0.302
1927	61000	61.000	4	4.75	59.600	3552.2	1.785	1.232	0.553	0.306	0.169
1924	46500	46.500	5	3.80	45.100	2034.0	1.667	1.232	0.435	0.190	0.083
1917	40000	40.000	6	3.17	38.600	1490.0	1.602	1.232	0.370	0.137	0.051
1922	36800	36.800	7	2.71	35.400	1253.2	1.566	1.232	0.334	0.111	0.037
1918	30900	30.900	8	2.38	29.500	870.3	1.490	1.232	0.258	0.067	0.017
1921	25000	25.000	9	2.11	23.600	557.0	1.398	1.232	0.166	0.028	0.005
1926	20000	20.000	10	1.90	18.600	346.0	1.301	1.232	0.069	0.005	0.000
1912	10000	10.000	11	1.73	8.600	74.0	1.000	1.232	−0.232	0.054	−0.012
1923	8000	8.000	12	1.58	6.600	43.6	0.903	1.232	−0.329	0.108	−0.036
1914	8000	8.000	13	1.46	6.600	43.6	0.903	1.232	−0.329	0.108	−0.036
1925	6500	6.500	14	1.36	5.100	26.0	0.813	1.232	−0.419	0.176	−0.074
1911	3500	3.500	15	1.27	2.100	4.4	0.544	1.232	−0.688	0.473	−0.326
1919	3000	3.000	16	1.19	1.600	2.6	0.477	1.232	−0.755	0.570	−0.430
1913	2500	2.500	17	1.12	1.100	1.2	0.398	1.232	−0.834	0.696	−0.580
1928	1400	1.400	18	1.06	0.000	0.0	0.146	1.232	−1.086	1.179	−1.280
	Sum	678.100					22.176			6.356	−0.473
	Mean	37.672					1.232			0.353	−0.C26

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.6115
S.C.(log X) = skew coefficient = −0.1369

K(2) =	0.0229 ,	log X(2) =	1.246 ,	X(2) =	17.619 ,	Q(2) =	17619 cfs
K(5) =	0.8475 ,	log X(5) =	1.750 ,	X(5) =	56.260 ,	Q(5) =	56260 cfs
K(10) =	1.2656 ,	log X(10) =	2.006 ,	X(10) =	101.357 ,	Q(10) =	101357 cfs
K(25) =	1.7027 ,	log X(25) =	2.273 ,	X(25) =	187.552 ,	Q(25) =	187552 cfs
K(50) =	1.9797 ,	log X(50) =	2.442 ,	X(50) =	277.011 ,	Q(50) =	277011 cfs
K(100) =	2.2247 ,	log X(100) =	2.592 ,	X(100) =	391.115 ,	Q(100) :	391115 cfs

dome.wk3

Flood Frequency Analysis, log – Pierson Type III
Gila River Navigability Study
Location: Guthrie (near Clifton)
Data sources: various U.S.G.S. Water Supply Papers
References: "Water – Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110 – 134, McGraw – Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380 – 415, McGraw – Hill Book Company, New York, 1987

Water Year	Peak flow x,(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^2	$(\log X - \overline{\log X})$ ^3
1979	57000	57.000	1	70.0	48.434	2345.845	1.756	0.759	0.996	0.993	0.989
1985	48800	48.800	2	35.0	40.234	1618.769	1.688	0.759	0.929	0.863	0.802
1973	33000	33.000	3	23.3	24.434	597.017	1.519	0.759	0.759	0.576	0.437
1941	28200	28.200	4	17.5	19.634	385.491	1.450	0.759	0.691	0.477	0.330
1912	21000	21.000	5	14.0	12.434	154.603	1.322	0.759	0.563	0.317	0.178
1917	19500	19.500	6	11.7	10.934	119.551	1.290	0.759	0.531	0.282	0.149
1934	17000	17.000	7	10.0	8.434	71.131	1.230	0.759	0.471	0.222	0.104
1911	16000	16.000	8	8.8	7.434	55.263	1.204	0.759	0.445	0.198	0.088
1984	15300	15.300	9	7.8	6.734	45.346	1.185	0.759	0.425	0.181	0.077
1949	13900	13.900	10	7.0	5.334	28.451	1.143	0.759	0.384	0.147	0.056
1929	13200	13.200	11	6.4	4.634	21.473	1.121	0.759	0.361	0.130	0.047
1956	12700	12.700	12	5.8	4.134	17.089	1.104	0.759	0.344	0.119	0.041
1915	12000	12.000	13	5.4	3.434	11.792	1.079	0.759	0.320	0.102	0.033
1967	11100	11.100	14	5.0	2.534	6.421	1.045	0.759	0.286	0.082	0.023
1966	10700	10.700	15	4.7	2.134	4.554	1.029	0.759	0.270	0.073	0.020
1955	9450	9.450	16	4.4	0.884	0.781	0.975	0.759	0.216	0.047	0.010
1962	8980	8.980	17	4.1	0.414	0.171	0.953	0.759	0.194	0.038	0.007
1939	8670	8.670	18	3.9	0.104	0.011	0.938	0.759	0.179	0.032	0.006
1980	8500	8.500	19	3.7	−0.066	0.004	0.929	0.759	0.170	0.029	0.005
1978	8420	8.420	20	3.5	−0.146	0.021	0.925	0.759	0.166	0.028	0.005
1981	8190	8.190	21	3.3	−0.376	0.141	0.913	0.759	0.154	0.024	0.004
1957	8070	8.070	22	3.2	−0.496	0.246	0.907	0.759	0.147	0.022	0.003
1916	7600	7.600	23	3.0	−0.966	0.933	0.881	0.759	0.121	0.015	0.002
1937	7450	7.450	24	2.9	−1.116	1.246	0.872	0.759	0.113	0.013	0.001
1931	6900	6.900	25	2.8	−1.666	2.776	0.839	0.759	0.079	0.006	0.001
1943	6770	6.770	26	2.7	−1.796	3.226	0.831	0.759	0.071	0.005	0.000
1988	6710	6.710	27	2.6	−1.856	3.445	0.827	0.759	0.067	0.005	0.000
1930	6300	6.300	28	2.5	−2.266	5.135	0.799	0.759	0.040	0.002	0.000
1940	6300	6.300	29	2.4	−2.266	5.135	0.799	0.759	0.040	0.002	0.000
1986	6270	6.270	30	2.3	−2.296	5.272	0.797	0.759	0.038	0.001	0.000
1972	6160	6.160	31	2.3	−2.406	5.789	0.790	0.759	0.030	0.001	0.000
1954	6000	6.000	32	2.2	−2.566	6.585	0.778	0.759	0.019	0.000	0.000
1938	5930	5.930	33	2.1	−2.636	6.949	0.773	0.759	0.014	0.000	0.000
1946	5800	5.800	34	2.1	−2.766	7.651	0.763	0.759	0.004	0.000	0.000

Water Year	Peak flow x,(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval tp,yr	$X - \bar{X}$	$(X - \bar{X})^2$	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})^2$	$(\log X - \overline{\log X})^3$
1914	5700	5.700	35	2.0	−2.866	8.214	0.756	0.759	−0.004	0.000	−0.000
1959	5610	5.610	36	1.9	−2.956	8.738	0.749	0.759	−0.010	0.000	−0.000
1964	5070	5.070	37	1.9	−3.496	12.223	0.705	0.759	−0.054	0.003	−0.000
1971	5010	5.010	38	1.8	−3.556	12.646	0.700	0.759	−0.060	0.004	−0.000
1983	4980	4.980	39	1.8	−3.586	12.860	0.697	0.759	−0.062	0.004	−0.000
1975	4660	4.660	40	1.8	−3.906	15.257	0.668	0.759	−0.091	0.008	−0.001
1951	4600	4.600	41	1.7	−3.966	15.730	0.663	0.759	−0.097	0.009	−0.001
1945	4540	4.540	42	1.7	−4.026	16.209	0.657	0.759	−0.102	0.010	−0.001
1982	4520	4.520	43	1.6	−4.046	16.371	0.655	0.759	−0.104	0.011	−0.001
1932	4500	4.500	44	1.6	−4.066	16.533	0.653	0.759	−0.106	0.011	−0.001
1968	4380	4.380	45	1.6	−4.186	17.523	0.641	0.759	−0.118	0.014	−0.002
1936	4300	4.300	46	1.5	−4.266	18.199	0.633	0.759	−0.126	0.016	−0.002
1952	4280	4.280	47	1.5	−4.286	18.370	0.631	0.759	−0.128	0.016	−0.002
1970	4220	4.220	48	1.5	−4.346	18.888	0.625	0.759	−0.134	0.018	−0.002
1933	4000	4.000	49	1.4	−4.566	20.849	0.602	0.759	−0.157	0.025	−0.004
1960	4000	4.000	50	1.4	−4.566	20.849	0.602	0.759	−0.157	0.025	−0.004
1958	3980	3.980	51	1.4	−4.586	21.032	0.600	0.759	−0.160	0.025	−0.004
1953	3700	3.700	52	1.3	−4.866	23.679	0.568	0.759	−0.191	0.037	−0.007
1969	3610	3.610	53	1.3	−4.956	24.563	0.558	0.759	−0.202	0.041	−0.008
1963	3580	3.580	54	1.3	−4.986	24.861	0.554	0.759	−0.206	0.042	−0.009
1974	3460	3.460	55	1.3	−5.106	26.072	0.539	0.759	−0.220	0.049	−0.011
1965	3310	3.310	56	1.3	−5.256	27.626	0.520	0.759	−0.240	0.057	−0.014
1942	3280	3.280	57	1.2	−5.286	27.943	0.516	0.759	−0.244	0.059	−0.014
1935	3100	3.100	58	1.2	−5.466	29.878	0.491	0.759	−0.268	0.072	−0.019
1987	3020	3.020	59	1.2	−5.546	30.759	0.480	0.759	−0.279	0.078	−0.022
1977	2820	2.820	60	1.2	−5.746	33.017	0.450	0.759	−0.309	0.096	−0.030
1928	2780	2.780	61	1.1	−5.786	33.479	0.444	0.759	−0.315	0.099	−0.031
1944	2610	2.610	62	1.1	−5.956	35.475	0.417	0.759	−0.343	0.118	−0.040
1961	2400	2.400	63	1.1	−6.166	38.020	0.380	0.759	−0.379	0.144	−0.055
1976	2390	2.390	64	1.1	−6.176	38.144	0.378	0.759	−0.381	0.145	−0.055
1950	1680	1.680	65	1.1	−6.886	47.418	0.225	0.759	−0.534	0.285	−0.152
1913	1200	1.200	66	1.1	−7.366	54.259	0.079	0.759	−0.680	0.463	−0.315
1948	1090	1.090	67	1.0	−7.476	55.892	0.037	0.759	−0.722	0.521	−0.376
1989	620	0.620	68	1.0	−7.946	63.140	−0.208	0.759	−0.967	0.935	−0.904
1947	189	0.189	69	1.0	−8.377	70.175	−0.724	0.759	−1.483	2.199	−3.261
	Sum	591.06				6493.205	52.402			10.668	−1.931
	Mean	8.57				94.104	0.759				

Flood Frequency Analysis, log – Pierson Type III
Location: Guthrie (near Clifton)

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.3961
S.C.(log X) = skew coefficient = −0.4707

K(2) =	0.078 ,	log X(2) =	0.790 ,	X(2) =	6.171 cfs ,	Q(2) =	6171 cfs
K(5) =	0.856 ,	log X(5) =	1.099 ,	X(5) =	12.546 cfs ,	Q(5) =	12546 cfs
K(10)	1.220 ,	log X(10) =	1.243 ,	X(10) =	17.486 cfs ,	Q(10) =	17486 cfs
K(25)	1.578 ,	log X(25) =	1.384 ,	X(25) =	24.237 cfs ,	Q(25) =	24237 cfs
K(50)	1.794 ,	log X(50) =	1.470 ,	X(50) =	29.515 cfs ,	Q(50) =	29515 cfs
K(100)	1.977 ,	log X(100) =	1.543 ,	X(100) =	34.876 cfs ,	Q(100) =	34876 cfs

Flood Frequency Analysis, log-Pierson Type III, total period
Gila River Navigability Study
Location: near Kelvin
Data sources: various U.S.G.S. Water Supply Papers
References: "Water-Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110-134, McGraw-Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380-415, McGraw-Hill Book Company, New York, 1987

Water Year	x(cfs)	Peak flow X,(cfs) x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^ 2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^ 2	$(\log X - \overline{\log X})$ ^ 3
1906	190000	190.000	1	83.0	171.216	29314.927	2.279	0.997	1.282	1.643	2.105
1916	132000	132.000	2	41.5	113.216	12817.868	2.121	0.997	1.123	1.262	1.418
1891	102000	102.000	3	27.7	83.216	6924.907	2.009	0.997	1.012	1.023	1.035
1984	100000	100.000	4	20.8	81.216	6596.043	2.000	0.997	1.003	1.006	1.009
1926	82000	82.000	5	16.6	63.216	3996.266	1.914	0.997	0.917	0.840	0.770
1915	67300	67.300	6	13.8	48.516	2353.805	1.828	0.997	0.831	0.690	0.574
1917	55000	55.000	7	11.9	36.216	1311.600	1.740	0.997	0.743	0.552	0.411
1930	42800	42.800	8	10.4	24.016	576.769	1.631	0.997	0.634	0.402	0.255
1940	38200	38.200	9	9.2	19.416	376.982	1.582	0.997	0.585	0.342	0.200
1912	35000	35.000	10	8.3	16.216	262.959	1.544	0.997	0.547	0.299	0.164
1931	28600	28.600	11	7.5	9.816	96.354	1.456	0.997	0.459	0.211	0.097
1944	28000	28.000	12	6.9	9.216	84.935	1.447	0.997	0.450	0.203	0.091
1968	27700	27.700	13	6.4	8.916	79.495	1.442	0.997	0.445	0.198	0.088
1979	27000	27.000	14	5.9	8.216	67.503	1.431	0.997	0.434	0.189	0.082
1966	26300	26.300	15	5.5	7.516	56.491	1.420	0.997	0.423	0.179	0.076
1920	25800	25.800	16	5.2	7.016	49.225	1.412	0.997	0.415	0.172	0.071
1921	24000	24.000	17	4.9	5.216	27.207	1.380	0.997	0.383	0.147	0.056
1941	23300	23.300	18	4.6	4.516	20.394	1.367	0.997	0.370	0.137	0.051
1935	21000	21.000	19	4.4	2.216	4.911	1.322	0.997	0.325	0.106	0.034
1919	20800	20.800	20	4.2	2.016	4.064	1.318	0.997	0.321	0.103	0.033
1914	18000	18.000	21	4.0	−0.784	0.615	1.255	0.997	0.258	0.067	0.017
1954	17800	17.800	22	3.8	−0.984	0.968	1.250	0.997	0.253	0.064	0.016
1978	16100	16.100	23	3.6	−2.684	7.204	1.207	0.997	0.210	0.044	0.009
1918	15100	15.100	24	3.5	−3.684	13.572	1.179	0.997	0.182	0.033	0.006
1951	13200	13.200	25	3.3	−5.584	31.181	1.121	0.997	0.123	0.015	0.002
1932	12800	12.800	26	3.2	−5.984	35.808	1.107	0.997	0.110	0.012	0.001
1911	12700	12.700	27	3.1	−6.084	37.015	1.104	0.997	0.107	0.011	0.001
1936	12600	12.600	28	3.0	−6.184	38.242	1.100	0.997	0.103	0.011	0.001
1928	12000	12.000	29	2.9	−6.784	46.022	1.079	0.997	0.082	0.007	0.001
1924	11700	11.700	30	2.8	−7.084	50.183	1.068	0.997	0.071	0.005	0.000
1923	11700	11.700	31	2.7	−7.084	50.183	1.068	0.997	0.071	0.005	0.000
1929	11600	11.600	32	2.6	−7.184	51.610	1.064	0.997	0.067	0.005	0.000
1925	11200	11.200	33	2.5	−7.584	57.517	1.049	0.997	0.052	0.003	0.000
1960	11200	11.200	34	2.4	−7.584	57.517	1.049	0.997	0.052	0.003	0.000
1991	11100	11.100	35	2.4	−7.684	59.043	1.045	0.997	0.048	0.002	0.000
1973	10300	10.300	36	2.3	−8.484	71.978	1.013	0.997	0.016	0.000	0.000
1937	10200	10.200	37	2.2	−8.584	73.685	1.009	0.997	0.012	0.000	0.000
1947	10000	10.000	38	2.2	−8.784	77.158	1.000	0.997	0.003	0.000	0.000
1955	9860	9.860	39	2.1	−8.924	79.637	0.994	0.997	−0.003	0.000	−0.000
1961	9600	9.600	40	2.1	−9.184	84.345	0.982	0.997	−0.015	0.000	−0.000

Water Year	Peak flow x(cfs)	Peak flow X,(cfs) x/1000	Rank m	Recurrence interval Tp,yr	X – X̄	(X – X̄) ^ 2	log X	$\overline{\log X}$	logX – $\overline{\log X}$	(logX – $\overline{\log X}$) ^ 2	(logX – $\overline{\log X}$) ^ 3
1939	9320	9.320	41	2.0	−9.464	89.567	0.969	0.997	−0.028	0.001	−0.000
1945	9200	9.200	42	2.0	−9.584	91.853	0.964	0.997	−0.033	0.001	−0.000
1933	8800	8.800	43	1.9	−9.984	99.680	0.944	0.997	−0.053	0.003	−0.000
1927	8570	8.570	44	1.9	−10.214	104.325	0.933	0.997	−0.064	0.004	−0.000
1980	6950	6.950	45	1.8	−11.834	140.043	0.842	0.997	−0.155	0.024	−0.004
1950	6920	6.920	46	1.8	−11.864	140.754	0.840	0.997	−0.157	0.025	−0.004
1934	6750	6.750	47	1.8	−12.034	144.817	0.829	0.997	−0.168	0.028	−0.005
1970	6600	6.600	48	1.7	−12.184	148.449	0.820	0.997	−0.178	0.032	−0.006
1946	6440	6.440	49	1.7	−12.344	152.374	0.809	0.997	−0.188	0.035	−0.007
1943	6290	6.290	50	1.7	−12.494	156.099	0.799	0.997	−0.198	0.039	−0.008
1985	6150	6.150	51	1.6	−12.634	159.617	0.789	0.997	−0.208	0.043	−0.009
1959	5930	5.930	52	1.6	−12.854	165.225	0.773	0.997	−0.224	0.050	−0.011
1963	5880	5.880	53	1.6	−12.904	166.513	0.769	0.997	−0.228	0.052	−0.012
1948	5850	5.850	54	1.5	−12.934	167.288	0.767	0.997	−0.230	0.053	−0.012
1969	5800	5.800	55	1.5	−12.984	168.584	0.763	0.997	−0.234	0.055	−0.013
1938	5660	5.660	56	1.5	−13.124	172.239	0.753	0.997	−0.244	0.060	−0.015
1949	5610	5.610	57	1.5	−13.174	173.554	0.749	0.997	−0.248	0.062	−0.015
1952	5430	5.430	58	1.4	−13.354	178.329	0.735	0.997	−0.262	0.069	−0.018
1958	5310	5.310	59	1.4	−13.474	181.548	0.725	0.997	−0.272	0.074	−0.020
1990	5120	5.120	60	1.4	−13.664	186.704	0.709	0.997	−0.288	0.083	−0.024
1965	4980	4.980	61	1.4	−13.804	190.550	0.697	0.997	−0.300	0.090	−0.027
1962	4910	4.910	62	1.3	−13.874	192.487	0.691	0.997	−0.306	0.094	−0.029
1957	4540	4.540	63	1.3	−14.244	202.891	0.657	0.997	−0.340	0.116	−0.039
1983	4490	4.490	64	1.3	−14.294	204.318	0.652	0.997	−0.345	0.119	−0.041
1913	4400	4.400	65	1.3	−14.384	206.899	0.643	0.997	−0.354	0.125	−0.044
1986	4270	4.270	66	1.3	−14.514	210.655	0.630	0.997	−0.367	0.134	−0.049
1967	4220	4.220	67	1.2	−14.564	212.109	0.625	0.997	−0.372	0.138	−0.051
1953	4210	4.210	68	1.2	−14.574	212.401	0.624	0.997	−0.373	0.139	−0.052
1964	4150	4.150	69	1.2	−14.634	214.153	0.618	0.997	−0.379	0.144	−0.054
1988	4080	4.080	70	1.2	−14.704	216.207	0.611	0.997	−0.386	0.149	−0.058
1972	3930	3.930	71	1.2	−14.854	220.641	0.594	0.997	−0.403	0.162	−0.065
1974	3880	3.880	72	1.2	−14.904	222.128	0.589	0.997	−0.408	0.167	−0.068
1982	3530	3.530	73	1.1	−15.254	232.684	0.548	0.997	−0.449	0.202	−0.091
1981	3320	3.320	74	1.1	−15.464	239.135	0.521	0.997	−0.476	0.227	−0.108
1942	3300	3.300	75	1.1	−15.484	239.754	0.519	0.997	−0.479	0.229	−0.110
1971	3120	3.120	76	1.1	−15.664	245.360	0.494	0.997	−0.503	0.253	−0.127
1922	2800	2.800	77	1.1	−15.984	255.487	0.447	0.997	−0.550	0.302	−0.166
1975	2650	2.650	78	1.1	−16.134	260.305	0.423	0.997	−0.574	0.329	−0.189
1976	2510	2.510	79	1.1	−16.274	264.842	0.400	0.997	−0.597	0.357	−0.213
1977	2450	2.450	80	1.0	−16.334	266.799	0.389	0.997	−0.608	0.370	−0.225
1956	1800	1.800	81	1.0	−16.984	288.455	0.255	0.997	−0.742	0.550	−0.408
1989	1720	1.720	82	1.0	−17.064	291.179	0.236	0.997	−0.762	0.580	−0.442
1987	1670	1.670	83	1.0	−17.114	292.888	0.223	0.997	−0.774	0.600	−0.464
	Sum	1559.070					82.759			16.359	5.374
	Mean	18.784					0.997			0.197	0.065

Flood Frequency Analysis, log–Pierson Type III, total period
Gila River Navigability Study
Location: near Kelvin

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.4494
S.C.(log X) = skew coefficient = 0.7493

K(2) =	−0.1239 ,	log X(2) =	0.9414 ,	X(2) =	8.738 ,	Q(2) =	8738 cfs
K(5) =	0.7851 ,	log X(5) =	1.3499 ,	X(5) =	22.383 ,	Q(5) =	22383 cfs
K(10) =	1.3345 ,	log X(10) =	1.5968 ,	X(10) =	39.520 ,	Q(10) =	39520 cfs
K(25) =	1.9798 ,	log X(25) =	1.8868 ,	X(25) =	77.056 ,	Q(25) =	77056 cfs
K(50) =	2.4297 ,	log X(50) =	2.0890 ,	X(50) =	122.741 ,	Q(50) =	122741 cfs
K(100) =	2.8570 ,	log X(100) =	2.2810 ,	X(100) =	190.993 ,	Q(100) =	190993 cfs

kelvin.wk3

Flood Frequency Analysis, log–Pierson Type III, pre–Coolidge Dam construction
Gila River Navigability Study 09/02/96
Location: near Kelvin
Data sources: various U.S.G.S. Water Supply Papers
References: "Water–Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110–134, McGraw–Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380–415, McGraw–Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X,(cfs) x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^ 2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^ 2	$(\log X - \overline{\log X})$ ^ 3
1906	190000	190.000	1	22.0	171.216	29314.927	2.279	1.354	0.925	0.855	0.791
1916	132000	132.000	2	11.0	113.216	12817.868	2.121	1.354	0.767	0.588	0.450
1891	102000	102.000	3	7.3	83.216	6924.907	2.009	1.354	0.655	0.428	0.280
1926	82000	82.000	4	5.5	63.216	3996.266	1.914	1.354	0.560	0.313	0.175
1915	67300	67.300	5	4.4	48.516	2353.805	1.828	1.354	0.474	0.225	0.106
1917	55000	55.000	6	3.7	36.216	1311.600	1.740	1.354	0.386	0.149	0.058
1912	35000	35.000	7	3.1	16.216	262.959	1.544	1.354	0.190	0.036	0.007
1920	25800	25.800	8	2.8	7.016	49.225	1.412	1.354	0.058	0.003	0.000
1921	24000	24.000	9	2.4	5.216	27.207	1.380	1.354	0.026	0.001	0.000
1919	20800	20.800	10	2.2	2.016	4.064	1.318	1.354	−0.036	0.001	0.000
1914	18000	18.000	11	2.0	−0.784	0.615	1.255	1.354	−0.099	0.010	−0.000
1918	15100	15.100	12	1.8	−3.684	13.572	1.179	1.354	−0.175	0.031	−0.001
1911	12700	12.700	13	1.7	−6.084	37.015	1.104	1.354	−0.250	0.063	−0.005
1928	12000	12.000	14	1.6	−6.784	46.022	1.079	1.354	−0.275	0.076	−0.016
1924	11700	11.700	15	1.5	−7.084	50.183	1.068	1.354	−0.286	0.082	−0.021
1923	11700	11.700	16	1.4	−7.084	50.183	1.068	1.354	−0.286	0.082	−0.023
1929	11600	11.600	17	1.3	−7.184	51.610	1.064	1.354	−0.290	0.084	−0.023
1925	11200	11.200	18	1.2	−7.584	57.517	1.049	1.354	−0.305	0.093	−0.024
1927	8570	8.570	19	1.2	−10.214	104.325	0.933	1.354	−0.421	0.177	−0.028
1913	4400	4.400	20	1.1	−14.384	206.899	0.643	1.354	−0.711	0.505	−0.075
1922	2800	2.800	21	1.0	−15.984	255.487	0.447	1.354	−0.907	0.822	−0.359
	Sum	853.670					28.435				−0.746
	Mean	40.651					1.354			4.623	0.547
										0.220	0.026

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.4808
S.C.(log X) = skew coefficient = 0.2718

K(2) =	−0.0452 ,	log X(2) =	1.332 ,	X(2) =	21.494 ,	Q(2) =	21494 cfs
K(5) =	0.8257 ,	log X(5) =	1.751 ,	X(5) =	56.368 ,	Q(5) =	56368 cfs
K(10) =	1.3067 ,	log X(10) =	1.982 ,	X(10) =	96.005 ,	Q(10) =	96005 cfs
K(25) =	1.8403 ,	log X(25) =	2.239 ,	X(25) =	173.318 ,	Q(25) =	173318 cfs
K(50) =	2.1963 ,	log X(50) =	2.410 ,	X(50) =	257.043 ,	Q(50) =	257043 cfs
K(100) =	2.5237 ,	log X(100) =	2.567 ,	X(100) =	369.332 ,	Q(100) =	369332 cfs

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})^2$	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})^2$	$(\log X - \overline{\log X})^3$
1980	545	0.545	34	1.6	−3.952	15.617	−0.264	********	−0.164	0.027	−0.004
1972	544	0.544	35	1.5	−3.953	15.625	−0.264	********	−0.165	0.027	−0.004
1990	456	0.456	36	1.5	−4.041	16.328	−0.341	********	−0.242	0.058	−0.014
1957	446	0.446	37	1.4	−4.051	16.409	−0.351	********	−0.251	0.063	−0.016
1977	430	0.430	38	1.4	−4.067	16.539	−0.367	********	−0.267	0.071	−0.019
1976	397	0.397	39	1.4	−4.100	16.809	−0.401	********	−0.302	0.091	−0.028
1983	385	0.385	40	1.3	−4.112	16.907	−0.415	********	−0.315	0.099	−0.031
1967	350	0.350	41	1.3	−4.147	17.196	−0.456	********	−0.357	0.127	−0.045
1991	203	0.203	42	1.3	−4.294	18.437	−0.693	********	−0.593	0.352	−0.209
1982	194	0.194	43	1.2	−4.303	18.515	−0.712	********	−0.613	0.376	−0.230
1970	178	0.178	44	1.2	−4.319	18.652	−0.750	********	−0.650	0.423	−0.275
1965	85	0.085	45	1.2	−4.412	19.464	−1.071	********	−0.971	0.943	−0.916
1956	46	0.046	46	1.2	−4.451	19.810	−1.337	********	−1.238	1.532	−1.897
1981	20	0.020	47	1.1	−4.477	20.042	−1.699	********	−1.600	2.559	−4.093
1975	19	0.019	48	1.1	−4.478	20.051	−1.721	********	−1.622	2.630	−4.266
1988	16	0.016	49	1.1	−4.481	20.078	−1.796	********	−1.697	2.878	−4.883
1989	12	0.012	50	1.1	−4.485	20.114	−1.921	********	−1.821	3.318	−6.043
1986	10	0.010	51	1.0	−4.487	20.132	−2.000	********	−1.901	3.612	−6.866
1987	7.1	0.007	52	1.0	−4.490	20.158	−2.149	********	−2.049	4.200	−8.607
1969	0		53								
Sum		233.836					−5.167			41.312	−14.130
Mean		4.497					−0.099			0.794	−0.272

K(i) = frequency factor, varies
S.D. = standard deviation = 0.9000
S.C. = skew coefficient = −0.3952

K(2) = 0.0652 ,	log X(2) = −0.041 ,	X(2) = 0.911 ,	Q(2) = 911 cfs
K(5) = 0.8549 ,	log X(5) = 0.670 ,	X(5) = 4.678 ,	Q(5) = 4678 cfs
K(10) = 1.2317 ,	log X(10) = 1.009 ,	X(10) = 10.214 ,	Q(10) = 10214 cfs
K(25) = 1.6078 ,	log X(25) = 1.348 ,	X(25) = 22.268 ,	Q(25) = 22268 cfs
K(50) = 1.8367 ,	log X(50) = 1.554 ,	X(50) = 35.785 ,	Q(50) = 35785 cfs
K(100) = 2.0326 ,	log X(100) = 1.730 ,	X(100) = 53.704 ,	Q(100) = 53704 cfs

Flood Frequency Analysis, log−Pierson Type III
Gila River Navigability Study
Location: near Laveen

laveen.wk3

09/03/96
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Flood Frequency Analysis, log–Pierson Type III
Gila River Navigability Study
Location: near Painted Rock Dam
Data sources: various U.S.G.S. Water Supply Papers
References: "Water–Resources Engineering, Third Edition," Ray K. Linsley & Joseph B. Franzini, pp. 110–134, McGraw–Hill Book Company, New York, 1979; "Applied Hydrology," Ven Te Chow, David R. Maidment & Larry W. Mays, pp. 380–415, McGraw–Hill Book Company, New York, 1987

Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X-\bar{X}$	$(X-\bar{X})^2$	log X	$\overline{\log X}$	$\log X-\overline{\log X}$	$(\log X-\overline{\log X})^2$	$(\log X-\overline{\log X})^3$
1983	9190	9.190	1	33.0	7.780	60.530	0.963	−0.461	1.424	2.028	2.887
1981	5200	5.200	2	16.5	3.790	14.365	0.716	−0.461	1.177	1.385	1.629
1980	5060	5.060	3	11.0	3.650	13.323	0.704	−0.461	1.165	1.357	1.580
1985	4240	4.240	4	8.3	2.830	8.009	0.627	−0.461	1.088	1.184	1.288
1984	4000	4.000	5	6.6	2.590	6.709	0.602	−0.461	1.063	1.129	1.200
1979	3340	3.340	6	5.5	1.930	3.725	0.524	−0.461	0.984	0.969	0.954
1973	2860	2.860	7	4.7	1.450	2.103	0.456	−0.461	0.917	0.841	0.771
1966	2850	2.850	8	4.1	1.440	2.074	0.455	−0.461	0.916	0.838	0.767
1978	1060	1.060	9	3.7	−0.350	0.122	0.025	−0.461	0.486	0.236	0.115
1974	856	0.856	10	3.3	−0.554	0.307	−0.068	−0.461	0.393	0.155	0.061
1970	505	0.505	11	3.0	−0.905	0.819	−0.297	−0.461	0.164	0.027	0.004
1971	415	0.415	12	2.8	−0.995	0.990	−0.382	−0.461	0.079	0.006	0.000
1986	321	0.321	13	2.5	−1.089	1.186	−0.493	−0.461	−0.033	0.001	−0.000
1991	291	0.291	14	2.4	−1.119	1.252	−0.536	−0.461	−0.075	0.006	−0.000
1968	280	0.280	15	2.2	−1.130	1.277	−0.553	−0.461	−0.092	0.008	−0.001
1960	240	0.240	16	2.1	−1.170	1.369	−0.620	−0.461	−0.159	0.025	−0.004
1976	226	0.226	17	1.9	−1.184	1.402	−0.646	−0.461	−0.185	0.034	−0.006
1975	223	0.223	18	1.8	−1.187	1.409	−0.652	−0.461	−0.191	0.036	−0.007
1967	203	0.203	19	1.7	−1.207	1.457	−0.693	−0.461	−0.232	0.054	−0.012
1964	156	0.156	20	1.7	−1.254	1.572	−0.807	−0.461	−0.346	0.120	−0.041
1982	147	0.147	21	1.6	−1.263	1.595	−0.833	−0.461	−0.372	0.138	−0.051
1965	133	0.133	22	1.5	−1.277	1.631	−0.876	−0.461	−0.415	0.173	−0.072
1961	132	0.132	23	1.4	−1.278	1.633	−0.879	−0.461	−0.419	0.175	−0.073
1969	120	0.120	24	1.4	−1.290	1.664	−0.921	−0.461	−0.460	0.212	−0.097
1963	86	0.086	25	1.3	−1.324	1.753	−1.066	−0.461	−0.605	0.366	−0.221
1988	72	0.072	26	1.3	−1.338	1.790	−1.143	−0.461	−0.682	0.465	−0.317
1987	47	0.047	27	1.2	−1.363	1.858	−1.328	−0.461	−0.867	0.752	−0.652
1989	35	0.035	28	1.2	−1.375	1.890	−1.456	−0.461	−0.995	0.991	−0.986
1977	5.5	0.006	29	1.1	−1.404	1.972	−2.260	−0.461	−1.799	3.236	−5.822
1990	4.1	0.004	30	1.1	−1.406	1.976	−2.387	−0.461	−1.927	3.712	−7.151
1962	0		31								
1972	0		32								
	Sum	42.298			−0.000	141.760	−13.820		0.000	20.659	−4.257
	Mean	1.410			−0.000	4.725	−0.461		0.000	0.689	−0.142

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.8440
S.C.(log X) = skew coefficient = −0.2616

K(2) =	0.0435 ,	log X(2) =	−0.424 ,	X(2) =	0.377 ,	Q(2) =	377 cfs
K(5) =	0.8518 ,	log X(5) =	0.258 ,	X(5) =	1.812 ,	Q(5) =	1812 cfs
K(10) =	1.2500 ,	log X(10) =	0.594 ,	X(10) =	3.930 ,	Q(10) =	3930 cfs
K(25) =	1.6572 ,	log X(25) =	0.938 ,	X(25) =	8.670 ,	Q(25) =	8670 cfs
K(50) =	1.9111 ,	log X(50) =	1.152 ,	X(50) =	14.202 ,	Q(50) =	14202 cfs
K(100) =	2.1324 ,	log X(100) =	1.339 ,	X(100) =	21.833 ,	Q(100) =	21833 cfs

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1958	2050	2.050	34	1.41	0.277	0.077	0.312	0.605	−0.293	0.086	−0.025
1945	1980	1.980	35	1.37	0.267	0.071	0.297	0.605	−0.308	0.095	−0.029
1988	1950	1.950	36	1.33	0.263	0.069	0.290	0.605	−0.315	0.099	−0.031
1989	1690	1.690	37	1.30	0.228	0.052	0.228	0.605	−0.377	0.142	−0.054
1969	1630	1.630	38	1.26	0.220	0.048	0.212	0.605	−0.393	0.154	−0.061
1965	1610	1.610	39	1.23	0.217	0.047	0.207	0.605	−0.398	0.158	−0.063
1976	1440	1.440	40	1.20	0.194	0.038	0.158	0.605	−0.446	0.199	−0.089
1987	1370	1.370	41	1.17	0.185	0.034	0.137	0.605	−0.468	0.219	−0.103
1959	1300	1.300	42	1.14	0.176	0.031	0.114	0.605	−0.491	0.241	−0.118
1957	1270	1.270	43	1.12	0.172	0.029	0.104	0.605	−0.501	0.251	−0.126
1948	1220	1.220	44	1.09	0.165	0.027	0.086	0.605	−0.518	0.269	−0.139
1956	1100	1.100	45	1.07	0.149	0.022	0.041	0.605	−0.563	0.317	−0.179
1962	1100	1.100	46	1.04	0.149	0.022	0.041	0.605	−0.563	0.317	−0.179
1953	732	0.732	47	1.02	0.099	0.010	−0.135	0.605	−0.740	0.548	−0.406
Sum		348.032					28.427			8.826	3.023
Mean		7.405					0.605			0.188	0.064
Water Year	Peak flow x(cfs)	Peak flow X, x/1000	Rank m	Recurrence interval Tp,yr	$X - \bar{X}$	$(X - \bar{X})$ ^ 2	log X	$\overline{\log X}$	$\log X - \overline{\log X}$	$(\log X - \overline{\log X})$ ^ 2	$(\log X - \overline{\log X})$ ^ 3

K(i) = frequency factor, varies
S.D.(log X) = standard deviation = 0.4380
S.C.(log X) = skew coefficient = 0.8167

K(2) =	−0.1347 ,	log X(2) =	0.546 ,	X(2) =	3.514 ,	Q(2) =	3514 cfs
K(5) =	0.7782 ,	log X(5) =	0.946 ,	X(5) =	8.825 ,	Q(5) =	8825 cfs
K(10) =	1.3365 ,	log X(10) =	1.190 ,	X(10) =	15.498 ,	Q(10) =	15498 cfs
K(25) =	1.9972 ,	log X(25) =	1.480 ,	X(25) =	30.178 ,	Q(25) =	30178 cfs
K(50) =	2.4605 ,	log X(50) =	1.683 ,	X(50) =	48.154 ,	Q(50) =	48154 cfs
K(100) =	2.9020 ,	log X(100) =	1.876 ,	X(100) =	75.167 ,	Q(100) =	75167 cfs

Flood Frequency Analysis, log−Pierson Type III
Gila River Navigability Study
Location: Winkelman

09/03/96

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Appendix H

Summary of Temperature and Precipitation Records

Summary of mean maximum temperatures
Gila River Navigability Study
Station: Buckeye
Data: Mean Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1893			78.7	85.6	93.3	104.2	103.8	102.5	97.5	91.2	79.7	76.0	
1894	73.2	72.9	80.5	88.1	93.0	95.9	103.2	100.4	98.9	91.9	86.4	73.6	88.25
1895	72.1	79.1	85.2	88.8	93.8	98.8	101.3	101.3	101.2	90.1	76.1	72.6	88.41
1896	78.2	81.6	83.0	81.8	90.5	102.8	98.7	101.6	96.4	87.5	76.7	76.8	87.99
1897	71.4	74.0	76.9	90.3	97.0	97.9	102.0	102.4	98.5	85.0	79.5	71.5	87.26
1898	65.5	82.8	77.8	88.9	87.0	98.0	102.5	100.3	98.9	86.7	75.1	68.2	85.95
1899	71.9	73.9	79.6	86.3	88.8	99.7	102.1	101.5	101.2	87.6	78.0	71.1	86.87
1900	73.7	77.0	85.3	77.9	91.9	100.7	102.0	100.3	95.1	87.6	79.5	71.3	86.90
1901	70.9	72.3	80.5	83.8	91.0	96.1	104.0	103.9	98.9	89.2	78.0	67.8	86.45
1902	69.5	73.4	74.0	87.1	92.2	101.2	101.2	102.0	96.4	89.1	71.5	66.8	85.42
1903	69.6	67.4	76.5	83.3	90.5	98.1	102.8	104.7	93.4	88.0			
1904			80.2	85.6	91.7	100.2	102.1	103.0	98.8	87.1	79.6	67.3	
1905	68.1	66.2	73.9	80.5	87.7	104.3	108.7	107.2	101.1	89.2	70.5	62.6	85.11
1906	64.6	71.1	75.9	81.4	92.5	102.6	106.6		100.1	89.1	73.0	65.9	
1907	64.1	73.3	76.5	88.7	91.4	99.5	103.6	101.2	100.8	85.4	75.7	69.7	85.87
1908	70.0	69.0	78.4	86.4	90.0	99.2	102.9	103.3	99.0	84.4	79.4	66.5	85.74
1909	70.6	70.2	73.9	86.9	91.6	104.1	104.9	102.6	98.3	93.2	77.3	63.0	86.46
1910	66.5	72.9	84.6	89.6	98.7	104.4	107.7	106.4	104.5	91.6	76.7	71.5	89.68
1911	70.5	69.0	81.8	87.3	93.7	102.5	102.6	106.2	101.4	89.4		64.8	
1912	72.5	75.6	74.1	79.1	92.4	105.4	101.0	102.8	97.8	83.8	76.5	62.9	85.33
1913	62.3	66.7	74.8	85.4	93.5	100.0	103.4	103.0	99.4	90.3	75.9	63.7	84.96
1914	67.9	71.4	80.7	87.0	95.7	102.2	107.0	107.0	103.0	86.7	78.1	60.0	87.30
1915	62.5	66.6	76.8	84.5	89.8	103.5	103.7	106.5	97.0	93.1	75.1	64.6	85.41
1916	61.0	74.8	82.2	87.7	93.5	104.8	105.4	101.9	96.4	82.7	74.5	61.5	85.53
1917	60.4	69.3	74.4	81.1	86.0	104.0	103.6	103.4	99.0	92.3	78.4	71.5	85.36
1918	65.5	72.2	78.8	87.0	91.7	106.4	104.7	100.6	103.3	92.0	72.3	62.5	86.47
1919	66.8	67.4					105.7	105.7	97.0	83.4	70.3	67.3	
1920	63.0	69.2	74.5	84.4	95.1	103.2	109.9	104.8	99.3	84.5	75.3	66.4	85.84
1921	68.2			89.1	99.0	104.8	105.5	102.6	105.9		80.5	71.2	
1922	66.1	67.0	69.9	83.0	98.2	106.4	107.9	106.5	105.1	92.2	73.2	67.8	87.05
1923	71.5	71.1	76.7	84.7	98.1	101.9	104.9	104.5	100.7	88.7	71.3	62.0	86.43
1924	66.6	77.7	76.0	84.7	99.7	107.4	105.9	107.8	102.2	88.1	78.0	62.8	88.08
1925	67.2	77.6	83.2	88.1	97.1	101.4	108.5	104.5	100.8	83.5	73.3	67.4	87.76
1926	65.9	77.1	80.9	83.1	93.9	104.7	106.1	107.0	101.3	92.7	77.6	62.5	87.78
1927	70.4	72.9	77.7	87.7	98.5	103.1	108.3	104.9	100.4	90.8	79.7	64.1	88.28
1928	69.2	70.1	81.2	84.4	95.4	103.1	108.8	104.4	102.7	91.1	75.3	67.4	87.82
1929	64.1	69.0	77.6	83.3	96.1	104.7	106.8	105.3	99.8	91.7	76.0	72.6	87.36
1930	63.5	77.3	77.4	89.8	89.3	105.9	107.2	105.9	99.8	89.9	77.1	69.5	87.74
1931	70.4	69.9	80.6	89.7	99.9	104.6	111.2	104.3	102.7	91.3	72.1	60.6	88.21
1932	63.5	70.5	80.1	88.2	95.7	104.6	107.1	105.4	105.2	88.5	82.9	63.1	87.92
1933	64.2	67.7	81.5	81.4	91.1	106.1	111.3	110.2	105.3	94.9	82.3	72.5	89.17
1934	73.4	78.6	90.8	94.2	102.1	102.2	111.0	105.1	103.1	94.2	79.5	70.5	92.14
1935	67.7	72.9	73.8	86.3	91.0	108.5	109.4	103.7	102.0	91.9	74.9	69.7	87.71
1936	70.0	71.5	82.8	92.7	102.0	109.1	110.3	108.6	94.7	89.9	77.9	68.4	89.88
1937	56.5	70.8	77.3	87.3	98.0	106.4	110.1	109.4	104.2	94.8	71.8	71.9	88.31
1938	72.0	71.9	75.9	89.3	96.9	107.0	109.7	108.6	105.4	91.8	75.5	71.6	89.73
1939	67.5	64.6	81.0	91.5	98.9	106.1	110.2	107.0	97.0	89.7	79.2	74.0	89.04
1940	71.9	72.7	82.4	88.9	100.5	108.3	110.6	108.0	100.7	89.3	74.8	68.5	89.77
1941	66.1	70.0	72.7	76.4	92.0	99.8	105.0	101.5	97.3	83.2	78.6	65.9	84.11

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1942	68.6	68.8	76.8	83.4	92.8	102.5	107.7	103.5	101.8	88.0	80.6	71.8	87.29
1943	68.3	76.4	81.2	89.4	95.8		106.6	101.5	101.6	89.3	79.8	67.1	
1944	67.0	65.9	75.2	81.8	92.8	98.3	105.7	106.7	100.1	89.6	69.9	67.7	85.14
1945	64.7	71.3	71.5	84.0	93.6	100.5	106.3	103.9	101.7				
1946			77.5		93.0	105.3	104.5	103.5	97.9	82.1	69.8	69.3	
1947	65.6	77.0	79.7	86.0	96.3	102.8	111.1	103.9	104.4	90.2	71.0	64.4	87.75
1948	72.2												
1949								104.6	103.1	86.0	82.9	67.1	
1950	65.8	76.1	79.4	91.5	92.8	102.7	104.4	106.8	98.7	96.9	82.3	75.9	89.50
1951	68.4	69.9	76.1	84.6	93.0	101.3	108.6	101.2	100.3	90.6	73.8	65.1	86.16
1952	64.1	70.4	69.4	82.9	97.2	102.7	106.2	105.2	102.7	97.2	72.8	64.6	86.33
1953	70.5	71.3	78.5	83.0	87.0	102.0	104.5	104.8	103.4	90.0	78.5	66.4	86.73
1954	66.9	78.5	73.2	90.7	95.3	100.7	105.1	102.8	102.0	92.6	81.8	69.5	88.28
1955	59.6	66.6	77.2	83.2	90.8	102.6	102.9	99.7	101.4	95.1	76.8	72.6	85.81
1956	71.1	67.3	82.5	84.1	96.0	105.9	105.6	105.4	105.4	89.6	77.0	71.3	88.50
1957	64.9	76.5	77.6	82.7	89.5	105.8	107.9	105.1	102.9	84.5	70.6	71.2	86.64
1958	70.0	71.9	69.6	83.5	100.3	104.0	108.3	104.8	101.1	91.3	76.0	75.3	88.11
1959	69.6	67.7	79.8	90.3	92.2	106.1	108.2	102.0	100.1	90.7	77.0	66.4	87.61
1960	61.6	65.9	80.4	86.7	94.4	107.6	108.9	106.1	103.3	86.6	78.7	68.2	87.41
1961	71.2	74.2	76.9	86.6	93.8	106.3	106.7	103.6	97.4	89.7	72.5	65.1	87.06
1962	65.0	69.7	71.3	92.4	90.9	102.2	107.0	109.2	99.5	90.8	81.2	70.6	87.56
1963	65.2	78.7	78.6	84.2	99.1	101.4	110.5	104.2	103.3	92.9	76.3	70.8	88.82
1964	65.2	69.1	74.8	84.1	94.0	103.3	106.6	99.5	93.6	91.1	72.7	66.8	85.12
1965	68.9	71.2	74.1	83.8	92.3	98.6	108.2	107.3	97.8	93.9	77.0	65.5	86.65
1966	63.7	66.1	81.1	90.6	99.5	106.3	109.9	107.8	100.2	90.1	79.0	69.3	88.76
1967	68.6	76.1	81.6	80.8	95.0	102.1	109.7	108.7	100.9	94.7	80.6	61.9	88.46
1968	69.1	76.3	77.7	86.5	97.8	107.2	107.5	104.2	102.6	92.5	75.9	64.9	88.53
1969	69.6	69.8	76.8	89.1	99.3	103.1	109.9	110.4	103.1	87.8	75.4	69.6	88.77
1970	67.8	76.5	75.8	83.9	98.8	106.9	110.9	108.1	98.8	86.9	78.0	66.4	88.29
1971	69.1	73.9	83.2	86.3	92.0	104.9	111.2	104.0	102.2	84.4	76.4	63.5	87.65
1972	68.8	77.5	90.0	90.4	97.8	105.9	111.9	106.6	101.6	85.4	71.2	65.1	89.38
1973	64.2	70.1	69.4	85.0	98.4	106.0	109.2	108.5	102.4	93.2	76.4	71.5	87.95
1974	66.9	73.6	80.7	88.9	97.8	111.3	107.5	107.3	101.4	89.7	76.1	64.4	88.86
1975	68.1	71.6	76.0	79.8	95.0	104.5	109.1	108.6	101.4	90.1	78.6	68.3	87.68
1976	70.2	75.2	77.4	85.0	97.5	106.4	107.5	107.0	97.5	86.1	78.6	70.2	88.25
1977	67.4	78.3	76.3	90.1	90.8	108.3	110.4	107.8	103.2	93.4	81.2	73.7	90.11
1978	67.1	70.1	79.5	85.9	96.7	109.1	109.7	105.9	99.2	93.0	75.0	64.2	88.05
1979	60.5	71.5	76.9	88.0	94.2	105.7	110.7	105.3	105.0	94.1	75.6	72.9	88.45
1980	69.9	74.6	75.6	86.4	91.5	107.9	112.4	106.9	102.6	90.4	79.8	76.9	89.61
1981	72.5	76.8	78.2	91.6	96.1	109.9	110.8	109.2	103.0	88.1	81.1	73.0	90.91
1982	67.6	74.3	75.7	88.1	95.7	103.7		107.1	100.6	88.5	73.8	65.7	
1983	70.5	70.5	76.1	82.9	96.0	104.6	108.6	106.5	104.5	89.5	78.8	70.3	88.33
1984	71.6	76.0	83.8	86.6	103.5	105.7	106.4	104.4	101.5	85.8	76.1	65.1	88.91
1985	66.0	71.6	78.8	92.6	99.5	110.3	110.6	109.5	96.7	89.1	75.1	69.4	89.19
1986	75.8	74.3	83.9	89.9	98.6	108.9	107.2	108.6	97.0	86.8	76.9	67.7	89.72
1987	66.9	71.3	77.0	92.5	91.4	108.4	108.3	106.6	100.4	93.3	74.5	63.6	87.92
1988	66.4	76.0	82.4	86.9	97.5	108.1	109.7	101.2	100.2	95.2	77.0	66.3	88.93
Mean	67.7	72.4	78.2	86.3	94.6	104.0	106.9	105.0	100.6	89.6	76.6	68.0	87.57
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average

No value indicates no report

No 'Annual Average' indicates incomplete record for that year

Summary of mean maximum temperatures

Station: Buckeye

Data: Mean Maximum Temperature

09/02/96

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1942	36.1	34.0	39.1	46.1	49.7	58.2	74.1	70.7	60.6	49.5	36.2	30.5	48.84
1943	36.9	35.7	39.3	45.3	50.5		75.1	73.4	66.0	52.4	36.8	36.6	
1944	30.5	36.0	40.0	46.4	52.8	55.1	61.1	68.5	56.1	54.2	41.3	34.8	48.11
1945	33.4	36.4	36.9	41.4	51.5	55.9	74.6	74.7	70.0				
1946			41.8		55.1	63.5	74.4	76.5	67.8	47.8	36.9	36.1	
1947	30.1	35.7	41.9	46.4	57.9	65.3	74.2	73.9	70.2	54.4	40.7	35.1	52.25
1948	33.5												
1949								69.1	70.9	49.3	42.3	34.0	
1950	28.9	38.5	41.9	52.4	53.1	62.4	74.4	68.6	59.7	52.0	41.0	33.6	50.60
1951	29.5	37.6	39.2	46.8	55.0	58.9	73.8	70.7	62.4	51.6	42.0	34.5	50.24
1952	31.7	36.0	40.6	50.5	58.8	61.9	71.0	74.9	68.9	53.6		34.8	
1953	35.3	34.3	45.4	48.0	50.9	61.6	76.0	71.6	61.0	50.5	41.3	29.6	50.56
1954	34.0	41.8	42.4	50.9	57.9	64.1	77.9	73.1	68.2	54.8	42.6	34.4	53.57
1955	34.8	33.2	40.7	45.0	55.1	61.3	70.5	73.2	62.5	54.6	38.9	36.8	50.68
1956	37.0	33.1	39.8	48.8	57.9	68.0	74.1	68.9	65.6	48.6	36.0	31.1	50.80
1957	41.1	45.7	44.4	48.1	53.6	67.5	76.6	73.7	62.8	55.2	39.0	34.8	53.60
1958	33.1	40.9	42.5	47.4	61.8	68.1	73.3	76.9	69.0	60.0	40.8	34.2	54.08
1959	34.9	36.6	42.2	52.9	55.5	69.1	79.1	75.0	65.2	53.5	45.3	38.9	54.11
1960	33.9	34.6	44.7	48.2	55.6	68.3	75.2	74.8	66.4	53.6	40.3	32.1	52.37
1961	36.3	37.8	42.1	49.3	54.6	69.6	75.5	74.2	62.9	49.4	39.9	35.2	52.32
1962	34.3	41.1	37.6	51.4	54.0	61.4	73.0	74.2	69.0	51.9	43.0	38.0	52.46
1963	30.1	42.7	41.7	45.6	58.1	59.8	73.2	71.1	65.5	53.0	41.2	29.0	50.96
1964	31.1	32.5	40.9	48.8	55.5	63.9	76.4	73.1	65.5	55.6	36.3	35.4	51.33
1965	37.6	36.6	40.1	47.5	52.6	58.1	74.8	71.1	59.9	50.3	43.3	36.1	50.77
1966	29.6	31.9	40.1	46.9	57.7	63.7	73.3	74.3	70.1	54.1	45.4	37.3	52.15
1967	34.2	39.4	45.9	46.0	56.7	65.1	79.1	77.7	68.8	55.8	48.1	35.8	54.48
1968	38.4	46.8	46.4	50.3	57.0	65.6	74.6	70.3	64.1	52.0	42.8	33.3	53.48
1969	42.6	39.8	39.9	50.4	58.2	63.6	77.1	78.2	68.5	48.6	46.0	38.4	54.36
1970	33.4	41.8	44.2	44.3	58.5	66.4	77.8	76.4	63.9	48.7	41.2	35.4	52.74
1971	31.6	37.1	41.3	46.2	52.8	64.7	76.8	76.5	66.6	50.7	40.8	34.3	51.70
1972	31.1	37.8	47.6	49.1	56.6	69.7	76.2	73.9	65.9	59.4	41.5	36.5	53.83
1973	35.5	43.7	42.8	48.6	60.3	67.2	76.2	75.8	63.3	51.9	42.4	37.5	53.83
1974	38.0	36.4	47.9	49.4	59.0	70.5	76.4	70.9	68.5	58.5	43.8	34.4	54.58
1975	35.2	37.2	42.7	45.9	53.8	61.2	75.6	73.3	68.2	50.6	37.6	34.2	51.39
1976	33.3	42.1	41.8	45.7	58.4	62.0	77.0	69.2	64.0	49.3	41.4	32.2	51.40
1977	37.6	38.3	39.9	49.9	55.3	69.4	77.6	76.8	67.4	59.7	45.4	42.1	55.05
1978	41.5	43.2	50.6	50.2	58.5	69.0	76.4	72.4	68.5	59.1	46.2	37.0	56.13
1979	37.6	37.5	45.7	50.3	60.2	68.1	74.2	69.6	70.1	52.1	37.8	36.5	53.40
1980	40.8	43.2	45.0	50.1	56.1	63.6	77.9	76.9	65.4	52.8	41.1	40.1	54.47
1981	41.9	40.6	45.5	53.9	58.7	69.2	78.2	77.2	69.1	52.1	44.2	38.7	55.86
1982	37.8	43.8	46.5	51.7	59.6	63.9		77.1	68.0	49.5	45.3	38.6	
1983	36.3	39.9	44.3	48.2	55.0	64.5	76.1	75.5	73.3	59.7	46.0	46.3	55.52
1984	39.2	38.9	44.7	50.5	63.9	68.5	77.5	75.1	70.0	51.8	43.1	41.2	55.43
1985	38.4	39.0	44.8	54.9	60.5	69.2	77.8	74.8	61.7	55.2	43.3	37.2	54.83
1986	41.5	43.3	50.7	53.4	59.9	71.8	74.8	78.8	64.1	52.5	44.6	38.3	56.22
1987	35.8	42.9	45.4	56.9	62.4	69.7	71.6	74.8	67.0	60.0	44.9	35.6	55.64
1988	37.5	42.6	44.7	52.2	59.2	68.5	78.3	75.5	63.8	61.3	43.9	42.7	55.91
Mean	34.4	38.0	42.0	47.9	55.3	63.6	74.2	73.4	65.0	51.6	40.8	35.0	51.85

No value indicates no report

No 'Annual Average' indicates incomplete record for that year

Summary of mean minimum temperatures

Station: Buckeye

Data: Mean Minimum Temperature

09/02/96

Summary of total annual precipitation

Gila River Navigability Study

09/02/96

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Station: Buckeye

Data: Total Precipitation (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1889								0.51	0.20	0.96	0.36	3.93	5.96
1890			1.70										
1891	0.00	0.47	0.00	0.00	0.10	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.63
1892	1.41	0.03											
1893			1.60	0.00	0.50	0.00	0.70	1.50	0.10	0.40	1.60	0.30	
1894	0.00	0.50	0.90	0.00	0.00	0.00	0.30	2.90	0.50	1.30	0.00	1.50	7.90
1895	1.90	0.10	0.00	0.00	0.00	0.00	1.20	1.00	0.00	0.40	0.50	0.00	5.10
1896	0.60	0.00	0.30	0.00	0.00	0.00	4.10	0.60	1.00	2.00	0.60	0.30	9.50
1897	2.30	0.60	0.20	0.00	0.00	0.00	0.03	0.70	1.01	0.00	0.00	0.10	4.94
1898	1.70	0.00	0.10	0.00	0.00	0.10	0.90	1.70	0.00	0.00	0.30	1.80	6.60
1899	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.40	0.10	0.70	0.20	3.45
1900	0.30	0.00	0.70	1.00	0.20	0.00	1.30	0.50	0.00	0.20	0.90	0.00	5.10
1901	0.80	1.40	0.40	0.00	0.00	0.00	0.00	0.80	0.00	0.30	0.00	0.00	3.70
1902	0.90	0.10	0.60	0.00	0.00	0.00	0.00	0.00	0.40	0.00	1.50	1.20	4.70
1903	0.00	0.00	0.40	0.00	0.00	0.00	0.20	1.10	3.40	0.00			
1904			0.30	0.00	0.00	0.00	3.00		0.00	0.28	0.03	0.17	
1905	2.91	6.46	3.61	2.04	0.00	0.00	0.28	0.46	0.58	0.00	5.01	0.45	21.80
1906	0.07	1.08	0.60	1.04	0.00	0.00	0.24		0.00	0.00	0.97	1.58	
1907	1.06	0.09	0.98	0.30	0.50	0.01	3.71	0.85	0.10	1.46	0.11	0.00	9.17
1908	0.22	1.78	0.46	0.50	0.00	0.00	1.55	0.91	0.55	0.67	0.14	2.67	9.45
1909	0.38	0.57	0.71	0.00	0.00	0.00	1.76	1.09	1.73	0.00	0.67	1.42	8.33
1910	0.72	0.00	0.18	0.12	0.00	0.02	0.79	0.78	0.05	0.02	2.43	0.19	5.30
1911	1.44	0.86	0.42	0.00	0.00	0.00	3.73	1.15	0.77	1.08	0.00	0.00	9.45
1912	0.00	0.00	2.24	0.68	0.04	0.00	1.16	0.65	0.00	1.25	0.00	0.71	6.73
1913	0.40	2.13	0.00	0.26	0.00	0.00	0.44	0.69	0.12	0.19	0.96	0.14	5.33
1914	0.41	1.40	0.69	0.05	0.16	0.16	0.15	0.35	0.10	2.42	0.80	2.84	9.53
1915	1.91	0.92	0.22	0.90	0.04	0.29	1.18	0.81	0.32	0.00	0.71	3.12	10.42
1916	2.60	0.17	0.81	0.08	0.00	0.00	1.48	1.08	3.30	0.96	0.00	0.40	10.88
1917	2.18	1.03	0.17	1.54	0.31	0.00	3.16	0.40	0.01	0.00	0.00	0.00	8.80
1918	1.50	0.26	1.36	0.05	0.00	0.86	1.76	0.56	0.42	0.43	0.52	2.32	10.04
1919	0.40	0.59	1.13	0.19	0.06	0.00	1.93	0.78	1.43	0.40	1.79	0.04	8.74
1920	1.77	1.23	1.15	0.00	0.20	0.02	0.00	1.32	0.00	0.47	0.00	0.00	6.16
1921	0.20			0.05	0.05	0.00	0.70	3.98	0.30		0.00	1.37	
1922	1.60	1.73	0.71	0.00	0.36	0.48	0.52	0.65	0.71	0.00	0.60	0.26	7.62
1923	0.34	0.36	0.91	0.07	0.27	0.00	0.69	0.63	0.64	0.03	3.42	2.87	10.23
1924	0.00	0.00	1.33	0.23	0.00	0.00	0.55	0.00	0.00	1.07	0.08	0.72	3.98
1925	0.00	0.00	0.00	0.75	0.00	0.23	0.22	0.46	0.96	1.22	0.30	0.64	4.78
1926	0.30	0.16	0.60	2.07	0.00	0.00	2.72	0.17	2.07	0.16	0.03	2.83	11.11
1927	0.05	1.61	0.41	0.43	0.00	0.46	0.25	1.00	1.38	0.21	0.60	1.01	7.41
1928	0.00	0.70	0.12	0.00	0.00	0.00	1.53	0.88	0.22	0.65	0.00	0.95	5.05
1929	1.09	0.12	0.02	0.02	0.00	0.00	0.67	1.17	0.65	0.00	0.02	0.00	3.76
1930	1.28	0.19	2.39	0.38	0.95	0.00	0.38	1.04	0.84	0.08	0.13	0.00	7.66
1931	0.05	3.88	0.00	0.67	0.00	0.48	1.16	2.55	0.44	0.35	0.98	0.62	11.18
1932	0.12	2.08	0.00	0.00	0.00	0.09	1.11	0.13	0.54	1.88	0.00	2.91	8.86
1933	2.44	0.10	0.00	0.93	0.03	0.00	0.28	0.87	1.35	0.65	1.05	0.00	7.70
1934	0.27	0.33	0.00	0.11	0.33	0.21	0.11	2.54	0.07	0.00	0.73	1.01	5.71
1935	1.22	1.85	0.84	0.05	0.15	0.00	0.52	2.04	0.98	0.11	0.44	0.28	8.48
1936	0.62	0.63	0.36	0.00	0.00	0.11	1.39	0.59	0.43	0.14	0.35	1.88	6.50
1937	1.57	0.52	1.56	0.00	0.00	0.00	0.47	1.05	0.90	0.00	0.00	0.57	6.64
1938	0.31	0.50	0.94	0.00	0.00	0.06	0.11	0.57	0.00	0.00	0.00	1.62	4.11
1939	0.23	0.44	0.02	0.00	0.00	0.00	0.22	2.69	4.57	0.00	1.60	0.03	9.80

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1940	0.53	0.16	0.00	0.07	0.07	0.00	0.13	0.15	1.07	2.07	0.05	3.27	7.57
1941	0.84	2.03	3.88	1.26	0.97	0.09	2.19	2.61	0.52	0.07	1.18	1.48	17.12
1942	0.43	0.81	0.54	0.81	0.00	0.00	1.12	0.50	0.00	0.17	0.00	0.26	4.64
1943	0.73	0.02	0.38	0.15	0.00	0.00	0.00	2.26	0.15	0.45	0.00	2.12	6.26
1944	0.31	2.20	0.75	0.28	0.18	0.00	1.31	0.07	0.20	0.08	1.06	0.75	7.19
1945	2.06	0.00	1.78	0.00	0.00	0.00	0.65	0.86	0.42				
1946			0.00	0.05	0.00	0.00	1.85	0.32	2.88	0.00	0.75	0.54	
1947	0.00	0.05	0.00	0.00	0.21	0.00	0.00	2.16	0.42	0.07	0.55	0.35	3.81
1948	0.00												
1949								1.84	0.39	0.18	0.10	0.94	
1950	0.26	0.35	0.80	0.00	0.00	0.00	0.31	0.00	0.21	0.00	0.49	0.00	2.42
1951	1.34	0.23	0.22	0.38	0.25	0.00	0.78	6.89	0.15	1.09	0.70	0.82	12.85
1952	0.73	0.14	1.96	1.63	0.00	0.40	1.53	0.78	0.04	0.00	1.71	1.09	10.01
1953	0.27	0.29	0.75	0.00	0.09	0.00	1.69	0.59	0.00	0.00	0.04	0.07	3.79
1954	1.38	0.28	1.14	0.00	0.00	0.20	1.30	0.10	0.17	0.00	0.00	0.01	4.58
1955	3.28	0.00	0.00	0.00	0.00	0.17	1.81	3.57	0.07	0.34	0.10	0.09	9.43
1956	0.35	0.12	0.00	0.00	0.00	0.00	0.36	0.05	0.00	0.52	0.00	0.00	1.40
1957	1.78	0.56	0.98	0.35	0.06	0.35	0.24	0.61	0.00	2.01	0.32	0.00	7.26
1958	0.00	1.48	1.08	0.28	0.00	0.00	0.62	0.84	0.63	0.41	0.10	0.00	5.44
1959	0.33	1.50	0.00	0.08	0.00	0.00	0.51	1.93	0.01	1.59	0.77	3.06	9.78
1960	0.81	0.16	0.49	0.00	0.00	0.00	0.11	1.40	0.17	0.69	0.05	0.03	3.91
1961	0.28	0.00	0.25	0.00	0.00	0.00	1.34	0.68	0.23	0.12	0.02	1.31	4.23
1962	1.35	0.75	0.53	0.00	0.00	0.34	0.09	0.10	1.63	0.07	0.09	0.49	5.44
1963	0.21	0.51	0.24	0.01	0.00	0.00	0.00	3.26	0.08	0.98	0.92	0.00	6.21
1964	0.16	0.28	0.49	0.02	0.00	0.01	0.75	1.29	0.99	0.20	0.39	0.78	5.36
1965	1.54	1.71	0.16	1.78	0.55	0.02	1.15	0.44	0.44	0.00	0.66	2.79	11.24
1966	0.51	1.42	0.11	0.00	0.00	0.08	0.12	0.26	2.27	0.18	0.52	0.05	5.52
1967	0.36	0.00	0.15	0.22	0.00	0.00	0.39	0.27	2.87	0.45	1.34	4.68	10.73
1968	0.03	1.80	0.62	0.01	0.00	0.23	1.07	0.39	0.00	0.28	0.70	0.41	5.54
1969	1.42	0.74	0.57	0.05	0.29	0.00	0.08	2.23	0.45	0.00	1.40	0.20	7.43
1970	0.00	0.37	2.36	0.00	0.00	0.00	0.95	0.18	4.65	0.00	0.00	0.00	8.51
1971	0.07	0.36	0.00	0.01	0.08	0.00	1.32	3.64	0.31	0.49	0.00	0.29	6.57
1972	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.90	0.08	3.10	0.96	1.67	7.10
1973	0.05	1.50	1.08	0.06	0.00	0.00	0.00	0.13	0.00	0.00	0.85	0.00	3.67
1974	0.94	0.00	1.76	0.00	0.00	0.00	0.12	1.61	0.48	2.21	0.00	0.89	8.01
1975	0.13	0.23	0.50	0.41	0.00	0.00	0.00	0.02	0.82	0.17	0.37	1.12	3.77
1976	0.00	0.67	0.11	0.55	0.14	0.00	0.31	0.46	2.84	0.69	0.58	0.10	6.45
1977	0.85	0.10	0.21	0.05	0.13	0.00	0.09	0.98	0.12	1.49	0.00	0.46	4.48
1978	2.18	2.79	3.32	0.41	0.00	0.00	0.50	1.33	0.00	0.80	1.50	1.44	14.27
1979	2.52	0.04	1.92	0.00	0.52	0.04	0.00	1.29	0.08	0.00	0.00	0.11	6.52
1980	1.17	2.32	1.24	0.56	0.23	0.00	1.32	0.55	0.28	0.00	0.00	0.00	7.67
1981	0.85	0.87	1.13	0.17	0.00	0.00	0.32	0.10	0.00	0.00	0.00	0.00	3.44
1982	0.26	0.70	1.80	0.00	0.70	0.00	1.07	4.27	0.25	0.00	2.85	2.37	14.27
1983	0.70	1.45	2.25	0.25	0.00	0.00	0.60	1.82	1.89	0.08	0.40	0.92	10.36
1984	0.00	0.00	0.00	0.39	0.00	0.05	1.46	2.46	3.23	0.00	2.73	3.83	14.15
1985	0.95	0.12	0.38	0.00	0.00	0.00	1.55	0.83	2.67	0.82	2.05	1.28	10.65
1986	0.18	0.88	1.20	0.04	0.30	0.00	1.41	0.28	0.16	1.52	0.19	0.90	7.06
1987	0.73	1.26	0.21	0.00	0.43	0.00	0.10	1.05	0.16	1.00	1.36	1.41	7.71
1988	1.33	0.30	0.06	1.20	0.00	0.00	0.13	1.90	0.00	0.86	0.48	0.02	6.28
Mean	0.80	0.74	0.73	0.27	0.10	0.06	0.86	1.13	0.70	0.50	0.62	0.92	7.44

No value indicates no report; 0.00" indicates 'Trace' or no rainfall recorded
No 'Year Total' indicates incomplete record for that year

Summary of total annual precipitation
Station: Buckeye
Data: Total Precipitation (inches)

Summary of mean maximum temperatures

Gila River Navigability Study

Station: Florence

Data: Mean Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1892												60.3	
1893	69.5	70.8	71.8	83.7	93.2	104.7	102.9	99.0	94.1	100.0	70.7	66.4	85.66
1894	61.2	63.5											
1908										85.4	75.0		
1909	70.1	68.5	71.6	86.0	92.3	103.2	106.3	102.0	97.2	85.1	73.3	54.4	84.23
1910	69.5	72.8	87.5	88.7	100.5	107.2	105.6	102.5	103.3	91.3	78.7	73.7	90.20
1911			77.5		94.7				99.8	87.5	83.9		
1912												63.2	
1913	61.5	65.8	74.1	84.3	95.9	108.0	104.1	104.9	99.0	89.7	74.4	63.5	85.53
1914	69.2	69.7	78.7	84.9	94.2	100.6	102.0	102.6	99.4	84.2	77.0	61.1	85.37
1915	62.2	66.5	72.6	81.4	87.6	102.1	103.2	104.5	98.0	93.4	78.0	68.1	84.89
1916	63.6	77.6	83.2	87.1	95.0	104.8	106.8	102.0	99.9	87.1	80.3	69.8	88.13
1917	69.2				89.5	105.3	105.4	103.7					
1918										90.1	72.6	62.6	
1919										83.5			
1921													
1923			73.5	80.7	95.7	96.6	101.4	98.6	95.5	85.2	72.0	61.4	
1924	64.0	71.4	68.9	79.0	94.6	106.2	104.2	104.5	99.4	86.3	80.1	62.1	85.10
1925	63.8	74.6	79.0	84.0	94.7	99.0	104.2	99.7	95.2	82.1	71.5	63.3	84.30
1926	61.7	71.8	76.4	81.3	91.7	104.8	103.9	102.9	96.8	87.9	76.8	62.2	84.90
1927	69.6	70.9			96.9	100.9	108.7	104.0	98.5	89.5		63.4	
1928	69.1	67.6	77.6	82.0	95.6	104.1	107.1	100.6	100.8	88.0	74.5	66.5	86.18
1929			74.6	84.1	96.3	105.2	106.3	102.7	100.0	92.7	74.0	72.5	
1930	61.5	76.1	75.3	88.7	88.2		102.2	101.8	98.8	87.4	74.3	66.5	
1931	67.8	69.3	77.8	88.1	96.9	103.4	108.3	100.4	98.9	89.9	70.6	64.1	86.39
1932	59.2	69.3	76.6	86.2	94.4	102.8	105.0	104.2	101.9	86.9	81.1	60.9	85.72
1933	62.3	65.1	78.5	80.4	89.4	103.1	107.6	105.4	101.0	91.1	80.2	70.1	86.30
1934	69.0	75.5	86.3	90.9	99.7	100.2	107.3	102.2	100.3	93.7	76.8	68.0	89.24
1935	66.4	70.5	72.0	84.3	88.8	106.7	106.9	101.5	98.7	90.6	73.9	67.4	85.71
1936	67.9	68.8	80.5	90.6	101.0	107.6	107.8	103.8	99.0	88.0	75.7	68.4	88.31
1937	56.9	70.0	76.9	86.3	97.4	104.4	107.3	106.8	103.5	95.6	82.8	71.0	88.33
1938	71.5	70.4	75.8	86.0	93.5	104.4	105.6	104.1	103.7	91.4	73.8	71.8	87.76
1939	66.0	62.0	80.3	90.2	97.5	105.7	107.5	104.0	97.6	89.6	82.5	78.7	88.62
1940	75.3	79.0	86.6	89.0	99.8	105.7	107.4	103.8	99.4	88.6	73.9	69.0	89.83
1941	66.1	70.2	72.1	76.9	93.2	100.9	105.4	101.9	96.5	83.4	78.1	72.1	84.82
1942	67.7	67.5	75.0	83.2	93.6	103.9	107.6	102.0	101.6	88.1	81.3	72.3	87.08
1943	67.8	76.5	79.3	91.3	95.5	100.4	106.0	101.5	101.2	90.1	80.8	66.8	88.14
1944	66.7	66.7	72.9	81.1	92.3	99.8	105.9	105.9	98.4	92.1	72.0	68.4	85.26
1945	66.3	72.3	72.0	84.5	94.7	101.6	106.5	104.3	101.4	90.9	79.0	65.9	86.68
1946	63.7	72.1	80.6	92.6	95.1	107.7	106.4	103.3	99.0	82.8	72.5	70.8	87.28
1947	65.4	77.7	80.5	86.6	98.3	103.2	110.3	103.2	104.7	91.5	71.6	65.0	88.22
1948	71.1	69.3	71.4	90.1	98.4	105.0	107.8	107.4	103.9	90.4	75.4	66.8	88.13

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1949	55.1	69.0	77.9	88.9	95.7	104.3	104.8	105.6	102.1	87.3	85.0	68.1	87.04
1950	67.0	76.0	80.1	90.0	92.4	103.0	101.4	105.0	98.4	99.5	84.0	77.9	89.62
1951	67.7	72.9	76.9	84.6	95.6	102.3	107.5	101.7	102.9	91.2	74.9	64.7	86.98
1952	65.6	70.0	69.3	83.9	98.5	102.8	105.6	104.2	103.4	98.3	72.3	65.6	86.67
1953	71.8	72.4	78.9		89.2	104.9	104.5	105.9	105.7	91.4	80.6	67.2	
1954	70.7	79.5	74.9	91.1	96.7	102.5	105.3	101.2	102.1	93.9	83.4	71.4	89.41
1955	61.8	67.3	78.2	85.2	92.7	103.9	102.5	98.6	102.6	96.0	79.1	73.7	86.90
1956	72.5	66.2	82.8	84.8	98.3	106.8	104.6	104.9	106.5	91.1	76.8	70.6	88.90
1957	66.9	77.5	77.5	84.5	89.8	105.6	107.3	102.9	102.8	83.5	70.6	69.9	86.59
1958	69.1	71.9	69.0	83.2	100.1	105.0	107.1	104.0	99.7	89.7	77.0	75.8	87.72
1959	73.2	70.4	80.8	89.9	92.2	107.6	108.2	100.7	100.6	90.5	76.5	66.5	88.18
1960	62.1	66.9	83.3	89.0	96.1	109.2	108.3	105.4	104.0	87.4	79.8	69.2	88.43
1961	70.7	75.4	78.2	88.7	95.0	105.8	105.2	101.5	97.1	88.9	72.8	66.1	87.17
1962	65.2	71.7	72.6	91.0	92.4	101.8	104.4	107.5	99.5	89.8	80.3	69.5	87.20
1963	64.3	75.4	75.9	82.8	97.1	99.7	106.9	100.7	101.6	92.2	75.3	69.6	86.85
1964	64.5	66.2	71.9	82.3	94.1	101.8	106.1	100.5	96.1	92.2	71.1	66.9	84.54
1965	68.2	68.3	72.4	82.5	91.3	98.1	105.4	104.5	96.8	93.2	78.1	65.6	85.47
1966	62.1	63.8	79.0	88.1	97.0	104.1	106.5	104.5	97.9	88.5	78.4	68.0	86.62
1967	68.0	73.9	80.3	79.4	93.3	100.0	104.7	104.8	100.0	91.7	80.7	60.6	86.51
1968	66.5	74.1	74.8	82.9	94.6	105.5	104.8	101.1	101.0	90.6	73.5	65.4	86.25
1969	67.9	67.9	73.0	86.2	97.5	101.9	106.9	108.3	101.7	85.3	74.3	67.9	86.67
1970	67.3	75.3	74.0	81.4	97.8	105.5	109.4	106.3	97.3	85.7	77.6	67.3	87.13
1971	69.6	71.2	80.3	84.3	90.6	103.4	108.7	102.3	99.0	82.4	75.0	62.6	85.85
1972	68.2	76.5	87.1	88.0	95.5	103.3	109.2	104.0	100.1	83.1	69.6	63.1	87.34
1973	62.5	67.5	66.8	82.5	97.5	105.9	107.1	106.8	101.9	92.8	76.3	70.5	86.61
1974	65.8	71.9	78.3	86.7	96.8	108.6	104.2	105.5	100.0	87.5	75.7	64.4	87.18
1975	67.3	69.3	73.7	78.3	92.4	103.1	106.9	107.0	100.6	89.8	77.9	67.8	86.27
1976	69.9	73.8	75.1	83.0	95.8	105.5	104.7	105.7	96.1	85.6	77.7	69.5	86.90
1977	65.2	75.6	73.8	87.2	90.1	106.4	107.1	105.2	99.7	91.5	79.2	71.9	87.78
1978	65.4	67.5	77.0	84.0	94.4	107.8	108.5	105.3	100.1	92.7	72.9	62.9	86.65
1979	59.6	69.1	73.8	86.2	93.2	105.0	107.5	102.8	105.1	93.1	74.0	72.5	86.91
1980	66.9	71.9	72.4	85.5	90.8	107.5	108.7	104.7	102.0	90.6	79.1	75.4	87.99
1981	70.6	75.3	75.4	89.7	93.5	107.4	105.6	106.6	101.1	87.1	80.8	71.6	88.77
1982	65.4	72.1	74.3	86.3	94.3	103.0	104.9	104.1	98.4	88.5	71.3	64.1	85.62
1983	67.9	68.4	72.7	79.3	95.8	103.6	108.1	103.5	100.8	85.9	73.8	66.4	85.62
1984	67.6	73.3	81.7	84.6	102.5	104.1	103.5	102.6	100.1	83.8	74.6	63.2	86.83
1985	63.5	69.6	77.4	90.9	97.0	107.7	107.6	105.4	94.4	85.7	70.5	66.7	86.46
1986	73.5	72.3	79.8	85.5	95.4	104.6	102.8	102.6	95.3	84.8	74.5	65.9	86.49
1987	65.3	68.9	73.1	89.1	91.7	104.0	103.0	101.8	96.3	90.5	72.4	61.6	84.88
1988	64.8	73.4	77.5	82.7	92.7	102.7	103.5	100.2	96.6	90.9		65.7	
Mean	66.4	71.1	76.6	85.5	94.7	104.0	105.9	103.5	99.9	89.3	76.3	67.3	86.78

No value indicates no report

No 'Annual Value' indicates incomplete record for that year

Summary of mean maximum temperatures

Station: Florence

Data: Mean Maximum Temperature

09/02/96

Summary of mean minimum temperatures

Gila River Navigability Study

Station: Florence

Data: Mean Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1892							84.0	78.0	64.0	54.0	42.0	42.0	
1893	34.0	34.0	42.0	52.0	54.0	72.0	80.0	78.0	78.0	55.0	50.0	50.0	56.70
1894	36.0	36.0	42.0	50.0	70.0		90.0	83.0	64.0	54.0	42.0	28.0	
1895	28.0	42.0	48.0	46.0	58.0	64.0	85.0	80.0	70.0	50.0	44.0	35.0	54.25
1896	38.8	41.9	46.5	51.1	61.1	71.9	82.5						
1898										61.1	47.6	37.1	
1899	42.1	39.6	47.3	47.1	59.0								
1906				47.4	55.7	62.7	77.8	72.2	68.5	60.9			
1907	34.8			44.6					71.1	49.6	42.0	35.8	
1908	41.7	48.8	51.7	49.6	53.2	64.2	73.1	79.3	70.7	53.5	47.4	35.8	55.78
1909	35.6	46.8	44.2	51.3	56.6	64.4			68.0	54.8	39.7	38.5	
1910	41.4	43.6	43.9	49.9	55.8	64.2	79.3	77.7	68.9	62.3	48.5	35.4	55.99
1911	37.1	40.7	46.5	51.0	53.9	62.0	78.3	78.2	66.2	50.6	46.4	40.0	54.33
1912	42.4	39.4	41.7	51.7	55.1	64.7	79.6	74.6	68.2	51.1	40.9	35.7	53.85
1913	37.3	37.0	49.1	53.0	63.4	68.9	75.9	73.6	71.4	58.2	44.9	40.5	56.22
1914				48.0	53.9	66.5	77.1	75.4		53.7	39.3	29.0	
1915	33.8		65.0	52.2	57.6	66.4	74.5	73.2	61.3	56.9	42.5	30.3	
1916	34.0	45.0	51.8		53.1	65.6	72.5	68.1		49.1	47.8	37.5	
1917	39.2	39.5	49.5	51.8	58.0	69.8	77.4	76.6	70.3	58.3	50.7	36.8	56.59
1918	36.5	38.7	40.4	47.6	53.7	66.0	75.8	75.0	62.1	52.5	41.1	33.3	51.97
1919	40.4	41.9	47.0	50.3	53.8	62.7	75.3	73.2	67.8	48.0	32.0	29.4	51.88
1920	39.0	37.9	37.7	47.8	53.1	67.1	79.2	69.2	69.1	56.8	43.9	36.5	53.19
1921		42.0	51.2	51.0	55.5	74.1	75.9		70.7	57.9	44.9	38.7	
1922	37.4	37.0	42.7	51.9	59.5	68.0	77.8	78.3	72.9	53.2	43.3	39.7	55.25
1923	42.9	45.6	43.7	48.5	58.1	67.2	76.9	75.8	65.5	52.3	43.9	34.5	54.63
1924	37.5	41.2	49.7	48.8	56.5	68.5	79.1	76.5	68.2	57.5	44.6	45.1	56.21
1925	34.7	40.7	43.2	47.4	59.0	70.3	80.8	74.1	68.0	56.5	41.6	42.8	55.02
1926	40.0	42.9	42.9	48.3				67.2	58.5			40.0	
1927	35.8	43.6	39.5		60.9	70.6	76.7	75.1	69.1	49.4	42.9	35.5	
1928	33.2	39.9	42.8	50.6	60.3	67.8	75.6			53.7	44.9	43.1	
1929	34.2	38.4		56.3		74.5	73.2	69.1	61.0	53.9			
1930				49.1	57.9					56.2	49.2		
1931	37.8	39.2	44.7	50.4	63.4	67.5	77.1	73.5		56.8	47.5	36.5	49.71
1932	36.6	36.3	41.4	48.2	59.3	65.6	76.4	76.1	68.3	57.9	40.1	38.2	53.82
1933	36.8	41.5	44.7	55.7		68.2	75.1	73.9	64.5	42.4	40.2	32.8	
1934		47.5	39.6	47.4		59.3		73.6	69.8	54.5	43.0	32.8	
1935	25.8	40.5	43.7	46.8	52.9	65.4	76.7	75.0	58.1	55.6	43.7	33.0	51.50
1936	33.6	32.8	42.1	44.2	51.3	66.4	80.3	76.4	70.5	58.6	40.7	34.9	52.78
1937		45.6	48.3	49.9	52.1	53.1	71.2	71.1	62.5	55.2	44.5	40.1	
1938	40.0	41.9	42.4	49.6	54.4	66.6	77.5	80.3	70.9	53.5	40.8	38.0	54.74
1939	35.9	42.6	46.2	49.9	60.3	71.8	79.1	75.2	68.4	53.3	37.7		
1940		37.6	43.7	48.0	56.9	65.3	78.3	77.3	71.3	48.2	38.9		
1941	38.6	36.0		49.1	58.0	66.2	68.3	75.4	71.9	54.1	37.4	40.4	
1942	38.8	34.2	44.8	54.6	58.2	66.5	76.1	75.4	71.4	52.6	50.0	41.7	55.47
1943	39.3	40.9	45.9	55.9	65.5	70.3	75.0	76.2	70.5	58.6	39.8	44.1	56.94
1944	40.6	38.4	38.1	39.4	54.5	53.2	64.7	67.2			46.6	41.0	

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1945	40.5		43.4	50.6	56.6	65.3	80.3	76.4	68.5	58.0	47.2	39.5	
1946	40.8	44.4	49.1	54.0	60.5	68.1	78.0	76.5	72.7	60.6			
1947	36.8		41.9	45.0	57.5	62.7	72.9	76.1	69.1	58.4	45.3	39.4	
1948	38.0	41.2	43.2	48.6	59.9	62.8	78.5	78.9	70.4	62.0	42.9	38.7	55.53
1949	40.0	36.9	45.1	56.7	59.9	68.9	78.2	78.8	71.5	52.7	41.9	40.5	56.04
1950	35.2	41.4	47.0	52.2	63.2	67.6	70.5	69.6	63.9	53.0	38.5	36.3	53.27
1951	35.6	38.0	43.9	53.6	56.6	66.1	76.2	77.4	70.5	61.6	38.9	36.6	54.69
1952	32.7	36.4	44.1	54.6	59.2	68.9	74.8	71.8	74.1	53.2	48.8	39.2	54.89
1953	33.9	42.7	45.9	53.0	56.3		77.5	74.9	66.2	60.5	46.8	41.2	
1954	36.4	41.6	45.2	53.5	61.3	65.5	76.0	74.4	62.8	55.6	46.8	39.5	54.97
1955	36.2	38.9	42.0	52.1	61.1	66.4	75.6	79.0	73.6	59.6	43.7	37.8	55.60
1956	38.5	36.8	46.0	52.2	53.0	65.1	81.6	75.4	67.7	56.6	46.0	34.8	54.58
1957	36.1	44.9	45.4	54.3	62.0	66.8	79.5	77.5	70.1	58.1	46.5	37.7	56.64
1958	36.5	34.1	43.0	46.9	56.2	66.6	73.0	77.8	66.4	56.9	43.5	40.2	53.56
1959	40.1	34.3	41.6	48.7	61.2	71.2	76.6	72.1	71.5	53.8	40.0	35.3	53.98
1960	41.1	47.9	48.6	51.8	58.0	71.7	79.2	77.2	68.6	58.6	44.1	41.2	57.39
1961	35.7	44.3	44.9	51.9	64.5	70.3	76.9	79.6	72.8	62.5	43.7	37.0	57.08
1962	33.9	39.3	45.0	55.1	59.4	72.5	83.1	77.5	67.0	57.4	48.2	41.3	56.74
1963	36.4	37.1	47.2	52.3	57.4	73.0		76.8	69.9		44.3	35.3	
1964	39.8									54.9	44.9	39.4	
1965	38.5	44.0	42.0	54.9	57.7	63.8	71.0	75.9	71.7	58.5	49.6	42.8	55.92
1966	33.7	47.0	44.5	50.4	63.6	65.5	80.3	77.1	74.8	63.0		37.1	
1967			42.5	51.0	60.3	67.8	80.1	77.7	68.1	62.5	44.3	40.0	
1968	41.4	39.9	44.6	53.2	57.3	61.7	78.6	77.7	67.5	59.0	49.9	42.4	56.21
1969	35.7	38.7	46.0	53.9	63.9	70.5	78.6	79.2	71.3	56.3	46.8		
1970	34.9	38.3	46.5	47.2	58.0	67.1	80.0	78.6	67.6	56.7	48.5	34.4	54.92
1971	36.7	44.8	45.5	48.3	56.6	65.5	75.4	69.2	64.5	51.5	41.7	30.3	52.54
1972	41.8	32.9	41.7	51.6	62.1	66.4	80.0	81.7	71.1	48.7	51.4	42.1	56.10
1973	37.7	44.9	46.7	51.5	61.6	67.4	82.4	80.3	68.3	55.1	46.5	38.8	56.85
1974	36.6	42.8	45.7	51.6	57.8	69.2	79.1	74.9	69.9	52.5	42.4	36.8	55.00
1975	32.6	40.7	51.1	52.9	58.9	71.8	81.8	76.3	69.1	60.3	44.1	39.0	56.65
1976	36.8	45.6	44.5	52.0	65.1	71.0	78.9	78.3	65.3	55.7	45.4	38.6	56.50
1977	39.6	38.1	48.1	52.1	61.9	74.5	79.3	75.2	74.1	61.7	45.9	35.0	57.23
1978	37.1	39.0	44.9	46.5	57.7	66.9	80.2	76.7	72.8	56.1	44.4	40.0	55.30
1979	39.5	46.6	45.5	51.3	63.5	70.0	79.1	75.9	70.6	58.5	47.8	38.5	57.29
1980	40.1	40.3	42.2	52.9	57.6	71.5	80.2	80.8	72.6	63.5	48.8	45.1	58.07
1981	43.7	45.1	52.4	52.8		73.6	80.4	77.2	72.4	63.8	49.0	38.4	
1982	38.2	40.8	46.7	52.1	62.1	72.1	78.1	74.2	75.3	59.3	44.5	41.0	57.12
1983	44.3	48.0	47.1	53.1	59.0	70.4	81.5	78.5	70.6	60.1	46.6	43.2	58.60
1984	45.2	44.0	47.4	55.6	61.8	75.0	81.0	80.6	73.0	56.0	48.5	40.8	59.16
1985	39.6	45.9	48.8	54.2	60.4	66.0	77.2	79.2	71.0	53.3	48.0	41.7	57.17
1986	43.6	43.4	48.4	50.0	59.5	66.5	77.8	79.1	76.0	62.1	47.4	45.5	58.38
1987	40.8	39.7	46.4	53.3	66.8	70.3	78.5	75.9	74.3	56.1	45.0	42.9	57.61
1988	40.7	40.8	47.8	57.5	64.2	72.3	80.6	78.7	70.6	62.9	51.0	44.6	59.42
Mean	37.7	40.9	45.4	50.8	58.7	67.5	77.7	76.0	69.1	56.1	44.6	38.4	55.32
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average

No value indicates no report

No 'Annual Value' indicates incomplete record for that year

Summary of mean minimum temperatures

Station: Florence

Data: Mean Minimum Temperature

09/02/96

Summary of total annual precipitation 09/02/96

Gila River Navigability Study Page 1

Station: Florence

Data: Total Precipitation (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1889							0.36	1.03	0.00	1.50	0.00	0.28	
1890	0.00	0.40	0.00	0.00	0.00	0.00	1.40	3.90	0.00	0.00	0.60	1.10	7.40
1891	0.00	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00
1892	2.77	2.30	1.11	0.33	0.20	0.00	0.40	0.60	0.65	0.00	0.00	0.00	8.36
1893	0.00	0.00	1.94	0.00	0.40	0.00	1.20	1.79	0.14	0.20	1.25	0.19	7.11
1894	0.00	0.40	0.71	0.00	0.00	0.00	0.99	0.00	0.00	0.60	0.00	1.55	4.25
1895	0.81	0.00	0.00	0.00	0.00	0.00	0.30	1.40	0.00	0.50	0.28	0.00	3.29
1896	0.00	1.10	1.10	0.00	0.00	2.45	2.58	1.06	1.42	0.00	0.40	0.40	0.10
1897	2.62	0.70	0.40	0.00	0.00	0.00	0.20	2.57	0.00	0.20	0.00	0.00	6.69
1898	1.65	0.00	0.49	0.00	0.00	0.70	0.25	0.60	0.00	0.00	0.00	1.10	4.79
1899	0.80	0.20	0.00	0.00	0.00	0.00	1.60	0.42	0.80	0.00	1.10	0.00	4.92
1900	0.00	0.00	1.00	1.10	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.12
1901	0.15	0.90	0.50	0.00	0.00	0.00	0.60	0.00	0.00	0.40	0.00	0.00	2.55
1902					0.00	0.00	0.00	0.00					
1903				0.14	0.03	0.00	0.57	0.40	1.01	0.00			
1904	0.00		0.00	0.00	0.09	0.00	0.80	1.30	0.60	0.00	0.00	0.00	
1905	1.30	3.60	2.74	0.00	0.00	0.01	0.34	0.05	1.03	0.00	3.84	0.30	13.21
1906	0.00	1.10	0.03	0.10	0.00	0.00			0.00	0.00	1.10	2.43	
1907	1.83	0.00	0.50	0.00	0.02	0.00	1.02	1.00	0.00	1.95	0.00	0.00	6.32
1908	0.40	1.47	0.47	1.25	0.00	0.00	0.42	0.21	0.40	0.45	0.08	2.54	7.69
1909	0.17	0.32	0.63	0.00	0.03	0.00	0.37	2.87	0.12	0.00	0.42	0.62	5.55
1910			0.20			0.00	0.43	0.07	0.00				
1911				0.00	0.00	0.00	2.27	0.00		0.05	0.00	0.00	
1912	0.00		2.00	0.00	0.56	0.00	1.06	2.68	0.00	0.53	0.00	0.97	
1913	0.28	1.70	0.00	1.10	0.05	0.00	0.72	0.30	0.00	0.00	1.24	0.25	5.64
1914	0.06	0.98	0.98	0.00	0.66	0.00	0.17	0.11	0.16	1.99	0.73	2.92	8.76
1915	1.53	1.15	0.18	0.34	0.21	0.20	0.21	0.00	0.25	0.00	0.77	2.69	7.53
1916	2.45	0.16	0.50	0.00	0.00	0.00	1.18	0.22	2.32	0.95	0.00	0.69	8.47
1917	1.60	0.05	0.20	0.92	0.00	0.00	1.50	0.50	0.00	0.10	0.00	0.00	4.87
1918	0.80	0.24	1.05	0.00	0.00	1.01	0.76		0.60	0.50	0.88	0.85	
1919	0.10	0.46	1.25	0.10	0.20	0.20	1.05	1.25	2.45	0.00	1.95	0.00	9.01
1920	1.45	0.80	1.30	0.00	0.00	0.00	0.80	1.00	0.00	0.50	0.00	0.00	5.85
1921	0.20	0.00	0.20	0.15	0.10	0.00	1.45	1.58	0.35	0.05	0.10	1.20	5.38
1922	0.57	0.40	0.84	0.15	0.00	0.20	0.70	2.20	0.30	0.00	0.20	0.15	5.71
1923	0.30	0.10	0.70	0.00	0.14	0.00	1.08	0.33	0.10	1.20	2.22	1.12	7.29
1924	0.00	0.00	0.65	0.31	0.00	0.00	0.08	0.45	0.00	0.25	0.05	1.10	2.89
1925	0.05	0.00	0.00	0.60	0.00	0.50	0.10	3.16	0.70	1.51	0.00	0.00	6.62
1926	0.42	0.08			0.00		0.00	0.00	2.47	0.00			
1927				0.00						1.25	0.00		
1928	0.00	0.86	0.05	0.00	0.01	0.00	0.05	0.76	0.32	0.00	0.00	0.83	2.88
1929	0.71	0.25	0.15	0.00	0.00	0.00	0.67	2.43	1.01	0.00	0.26	0.00	5.48
1930	1.15	0.00	1.58	0.00	1.50	0.00	0.15	1.48	0.00	0.00	0.00	0.00	5.86
1931	0.00	2.87	0.00		0.00	0.00			0.00	0.03	1.25	1.15	
1932	0.00	1.67	0.35	0.00	0.00	0.39	1.47	0.20	0.00	1.10	0.00	2.09	7.27
1933	3.32	0.00	0.00	0.10	0.00	0.00	0.50	0.35	0.10	0.00	1.30	0.00	5.67
1934	0.17	0.30	0.00	0.00	0.00	0.00	0.32	2.96	0.00	0.00	0.00	0.11	3.86
1935	0.03	0.17	0.07	0.00	0.00	0.00	0.03	0.27	1.39	0.00	0.55	0.30	2.81
1936	0.85	0.47	0.61	0.00	0.00	0.00	2.20	0.25	0.00	0.00	0.70	1.74	6.82
1937	0.20	0.00	1.33	0.00	0.20	0.02	1.12	1.10	0.05	0.00	0.00	0.05	4.07
1938	0.15	0.31	1.25	0.00	0.00	0.00	0.14	1.21	0.11	0.00	0.00	0.91	4.08
1939	0.27	0.40	0.02	0.00	0.00	0.00	0.70	1.12	1.86	0.00	0.51	0.09	4.97

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1940	0.00	0.30	0.00	0.10	0.24	0.00	0.08	0.85	1.72	1.85	0.35	2.25	7.74
1941	0.40	1.56	3.74	2.29	0.73	0.00	0.50	1.84	0.12	0.00	0.95	1.45	13.58
1942	0.37	0.28	0.40	0.71	0.00	0.00	0.43	0.81	0.15	0.12	0.00	0.10	3.37
1943	0.29	0.15	0.79	0.12	0.00	0.00	0.00	2.03	0.02	0.35	0.00		
1944	0.00	1.20	0.77	0.26	0.20	0.00	0.70	0.68	1.13	0.15	1.01	0.60	6.70
1945	1.17	0.07	1.11	0.00	0.00	0.00	1.53	0.95	0.00	0.57	0.00	0.05	5.45
1946	0.60	0.00	0.00	0.34	0.00	0.00	1.96	1.42	3.29	0.00	0.52	0.19	8.32
1947	0.00	0.00	0.00	0.00	0.15	0.00	0.00	1.03	0.00	0.00	1.00	0.48	2.66
1948	0.00	0.19	0.65	0.00	0.00	0.00	1.17	0.73	0.00	1.00	0.00	0.43	4.17
1949	1.78	0.00	0.25	0.21	0.00	0.10	0.31	0.55	1.69	0.10	0.50		
1950	0.37	0.31	0.12	0.00	0.00	0.00	1.11	0.00	0.22	0.00	0.00	0.00	2.13
1951	1.25	0.06	0.08	0.40	0.45	0.00	1.64	5.60	0.00	0.12	1.14		
1952	0.75	0.60	2.61	1.28	0.00	0.06	0.31	0.03	0.00	0.00	0.58	0.08	6.30
1953	0.10	0.38	0.30	0.09	0.00	0.00	1.28	0.53	0.00	0.00	0.00	0.00	2.68
1954	0.42	0.26	0.67	0.00	0.10	0.27	1.75	0.00	0.28	0.00	0.00	0.00	3.75
1955	1.96	0.00	0.00	0.00	0.00	0.00	3.36	1.66	0.00	0.00	0.04	0.00	7.02
1956	0.20	0.10	0.00	0.00	0.00	0.00	1.35	0.00	0.00	0.37	0.00	0.00	2.02
1957	1.58	0.30	0.47	0.29	0.53	0.16	1.47	0.08	0.00	2.36	0.06	0.00	7.30
1958	0.00	1.14	1.32	0.89	0.00	0.07	0.00	0.21	0.00	0.07	0.00	0.00	3.70
1959	0.00	0.62	0.00	0.00	0.01	0.15	0.12	1.37	0.00	0.79	0.15	2.04	5.25
1960	0.90	0.00	0.23	0.00	0.00	0.00	0.00	0.77	0.00	0.49	0.00	0.00	2.39
1961	0.28	0.00	0.27	0.00	0.00	0.08	0.32	3.06	1.09	0.38	0.04	0.70	6.22
1962	2.13	0.43	0.51	0.00	0.00	0.16	0.00	0.00	0.47	0.00	0.02	0.42	4.14
1963	0.08	0.21	0.35	0.00	0.00	0.00	0.00	0.58	0.04	1.31	0.44	0.00	3.01
1964	0.12	0.12	0.00	0.02	0.00	0.00	0.87	2.42	1.24	0.80	0.51	1.21	7.31
1965	1.32	1.25	0.68	1.89	0.12	0.00	0.10	0.29	0.34	0.00	0.60	3.42	10.01
1966	0.88	1.32	0.00	0.00	0.00	0.00	0.16	2.06	1.02	0.38	0.41	0.07	6.30
1967	0.14	0.00	0.09	0.33	0.02	0.00	0.94	0.12	2.15	0.62	1.25	3.00	8.66
1968	0.00	0.68	1.66	0.02	0.00	0.00	0.86	2.63	0.00	0.00	0.35	0.29	6.49
1969	1.39	0.73	0.16	0.00	0.82	0.00	0.00	0.60	0.15	0.00	0.97	0.38	5.20
1970	0.00	0.33	2.36	0.00	0.00	0.00	0.66	0.20	1.66	0.03	0.08	0.16	5.48
1971	0.01	0.33	0.00	0.00	0.00	0.00	0.20	2.59	0.63	0.18	0.00	0.26	4.20
1972	0.00	0.00	0.00	0.00	0.00	0.59	0.02	0.66	0.00	2.02	0.98	1.14	5.41
1973	0.02	1.83	1.45	0.05	0.00	0.12	0.60	0.10	0.00	0.00	1.51	0.00	5.68
1974	0.41	0.00	0.61	0.00	0.00	0.00	1.22	0.45	0.03	2.14	0.20	0.52	5.58
1975	0.06	0.24	0.81	0.50	0.00	0.00	0.48	0.05	0.69	0.05	0.74	1.93	5.55
1976	0.00	1.01	0.65	0.31	0.35	0.00	1.24	0.30	2.45	0.42	0.74	0.75	8.22
1977	0.24	0.00	0.16	0.06	0.02	0.02	0.21	0.76	1.22	0.53	0.01	0.78	4.01
1978	2.10	1.06	0.62	0.37	0.00	0.00	0.39	1.90	0.00	1.01	1.10	1.31	9.86
1979	2.61	0.18	1.27	0.04	0.41	0.00	0.84	0.91	0.30	0.09	0.01	0.02	6.70
1980	1.27	1.60	0.85	0.18	0.09	0.00	0.32	0.34	0.01	0.09	0.00	0.02	4.77
1981	0.95	0.43	0.73	0.26	0.09	0.00	0.38	0.61	0.24	0.34	0.35	0.00	4.38
1982	0.32	0.76	1.93	0.00	0.23	0.00	1.40	1.00	1.18	0.00	1.29	1.45	9.56
1983	0.94	0.92	1.46	0.04	0.00	0.00	0.00	8.37	1.30	0.35	0.69	2.52	16.59
1984	0.20	0.00	0.00	1.00	1.85	0.01	4.72	1.09	1.57	0.00	2.33	2.36	15.13
1985	0.39	0.90	0.09	0.37	0.00	0.00	0.60	1.14	0.99	0.75	2.19	1.05	8.47
1986	0.15	1.13	0.85	0.00	0.00	0.00	1.46	1.01	0.53	0.73	0.00	1.14	7.00
1987	0.16	1.28	0.34	0.01	0.10	0.00	0.38	1.21	0.30	0.26	0.86	1.33	5.96
1988	0.42	0.27	0.02	0.45	0.00	0.00	0.28	0.65	0.00	0.81	2.33	0.00	5.23
Mean	0.62	0.58	0.62	0.21	0.11	0.08	0.74	1.06	0.50	0.38	0.50	0.69	5.95
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total

No value indicates no report; 0.00" indicates 'Trace' or no rainfall recorded
No 'Year Total' indicates incomplete record for that year

Summary of total annual precipitation

Station: Florence

Data: Total Precipitation (inches)

Summary of mean maximum temperatures
Gila River Navigability Study

Station: Gila Bend
Data: Mean Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1889							112.0	111.0	104.0	104.0	74.0	76.0	
1890	68.0	66.0	80.0	90.0	102.0	104.0	110.0	104.0	116.0	100.0	83.0	82.0	92.23
1891	70.0	75.0	90.0	103.0	103.0		118.0	114.0	113.0	106.0	98.0	77.0	
1892	82.0	86.0	92.0	98.0	110.0	120.0	120.0	120.0	114.0	102.0	90.0	85.0	101.63
1893	69.5	72.5	73.7	83.2	92.3	104.4	105.0						
1895										94.9	76.8	71.0	
1896	75.5	76.8	82.5	85.7	96.3								
1903				85.6	95.3	105.3	110.4	111.5	105.6	96.0			
1904	69.2			93.4		109.1	108.6	107.2	99.0	93.6	87.3	77.9	
1905	77.2		80.2	83.3	92.1	105.8	110.5	108.8	103.5	91.7	75.3	65.2	
1906	68.4	72.5	78.9	83.9	93.8	105.2			101.3	91.4	75.0	66.7	
1907	67.2	79.1	78.3	93.0	91.4	97.4	107.1	106.7	105.0	87.8	80.2	71.8	88.77
1908	72.0	70.4	81.2	90.0	95.3	104.1	107.4	106.8	105.2	88.1	83.8	67.9	89.38
1909	72.3	71.6	76.4	89.2	94.1	108.4	108.2	102.9	100.1	93.6	80.7	63.2	88.46
1910	68.5	73.7	88.1	94.6	102.8	106.7	111.4	110.4	104.0	88.6	78.4	68.6	91.41
1911				91.2	98.1	106.3	104.9	111.1		89.2	82.6	69.9	
1912	76.4		79.4	82.0	95.5	104.8	103.0	104.0	99.5	87.1		67.1	
1913	65.6	69.8	81.2		96.5	101.8	103.0	107.1		94.1	80.2	67.2	
1914	72.8	74.1	81.9	88.6	97.0	103.5	105.7	105.7	103.2	90.0	82.2	64.5	89.17
1915	66.0	69.4	79.5	85.2	90.8	104.7	105.0	108.0	100.9	97.4	80.6	66.5	87.93
1916	66.1	77.6	85.2	88.6	95.4	106.0	107.2	106.0	95.0	86.5	78.7	64.9	88.11
1917	64.6	73.0	78.3	84.4	87.9	107.5	108.1	106.7	103.3	96.3	86.6	77.0	89.54
1918		74.2	79.3	86.4	91.1	108.3	107.7		103.8	91.4	75.4	65.4	
1919	69.1	68.8	75.3	89.8	96.0	107.9	105.4	107.4	99.6	85.4	74.8	69.7	87.53
1920	66.2	72.2	75.8	83.7	96.5	105.0	111.8	105.8	101.3	88.6	78.3	69.5	87.93
1921	69.0	76.8	83.9	87.6	93.0	106.0	106.9	104.5	103.6	95.8	83.0	71.2	90.16
1922	65.5	73.0	75.1	83.2	98.7	108.1	108.5	106.5	105.0	94.0	75.9	71.5	88.83
1923	73.6	72.2	77.7	90.0			106.6	107.7	103.8			69.9	
1924	67.4	81.2	77.9			110.5	108.8	109.4	105.5	94.1	84.1	67.7	
1925	71.7	80.3	85.8	92.3	99.8	102.8	108.6			85.2	78.8	78.3	
1926	67.8	78.5		90.5	100.2	115.2	113.8	110.5	106.4	99.2			
1927					105.1					92.5	81.0		
1928	70.0	72.4	83.0	90.1	99.1	106.5	111.5	106.8		92.6	77.1	68.6	
1929	68.4	68.2	79.7	88.4	97.4	106.7	109.1	106.0	100.8	94.2	77.0	75.2	89.39
1930	65.3	79.8	79.7	92.9		107.9	110.4	107.6	102.9	94.6	78.7	70.1	
1931		78.3	88.4	98.0		109.8		110.0	105.9	94.2	74.7	66.1	
1932	65.3	72.8	83.8	91.8	101.0	108.6	112.5	112.8	108.0	90.0	81.5	60.4	90.73
1933	60.0	64.4	83.6	81.6	93.1	108.5	112.8	109.0	107.6	98.5	83.5	68.4	89.39
1934		80.5	93.6	95.8	105.1	103.6	111.6	106.9	105.3	96.9	81.7	71.6	
1935	70.0	77.1	79.3	90.3	95.7	109.7	111.9	107.8	103.5	92.0	75.2	70.7	90.33
1936	69.9	71.3	81.5	94.1	99.2	113.1	112.5	108.5	101.7	98.6	76.2		
1937		71.9	79.3	86.1	95.6	105.0	106.9	106.8	100.4	88.6	77.3		
1938	70.7	68.1		90.9	95.6	105.8		108.5	105.8		76.3	72.2	
1939	70.8	67.4	85.1	92.2	99.8	106.3	109.1	107.6	99.1	91.7	82.5	76.5	90.82
1940	75.0	75.2	85.4	91.7	103.2	110.8	111.6	110.1	103.4	93.0	79.9	74.4	92.86
1941	69.0	76.0	76.9	81.4	97.6	104.9	110.6	106.1	101.7	89.3	80.1	69.9	88.69
1942	69.8		79.4	87.0	96.5	106.8	111.8	106.3	104.5	91.5	83.3	73.8	
1943	69.2	77.6	82.2	91.8	98.8	102.3	110.0	103.2	106.3	90.9			

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1944	68.7		75.3	85.3	93.4	101.5	109.5	111.6	104.2	94.7	73.8	70.1	
1945	64.0	71.2	73.7	87.1	96.5	102.8	109.6	106.5	104.4	92.5	78.7	67.6	87.96
1946	68.0	74.7	82.2	93.9	95.9	108.5	107.7	106.7	102.7	86.1	73.6	72.6	89.45
1947	66.6	80.0	82.2	88.6	101.5	104.1	113.5	108.5	107.1	95.6	72.6	66.7	90.64
1948	71.7	70.7	73.9	89.8	97.0	104.3	108.7	108.0	104.4	92.7	75.0	66.6	88.61
1949	57.2	69.4	79.0	89.5	97.6	105.0	108.7	108.2	104.5	88.0	86.0	72.5	88.88
1950	66.8	77.5	81.9	93.2	95.3	104.8	105.2	110.3	100.9	99.0	84.3	77.7	91.47
1951	69.7	71.5	78.1	86.0	96.5	103.3	110.9	104.8	106.1	91.5	75.0	66.5	88.42
1952	65.3	71.5	70.5	84.1	99.6	105.2	108.3	109.0	106.3	100.5	74.2	65.0	88.34
1953	72.1	71.5	80.0	85.5	89.8	105.4	109.1	109.4	107.9	92.8	80.2	69.0	89.48
1954	68.7	80.3	77.0	93.8	98.5	103.7	107.7	105.6	105.3	95.8	83.6	71.5	90.98
1955	62.5	68.0	81.0	89.2	93.4	105.3	104.9	101.5	105.0	97.6	79.0	73.5	88.51
1956	76.7	69.0	83.6	86.3	98.2	107.0	106.3	107.0	107.9	92.1	76.7	71.8	90.29
1957	67.7	76.5	78.1	85.1	90.7	107.2	110.0	106.1	103.7	87.2	73.1	71.6	88.13
1958	70.8	74.3	72.5	85.0	102.2	106.4	110.5	106.4	103.3	92.2	76.9	76.3	89.83
1959	75.9	69.1		92.3	94.2	107.6	109.3	103.5	102.0	92.5	77.8	67.4	
1960	60.7	69.4	83.1	89.7	97.1	108.9		107.9	104.0		78.1	68.2	
1961	71.0	75.8	79.7							90.4	72.1	65.5	
1962	64.4	71.1	72.4	93.8	92.5	103.6	109.5	110.9	101.4	92.9	82.3	70.5	88.85
1963	64.6	79.8	78.5	84.1	100.0	102.4	111.1	102.6	103.6	93.0		69.7	
1964			75.2	85.4	95.5	104.2	109.0	109.3	100.0	93.9	71.4	67.4	
1965	66.8	70.1	73.5	83.4	93.3	99.7	109.0	107.7	99.2	94.5	78.8	66.0	86.93
1966	61.6	65.8	79.3	91.3	101.3	107.4	110.1	107.5	99.9	89.1	78.3		
1967	67.6	75.0	81.0	80.0	96.4	101.7	108.4	107.6	98.4	93.8	82.6	61.9	87.94
1968	68.0	75.7	77.4	83.2	95.5	106.3	106.0	102.7	103.3	93.0	77.4	65.5	87.85
1969	71.9	71.5	78.1	88.6	98.8	101.2	109.5	110.5	103.8	86.5	77.7	70.5	89.15
1970	69.0	75.9	76.3	82.3	98.5	107.0	110.1	106.3	99.1	88.1	79.6	67.6	88.38
1971	68.5	73.4	82.5	85.1	90.4	103.1	110.5	101.3	99.7	83.4	75.4	64.0	86.50
1972	68.8	77.3	87.6	88.9	95.5	103.8	112.2	105.4	101.7	82.0	72.3	65.1	88.41
1973	65.1	70.0	68.6	83.3	99.0	106.0	109.5	108.7	103.9	94.9	77.8	72.1	88.34
1974	67.9	73.9	81.0	88.4	98.1	110.0	106.1	107.8	102.3	90.1	77.6	65.3	89.11
1975	69.2	72.0	75.2	78.5	94.2	104.9	108.5	109.9	104.0	91.2	77.6	67.0	87.77
1976	72.6	75.4	77.7	84.6	97.6	105.7	106.1	107.8	97.8	88.2	79.4	71.4	88.73
1977	68.2	78.6	75.7	89.6	89.5	108.3	111.3	108.4	104.1	93.6	83.2	74.9	90.48
1978	69.0	71.5	81.2	86.4		109.8	110.8	107.1	102.1	95.8	76.0	65.8	
1979	61.6	72.9	77.3	89.1	95.6	107.6	110.5	105.4	107.6	95.5	77.5	76.0	89.79
1980	72.0	76.3	77.3	88.6	92.8	108.0	112.8	108.0	105.2	93.8	81.1	76.5	91.06
1981	73.1	77.2	78.5	92.1	96.2	110.1	110.3	110.3	103.6	88.5	82.1	73.6	91.35
1982	67.5	75.0	76.5	87.9	95.9	103.7	107.6	106.2	100.5	89.1	73.5	65.4	87.46
1983	70.0	70.4	75.5	81.7	96.9	105.3	112.4	108.3	106.8	92.5	79.5	69.9	89.21
1984	70.3	75.3	84.2	87.2	104.0	104.6	104.8	104.7	102.7	86.4	76.5	65.2	88.86
1985	66.5	70.5	78.3	93.4	100.2	110.3	112.1	110.6	103.0	91.6	77.4	70.7	90.48
1986	76.0	75.5	85.0	89.8	99.5	108.4	107.5	108.2	98.0	88.9	78.4	69.1	90.44
1987	68.9	73.2	78.2	93.8	96.6	109.0	108.4	105.1	100.8	94.6	78.8	69.7	89.83
1988	66.7	75.7	81.7	86.7	96.6	106.4	108.1	105.0	100.6	95.2	77.9	68.2	89.10
Mean	68.9	73.7	79.8	88.4	96.9	106.2	109.3	107.6	103.5	92.5	78.9	70.0	89.70

No value indicates no report
No 'Annual Average' indicates incomplete record for that year

Summary of mean maximum temperatures
Station: Gila Bend
Data: · Mean Maximum Temperature

Summary of mean minimum temperatures 09/02/96
Gila River Navigability Study Page 1
Station: Gila Bend
Data: Mean Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1889							84.0	78.0	64.0	54.0	42.0	42.0	
1890	34.0	34.0	42.0	52.0	54.0	72.0	80.0	78.0	78.0	55.0	50.0	50.0	56.70
1891	36.0	36.0	42.0	50.0	70.0		90.0	83.0	64.0	54.0	42.0	28.0	
1892	28.0	42.0	48.0	46.0	58.0	64.0	85.0	80.0	70.0	50.0	44.0	35.0	54.21
1893	38.8	41.9	46.5	51.1	61.1	71.9	82.5						
1895										61.1	47.6	37.1	
1896	42.1	39.6	47.3	47.1	59.0								
1903				47.4	55.7	62.7	77.8	72.2	68.5	60.9			
1904	34.8			44.6					71.1	49.6	42.0	35.8	
1905	41.7	48.8	51.7	49.6	53.2	64.2	73.1	79.3	70.7	53.5	47.4	35.8	55.78
1906	35.6	46.8	44.2	51.3	56.6	64.4			68.0	54.8	39.7	38.5	
1907	41.4	43.6	43.9	49.9	55.8	64.2	79.3	77.7	68.9	62.3	48.5	35.4	55.99
1908	37.1	40.7	46.5	51.0	53.9	62.0	78.3	78.2	66.2	50.6	46.4	40.0	54.29
1909	42.4	39.4	41.7	51.7	55.1	64.7	79.6	74.6	68.2	51.1	40.9	35.7	53.85
1910	37.3	37.0	49.1	53.0	63.4	68.9	75.9	73.6	71.4	58.2	44.9	40.5	56.22
1911				48.0	53.9	66.5	77.1	75.4		53.7	39.3	29.0	
1912	33.8		65.0	52.2	57.6	66.4	74.5	73.2	61.3	56.9	42.5	30.3	
1913	34.0	45.0	51.8		53.1	65.6	72.5	68.1		49.1	47.8	37.5	
1914	39.2	39.5	49.5	51.8	58.0	69.8	77.4	76.6	70.3	58.3	50.7	36.8	56.59
1915	36.5	38.7	40.4	47.6	53.7	66.0	75.8	75.0	62.1	52.5	41.1	33.3	51.97
1916	40.4	41.9	47.0	50.3	53.8	62.7	75.3	73.2	67.8	48.0	32.0	29.4	51.86
1917	39.0	37.9	37.7	47.8	53.1	67.1	79.2	69.2	69.1	56.8	43.9	36.5	53.19
1918		42.0	51.2	51.0	55.5	74.1	75.9		70.7	57.9	44.9	38.7	
1919	37.4	37.0	42.7	51.9	59.5	68.0	77.8	78.3	72.9	53.2	43.3	39.7	55.25
1920	42.9	45.6	43.7	48.5	58.1	67.2	76.9	75.8	65.5	52.3	43.9	34.5	54.61
1921	37.5	41.2	49.7	48.8	56.5	68.5	79.1	76.5	68.2	57.5	44.6	45.1	56.21
1922	34.7	40.7	43.2	47.4	59.0	70.3	80.8	74.1	68.0	56.5	41.6	42.8	55.02
1923	40.0	42.9	42.9	48.3				67.2	58.5			40.0	
1924	35.8	43.6	39.5		60.9	70.6	76.7	75.1	69.1	49.4	42.9	35.5	
1925	33.2	39.9	42.8	50.6	60.3	67.8	75.6			53.7	44.9	43.1	
1926	34.2	38.4		56.3		74.5	73.2	69.1	61.0	53.9			
1927				49.1	57.9					56.2	49.2		
1928	37.8	39.2	44.7	50.4	63.4	67.5	77.1	73.5		56.8	47.5	36.5	49.68
1929	36.6	36.3	41.4	48.2	59.3	65.6	76.4	76.1	68.3	57.9	40.1	38.2	53.82
1930	36.8	41.5	44.7	55.7		68.2	75.1	73.9	64.5	42.4	40.2	32.8	
1931		47.5	39.6	47.4		59.3		73.6	69.8	54.5	43.0	32.8	
1932	25.8	40.5	43.7	46.8	52.9	65.4	76.7	75.0	58.1	55.6	43.7	33.0	51.47
1933	33.6	32.8	42.1	44.2	51.3	66.4	80.3	76.4	70.5	58.6	40.7	34.9	52.78
1934		45.6	48.3	49.9	52.1	53.1	71.2	71.1	62.5	55.2	44.5	40.1	
1935	40.0	41.9	42.4	49.6	54.4	66.6	77.5	80.3	70.9	53.5	40.8	38.0	54.74
1936	35.9	42.6	46.2	49.9	60.3	71.8	79.1	75.2	68.4	53.3	37.7		
1937		37.6	43.7	48.0	56.9	65.3	78.3	77.3	71.3	48.2	38.9		
1938	38.6	36.0		49.1	58.0	66.2	68.3	75.4	71.9	54.1	37.4	40.4	
1939	38.8	34.2	44.8	54.6	58.2	66.5	76.1	75.4	71.4	52.6	50.0	41.7	55.47
1940	39.3	40.9	45.9	55.9	65.5	70.3	75.0	76.2	70.5	58.6	39.8	44.1	56.90
1941	40.6	38.4	38.1	39.4	54.5	53.2	64.7	67.2			46.6	41.0	
1942	40.5		43.4	50.6	56.6	65.3	80.3	76.4	68.5	58.0	47.2	39.5	
1943	40.8	44.4	49.1	54.0	60.5	68.1	78.0	76.5	72.7	60.6			

1944	36.8		41.9	45.0	57.5	62.7	72.9	76.1	69.1	58.4	45.3	39.4	
1945	38.0	41.2	43.2	48.6	59.9	62.8	78.5	78.9	70.4	62.0	42.9	38.7	55.53
1946	40.0	36.9	45.1	56.7	59.9	68.9	78.2	78.8	71.5	52.7	41.9	40.5	56.04
1947	35.2	41.4	47.0	52.2	63.2	67.6	70.5	69.6	63.9	53.0	38.5	36.3	53.27
1948	35.6	38.0	43.9	53.6	56.6	66.1	76.2	77.4	70.5	61.6	38.9	36.6	54.64
1949	32.7	36.4	44.1	54.6	59.2	68.9	74.8	71.8	74.1	53.2	48.8	39.2	54.89
1950	33.9	42.7	45.9	53.0	56.3		77.5	74.9	66.2	60.5	46.8	41.2	
1951	36.4	41.6	45.2	53.5	61.3	65.5	76.0	74.4	62.8	55.6	46.8	39.5	54.97
1952	36.2	38.9	42.0	52.1	61.1	66.4	75.6	79.0	73.6	59.6	43.7	37.8	55.55
1953	38.5	36.8	46.0	52.2	53.0	65.1	81.6	75.4	67.7	56.6	46.0	34.8	54.58
1954	36.1	44.9	45.4	54.3	62.0	66.8	79.5	77.5	70.1	58.1	46.5	37.7	56.64
1955	36.5	34.1	43.0	46.9	56.2	66.6	73.0	77.8	66.4	56.9	43.5	40.2	53.56
1956	40.1	34.3	41.6	48.7	61.2	71.2	76.6	72.1	71.5	53.8	40.0	35.3	53.93
1957	41.1	47.9	48.6	51.8	58.0	71.7	79.2	77.2	68.6	58.6	44.1	41.2	57.39
1958	35.7	44.3	44.9	51.9	64.5	70.3	76.9	79.6	72.8	62.5	43.7	37.0	57.08
1959	33.9	39.3	45.0	55.1	59.4	72.5	83.1	77.5	67.0	57.4	48.2	41.3	56.74
1960	36.4	37.1	47.2	52.3	57.4	73.0		76.8	69.9		44.3	35.3	
1961	39.8									54.9	44.9	39.4	
1962	38.5	44.0	42.0	54.9	57.7	63.8	71.0	75.9	71.7	58.5	49.6	42.8	55.92
1963	33.7	47.0	44.5	50.4	63.6	65.5	80.3	77.1	74.8	63.0		37.1	
1964			42.5	51.0	60.3	67.8	80.1	77.7	68.1	62.5	44.3	40.0	
1965	41.4	39.9	44.6	53.2	57.3	61.7	78.6	77.7	67.5	59.0	49.9	42.4	56.21
1966	35.7	38.7	46.0	53.9	63.9	70.5	78.6	79.2	71.3	56.3	46.8		
1967	34.9	38.3	46.5	47.2	58.0	67.1	80.0	78.6	67.6	56.7	48.5	34.4	54.92
1968	36.7	44.8	45.5	48.3	56.6	65.5	75.4	69.2	64.5	51.5	41.7	30.3	52.51
1969	41.8	32.9	41.7	51.6	62.1	66.4	80.0	81.7	71.1	48.7	51.4	42.1	56.10
1970	37.7	44.9	46.7	51.5	61.6	67.4	82.4	80.3	68.3	55.1	46.5	38.8	56.85
1971	36.6	42.8	45.7	51.6	57.8	69.2	79.1	74.9	69.9	52.5	42.4	36.8	55.00
1972	32.6	40.7	51.1	52.9	58.9	71.8	81.8	76.3	69.1	60.3	44.1	39.0	56.60
1973	36.8	45.6	44.5	52.0	65.1	71.0	78.9	78.3	65.3	55.7	45.4	38.6	56.50
1974	39.6	38.1	48.1	52.1	61.9	74.5	79.3	75.2	74.1	61.7	45.9	35.0	57.23
1975	37.1	39.0	44.9	46.5	57.7	66.9	80.2	76.7	72.8	56.1	44.4	40.0	55.30
1976	39.5	46.6	45.5	51.3	63.5	70.0	79.1	75.9	70.6	58.5	47.8	38.5	57.26
1977	40.1	40.3	42.2	52.9	57.6	71.5	80.2	80.8	72.6	63.5	48.8	45.1	58.07
1978	43.7	45.1	52.4	52.8		73.6	80.4	77.2	72.4	63.8	49.0	38.4	
1979	38.2	40.8	46.7	52.1	62.1	72.1	78.1	74.2	75.3	59.3	44.5	41.0	57.12
1980	44.3	48.0	47.1	53.1	59.0	70.4	81.5	78.5	70.6	60.1	46.6	43.2	58.57
1981	45.2	44.0	47.4	55.6	61.8	75.0	81.0	80.6	73.0	56.0	48.5	40.8	59.16
1982	39.6	45.9	48.8	54.2	60.4	66.0	77.2	79.2	71.0	53.3	48.0	41.7	57.17
1983	43.6	43.4	48.4	50.0	59.5	66.5	77.8	79.1	76.0	62.1	47.4	45.5	58.38
1984	40.8	39.7	46.4	53.3	66.8	70.3	78.5	75.9	74.3	56.1	45.0	42.9	57.56
1985	40.7	40.8	47.8	57.5	64.2	72.3	80.6	78.7	70.6	62.9	51.0	44.6	59.42
1986	45.5	48.3	54.0	56.4	63.0	75.2	78.3	83.0	68.1	58.2	48.2	42.3	60.12
1987	38.6	45.4	48.4	59.0	65.6	73.3	74.4	78.7	71.8	64.5	52.8	44.5	59.82
1988	39.5	45.9	46.8	54.4	61.3	72.4	81.1	79.7	68.5	65.4	47.2	40.0	58.56
Mean	37.8	41.1	45.5	51.0	58.9	67.7	77.8	76.1	69.2	56.3	44.7	38.5	55.47
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average

No value indicates no report

No 'Annual Average' indicates incomplete record for that year

Summary of mean minimum temperatures

09/02/96

Station: Gila Bend

Data: Mean Minimum Temperature

Summary of total annual precipitation — 09/02/96

Gila River Navigability Study — Page 1

Station: Gila Bend

Data: Total Precipitation (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
1889							0.36	1.03	0.00	1.50	0.00	0.28	
1890	0.00	0.40	0.00	0.00	0.00	0.00	1.40	3.90	0.00	0.00	0.60	1.10	7.40
1891	0.00	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	2.85
1892	2.77	2.30	1.11	0.33	0.20	0.00	0.40	0.60	0.65	0.00	0.00	0.00	8.36
1893	0.00	0.00	1.94	0.00	0.40	0.00	1.20	1.79	0.14	0.20	1.25	0.19	7.11
1894	0.00	0.40	0.71	0.00	0.00	0.00	0.99	0.00	0.00	0.60	0.00	1.55	4.25
1895	0.81	0.00	0.00	0.00	0.00	0.00	0.30	1.40	0.00	0.50	0.28	0.00	3.29
1896	0.00	1.10	1.10	0.00	0.00	2.45	2.58	1.06	1.42	0.00	0.40	0.40	0.10
1897	2.62	0.70	0.40	0.00	0.00	0.00	0.20	2.57	0.00	0.20	0.00	0.00	6.69
1898	1.65	0.00	0.49	0.00	0.00	0.70	0.25	0.60	0.00	0.00	0.00	1.10	4.79
1899	0.80	0.20	0.00	0.00	0.00	0.00	1.60	0.42	0.80	0.00	1.10	0.00	4.92
1900	0.00	0.00	1.00	1.10	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.12
1901	0.15	0.90	0.50	0.00	0.00	0.00	0.60	0.00	0.00	0.40	0.00	0.00	2.55
1902					0.00	0.00	0.00	0.00					
1903				0.14	0.03	0.00	0.57	0.40	1.01	0.00			
1904	0.00		0.00	0.00	0.09	0.00	0.80	1.30	0.60	0.00	0.00	0.00	
1905	1.30	3.60	2.74	0.00	0.00	0.01	0.34	0.05	1.03	0.00	3.84	0.30	13.21
1906	0.00	1.10	0.03	0.10	0.00	0.00			0.00	0.00	1.10	2.43	
1907	1.83	0.00	0.50	0.00	0.02	0.00	1.02	1.00	0.00	1.95	0.00	0.00	6.32
1908	0.40	1.47	0.47	1.25	0.00	0.00	0.42	0.21	0.40	0.45	0.08	2.54	7.69
1909	0.17	0.32	0.63	0.00	0.03	0.00	0.37	2.87	0.12	0.00	0.42	0.62	5.55
1910			0.20			0.00	0.43	0.07	0.00				
1911				0.00	0.00	0.00	2.27	0.00		0.05	0.00	0.00	
1912	0.00		2.00	0.00	0.56	0.00	1.06	2.68	0.00	0.53	0.00	0.97	
1913	0.28	1.70	0.00	1.10	0.05	0.00	0.72	0.30	0.00	0.00	1.24	0.25	5.64
1914	0.06	0.98	0.98	0.00	0.66	0.00	0.17	0.11	0.16	1.99	0.73	2.92	8.76
1915	1.53	1.15	0.18	0.34	0.21	0.20	0.21	0.00	0.25	0.00	0.77	2.69	7.53
1916	2.45	0.16	0.50	0.00	0.00	0.00	1.18	0.22	2.32	0.95	0.00	0.69	8.47
1917	1.60	0.05	0.20	0.92	0.00	0.00	1.50	0.50	0.00	0.10	0.00	0.00	4.87
1918	0.80	0.24	1.05	0.00	0.00	1.01	0.76		0.60	0.50	0.88	0.85	
1919	0.10	0.46	1.25	0.10	0.20	0.20	1.05	1.25	2.45	0.00	1.95	0.00	9.01
1920	1.45	0.80	1.30	0.00	0.00	0.00	0.80	1.00	0.00	0.50	0.00	0.00	5.85
1921	0.20	0.00	0.20	0.15	0.10	0.00	1.45	1.58	0.35	0.05	0.10	1.20	5.38
1922	0.57	0.40	0.84	0.15	0.00	0.20	0.70	2.20	0.30	0.00	0.20	0.15	5.71
1923	0.30	0.10	0.70	0.00	0.14	0.00	1.08	0.33	0.10	1.20	2.22	1.12	7.29
1924	0.00	0.00	0.65	0.31	0.00	0.00	0.08	0.45	0.00	0.25	0.05	1.10	2.89
1925	0.05	0.00	0.00	0.60	0.00	0.50	0.10	3.16	0.70	1.51	0.00	0.00	6.62
1926	0.42	0.08			0.00		0.00	0.00	2.47	0.00			
1927				0.00						1.25	0.00		
1928	0.00	0.86	0.05	0.00	0.01	0.00	0.05	0.76	0.32	0.00	0.00	0.83	2.88
1929	0.71	0.25	0.15	0.00	0.00	0.00	0.67	2.43	1.01	0.00	0.26	0.00	5.48
1930	1.15	0.00	1.58	0.00	1.50	0.00	0.15	1.48	0.00	0.00	0.00	0.00	5.86
1931	0.00	2.87	0.00		0.00	0.00			0.00	0.03	1.25	1.15	
1932	0.00	1.67	0.35	0.00	0.00	0.39	1.47	0.20	0.00	1.10	0.00	2.09	7.27
1933	3.32	0.00	0.00	0.10	0.00	0.00	0.50	0.35	0.10	0.00	1.30	0.00	5.67
1934	0.17	0.30	0.00	0.00	0.00	0.00	0.32	2.96	0.00	0.00	0.00	0.11	3.86
1935	0.03	0.17	0.07	0.00	0.00	0.00	0.03	0.27	1.39	0.00	0.55	0.30	2.81
1936	0.85	0.47	0.61	0.00	0.00	0.00	2.20	0.25	0.00	0.00	0.70	1.74	6.82
1937	0.20	0.00	1.33	0.00	0.20	0.02	1.12	1.10	0.05	0.00	0.00	0.05	4.07
1938	0.15	0.31	1.25	0.00	0.00	0.00	0.14	1.21	0.11	0.00	0.00	0.91	4.08
1939	0.27	0.40	0.02	0.00	0.00	0.00	0.70	1.12	1.86	0.00	0.51	0.09	4.97

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1940	0.00	0.30	0.00	0.10	0.24	0.00	0.08	0.85	1.72	1.85	0.35	2.25	7.74
1941	0.40	1.56	3.74	2.29	0.73	0.00	0.50	1.84	0.12	0.00	0.95	1.45	13.58
1942	0.37	0.28	0.40	0.71	0.00	0.00	0.43	0.81	0.15	0.12	0.00	0.10	3.37
1943	0.29	0.15	0.79	0.12	0.00	0.00	0.00	2.03	0.02	0.35	0.00		
1944	0.00	1.20	0.77	0.26	0.20	0.00	0.70	0.68	1.13	0.15	1.01	0.60	6.70
1945	1.17	0.07	1.11	0.00	0.00	0.00	1.53	0.95	0.00	0.57	0.00	0.05	5.45
1946	0.60	0.00	0.00	0.34	0.00	0.00	1.96	1.42	3.29	0.00	0.52	0.19	8.32
1947	0.00	0.00	0.00	0.00	0.15	0.00	0.00	1.03	0.00	0.00	1.00	0.48	2.66
1948	0.00	0.19	0.65	0.00	0.00	0.00	1.17	0.73	0.00	1.00	0.00	0.43	4.17
1949	1.78	0.00	0.25	0.21	0.00	0.10	0.31	0.55	1.69	0.10	0.50	0.78	6.27
1950	0.37	0.31	0.12	0.00	0.00	0.00	1.11	0.00	0.22	0.00	0.00	0.00	2.13
1951	1.25	0.06	0.08	0.40	0.45	0.00	1.64	5.60	0.00	0.12	1.14	0.35	11.09
1952	0.75	0.60	2.61	1.28	0.00	0.06	0.31	0.03	0.00	0.00	0.58	0.08	6.30
1953	0.10	0.38	0.30	0.09	0.00	0.00	1.28	0.53	0.00	0.00	0.00	0.00	2.68
1954	0.42	0.26	0.67	0.00	0.10	0.27	1.75	0.00	0.28	0.00	0.00	0.00	3.75
1955	1.96	0.00	0.00	0.00	0.00	0.00	3.36	1.66	0.00	0.00	0.04	0.00	7.02
1956	0.20	0.10	0.00	0.00	0.00	0.00	1.35	0.00	0.00	0.37	0.00	0.00	2.02
1957	1.58	0.30	0.47	0.29	0.53	0.16	1.47	0.08	0.00	2.36	0.06	0.00	7.30
1958	0.00	1.14	1.32	0.89	0.00	0.07	0.00	0.21	0.00	0.07	0.00	0.00	3.70
1959	0.00	0.62	0.00	0.00	0.01	0.15	0.12	1.37	0.00	0.79	0.15	2.04	5.25
1960	0.90	0.00	0.23	0.00	0.00	0.00	0.00	0.77	0.00	0.49	0.00	0.00	2.39
1961	0.28	0.00	0.27	0.00	0.00	0.08	0.32	3.06	1.09	0.38	0.04	0.70	6.22
1962	2.13	0.43	0.51	0.00	0.00	0.16	0.00	0.00	0.47	0.00	0.02	0.42	4.14
1963	0.08	0.21	0.35	0.00	0.00	0.00	0.00	0.58	0.04	1.31	0.44	0.00	3.01
1964	0.12	0.12	0.00	0.02	0.00	0.00	0.87	2.42	1.24	0.80	0.51	1.21	7.31
1965	1.32	1.25	0.68	1.89	0.12	0.00	0.10	0.29	0.34	0.00	0.60	3.42	10.01
1966	0.88	1.32	0.00	0.00	0.00	0.00	0.16	2.06	1.02	0.38	0.41	0.07	6.30
1967	0.14	0.00	0.09	0.33	0.02	0.00	0.94	0.12	2.15	0.62	1.25	3.00	8.66
1968	0.00	0.68	1.66	0.02	0.00	0.00	0.86	2.63	0.00	0.00	0.35	0.29	6.49
1969	1.39	0.73	0.16	0.00	0.82	0.00	0.00	0.60	0.15	0.00	0.97	0.38	5.20
1970	0.00	0.33	2.36	0.00	0.00	0.00	0.66	0.20	1.66	0.03	0.08	0.16	5.48
1971	0.01	0.33	0.00	0.00	0.00	0.00	0.20	2.59	0.63	0.18	0.00	0.26	4.20
1972	0.00	0.00	0.00	0.00	0.00	0.59	0.02	0.66	0.00	2.02	0.98	1.14	5.41
1973	0.02	1.83	1.45	0.05	0.00	0.12	0.60	0.10	0.00	0.00	1.51	0.00	5.68
1974	0.41	0.00	0.61	0.00	0.00	0.00	1.22	0.45	0.03	2.14	0.20	0.52	5.58
1975	0.06	0.24	0.81	0.50	0.00	0.00	0.48	0.05	0.69	0.05	0.74	1.93	5.55
1976	0.00	1.01	0.65	0.31	0.35	0.00	1.24	0.30	2.45	0.42	0.74	0.75	8.22
1977	0.24	0.00	0.16	0.06	0.02	0.02	0.21	0.76	1.22	0.53	0.01	0.78	4.01
1978	2.10	1.06	0.62	0.37	0.00	0.00	0.39	1.90	0.00	1.01	1.10	1.31	9.86
1979	2.61	0.18	1.27	0.04	0.41	0.00	0.84	0.91	0.30	0.09	0.01	0.02	6.70
1980	1.27	1.60	0.85	0.18	0.09	0.00	0.32	0.34	0.01	0.09	0.00	0.02	4.77
1981	0.95	0.43	0.73	0.26	0.09	0.00	0.38	0.61	0.24	0.34	0.35	0.00	4.38
1982	0.32	0.76	1.93	0.00	0.23	0.00	1.40	1.00	1.18	0.00	1.29	1.45	9.56
1983	0.94	0.92	1.46	0.04	0.00	0.00	0.00	8.37	1.30	0.35	0.69	2.52	16.59
1984	0.20	0.00	0.00	1.00	1.85	0.01	4.72	1.09	1.57	0.00	2.33	2.36	15.13
1985	0.39	0.90	0.09	0.37	0.00	0.00	0.60	1.14	0.99	0.75	2.19	1.05	8.47
1986	0.15	1.13	0.85	0.00	0.00	0.00	1.46	1.01	0.53	0.73	0.00	1.14	7.00
1987	0.16	1.28	0.34	0.01	0.10	0.00	0.38	1.21	0.30	0.26	0.86	1.33	5.96
1988	0.42	0.27	0.02	0.45	0.00	0.00	0.28	0.65	0.00	0.81	2.33	0.00	5.23
Mean	0.62	0.58	0.62	0.21	0.11	0.08	0.74	1.06	0.50	0.38	0.50	0.69	6.05

No value indicates no report; 0.00" indicates 'Trace' or no rainfall record
No 'Year Total' indicates incomplete record for that year

Summary of total annual precipitation
Station: Gila Bend
Data: Total Precipitation (inches)

09/02/96

Summary of mean maximum temperatures
Gila River Navigability Study
Station: Sacaton
Data: Mean Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1908				86.5	89.7	102.0	102.5	102.2	99.6	86.0	78.2	66.6	
1909	69.5	69.9	72.4	85.3	91.1	103.6	103.5	101.2	97.4	92.4	78.9	63.8	85.82
1910	69.0	73.5	85.3	89.9	98.9	104.5	106.2	104.6	103.4	91.3	77.4	72.1	89.76
1911		66.4							98.7	85.8	75.9	63.4	
1912	71.8	75.0	73.9	78.6	92.5	104.1	101.4	100.2	97.7	84.4	77.6	63.2	85.07
1913	62.0	67.0	73.9	85.3	93.8	101.0	103.3	104.4	101.0	90.3	75.1	64.7	85.24
1914	69.7	71.0	80.7	87.1	96.2	102.5	103.1	104.1	100.3	85.4	81.2	62.6	87.06
1915	66.8	73.2	75.2	84.4	89.2	104.1	105.5	106.1	100.5	95.5	78.6	66.9	87.19
1916	63.0	76.6	84.5	88.1	96.3	106.1	106.0	103.7	100.1	86.3	79.4	68.8	88.28
1917	63.5	69.3	74.9	81.6	86.7	103.6	102.0	99.9	95.6	91.3	80.2	72.6	85.17
1918	64.7	69.6	75.9	82.4	87.5	102.5	100.1	97.3	97.8	86.8	70.3	61.2	83.06
1919	64.6	64.4	71.3	84.1	90.4	100.8	97.5	99.8	92.9	80.2	75.2	68.2	82.49
1920	64.2	68.7	71.2	78.9	91.1	99.4	104.4	98.9	95.4	82.4	74.8	66.2	83.04
1921	67.2	73.4	80.1	81.9	89.5	100.9	98.3	96.5	96.3	89.9	78.3	68.7	85.13
1922	62.3	68.3	70.4	78.3	94.0	103.6	102.6	101.1	98.2	88.3	71.0	67.1	83.85
1923	70.1	67.9	72.4	81.8	95.0	99.8	100.2	98.1	94.7	85.0	69.3	61.3	83.01
1924	64.7	73.8	70.1	80.0	94.5	103.8	102.0	103.6	99.0	87.0	78.6	63.0	85.04
1925	65.2	74.8	80.0	85.5	94.2	97.9	102.9	98.2	94.0	81.4	73.3	66.4	84.53
1926	63.5	73.1	77.4	81.4	90.2	103.3	102.5	100.7	96.2	87.6	77.1	63.8	84.78
1927	70.0	70.5	73.8	82.6	93.3	98.7	103.5	99.2	94.7	87.3	79.3	63.2	84.71
1928	68.2	68.0	79.1	83.7	93.7	101.4	103.9	99.3	98.3	86.2	73.8	65.4	85.18
1929	63.2	65.5	74.1	81.1	93.6	102.1	100.4	99.8	94.4	87.8	73.8	72.8	84.16
1930	63.0	74.8	72.5	86.9	87.2	101.9	101.0	100.0	96.1	86.2	73.3	66.0	84.09
1931	67.5	68.4	77.5	86.8	95.5	101.0	105.8	99.1	97.4	88.0	69.0	63.1	84.98
1932	59.3	68.6	75.7	85.2	93.6	100.8	102.5	103.7	101.6	85.1	80.6	60.1	84.79
1933	62.1	63.2	77.5	79.7	88.5	102.6	106.1	103.5	99.0	90.8	80.0	69.4	85.32
1934	69.5	74.8	85.5	90.8	99.1	99.1	105.0	99.1	96.6	90.7	75.5	68.1	87.89
1935	65.6	69.5	70.0	83.0	87.8	104.5	103.8	98.3	97.0	88.4	71.9	67.0	83.92
1936	66.2	67.3	78.0	88.4	98.0	105.1	103.9	100.5	95.8	86.7	75.3	65.7	86.00
1937	54.2	67.4	72.6	84.0	96.0	100.4	103.2	102.7	99.2	89.3	76.4	69.2	84.63
1938	68.2	68.3	72.1	85.1	92.8	102.4	103.3	101.8	100.4	87.7	72.6	68.8	85.38
1939	65.0	60.2	77.1	86.5	94.7	102.4	105.0	102.2	93.4	83.8	74.4	68.7	84.53
1940	67.6	68.3	78.8	84.5	97.5	104.3	106.3	103.2	96.8	86.3	71.6	66.8	86.11
1941	64.9	68.5	71.4	75.6	91.1	99.8	103.6	99.7	95.6	81.8	77.1	65.0	82.91
1942	66.3	66.8	74.3	81.5	93.5	103.2	105.7	100.9	99.7	86.0	76.7	67.7	85.29
1943	64.9	72.9	76.7	87.2	93.4	100.2	104.7	98.3	97.8	86.0	76.6	64.4	85.27
1944	63.6	65.2	71.5	79.3	90.6	98.3	104.2	104.2	96.6	89.5	68.6	66.4	83.29
1945	63.4	69.5	69.6	82.4	92.3	99.3	103.9	101.8	99.5	88.5	74.7	63.5	84.10
1946	61.8	69.1	77.6	89.3	92.1	104.5	103.1	101.6	96.8	80.1	68.6	67.8	84.43
1947	63.5	74.2	76.5	82.9	96.0	101.1	107.7	101.6	102.1	89.1	68.2	62.5	85.48
1948	67.1	65.3	68.9	86.1	94.6	102.3	105.5	104.0	101.2	89.1	71.1	63.5	84.99
1949	53.1	65.0	74.7	86.3	93.3	101.5	103.1	103.7	100.0	84.2	82.1	65.5	84.45

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1950	63.2	72.5	77.4	89.2	92.1	101.0	101.3	102.3	95.5	95.1	81.0	75.0	87.20
1951	65.4	67.6	75.4	83.5	93.9	101.1	105.4	99.7	99.1	88.5	72.4	64.1	84.72
1952	63.7	68.7	67.8	81.3	96.6	101.8	102.8	101.9	100.0	96.0	70.4	63.4	84.62
1953	69.7	69.6	77.0	83.2	87.9	102.7	102.7	104.2	102.6	89.7	78.3	66.2	86.23
1954	67.7	78.7	73.4	90.9	96.0	101.1	102.9	100.5	99.3	88.4	80.9	68.8	87.39
1955	58.9		77.8	84.5	92.2	102.3	101.8	98.5	100.0	93.5	75.9	71.1	
1956	71.8	64.3	80.5	83.2	96.5	106.0	104.7	104.1	104.8	89.4		69.2	
1957	66.5	76.6	78.5	84.0	89.2	106.8	106.6	102.8	100.3	83.0	69.3	68.4	86.03
1958	68.7	71.2	68.3	82.6	99.0	104.0	107.0	102.8	98.9	89.8	75.1	73.8	86.86
1959	70.2	67.5	78.9	88.5	92.6	106.0	106.5	99.7	99.2	89.2	74.5	65.4	86.56
1960	59.5	64.6	80.1	87.3	94.0	106.6	107.6	104.4	102.7	84.5	77.1	67.6	86.43
1961	70.6	74.1	76.3	85.4	93.6	103.8	105.8	101.6	95.5	88.1	71.7	62.6	85.82
1962	62.2	68.7	70.9	90.4	91.8	100.5	104.9	107.5	98.4	89.7	80.2	70.6	86.40
1963	62.8	75.6	75.3	80.8	95.7	98.3	107.0	100.6	101.2	92.6	75.2	69.3	86.23
1964	63.2	66.8	72.8	83.3	92.4	100.8	106.3	99.0	96.2	92.8	71.0	66.9	84.40
1965	66.4	69.7	72.4	81.8	90.9	97.1	105.6	105.3	97.6	92.5	78.4	64.8	85.30
1966	61.8	63.3	77.5	87.5	96.4	103.0	105.8	104.4	96.9	87.6	77.3	67.4	85.87
1967	66.7	73.5	79.5	78.8	91.6	97.3	103.9	104.2	98.6	90.9	81.1	61.7	85.68
1968	67.2	73.9	75.3	83.5	93.9	104.2	104.5	101.3	101.5	91.1	75.5	64.6	86.42
1969	68.8	67.9	72.5	88.2	97.1	101.7	105.5	108.8	103.2	86.5	75.4	69.5	87.19
1970	67.6	75.7	74.1	81.3	96.5	104.5	107.7	105.0	95.4	85.9	78.0	66.1	86.54
1971	68.4	72.5	80.6	84.0	89.5	102.2	108.2	100.6	100.1	82.1	76.1	61.8	85.52
1972	67.4	75.6	87.0	88.0	97.0	103.1	107.9	104.7	101.3	85.4	70.1	63.5	87.65
1973	64.7	67.5	68.5	83.3	95.9	104.6	108.1	106.6	102.0	93.5	76.9	79.8	87.74
1974	65.9	71.7	77.2	87.4	96.4	108.5	104.8	104.1	100.4	87.0	76.0	64.2	87.03
1975	67.2	71.7	69.8	77.1	91.7	102.5	106.3	106.8	102.7	90.1	82.3	68.7	86.44
1976	68.3	71.8	74.3	81.6	96.5	105.1	105.5	105.4	95.1	87.6	80.9	70.8	86.99
1977	64.9	76.6	73.5	90.0	89.5	106.5	105.6	106.0	99.8	91.4	77.7	71.1	87.74
1978	65.0	68.2	76.7	83.6	94.9	107.9	108.7	106.5	99.9			61.1	
1979	58.6	69.1	73.4	85.9	92.1	103.8	108.3	101.0	104.5	93.3	74.2	72.2	86.40
1980	67.5	72.1	71.5	84.8	88.9	106.4	107.3	103.0	99.8	87.8			
1981		75.7	75.5	90.5	94.3	108.3	106.7	107.7	101.9	88.3	82.5	71.5	
1982	67.0	72.4	75.5	86.7	94.8	103.1	106.3	105.3		89.2			
1983					97.1					86.0	76.3	59.2	
1984	59.5	69.0	83.6	85.5	101.5	103.6	103.7	100.5	98.9	84.5	74.9	62.2	85.70
1985	62.3	68.6	78.1	92.5	99.0	109.5	109.6	108.6	96.6	88.8	74.5	68.0	88.11
1986	75.7	73.1	82.2	89.2	98.6	107.9		107.6		86.7	76.5	67.4	
1987	67.5	70.4		91.4	94.2	106.2	107.0	104.3	99.1	93.5	74.0	62.8	
1988	66.2	75.3	81.1	85.9	94.4	106.6	106.1	103.5				67.0	
Mean	65.4	70.2	75.7	84.6	93.6	102.9	104.6	102.4	98.7	88.0	75.7	66.6	85.76
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average

No value indicates no report

No 'Annual Average' indicates incomplete record for that year

Summary of mean maximum temperatures

Station: Sacaton

Data: Mean Maximum Temperature

09/02/96

Summary of mean minimum temperatures

Gila River Navigability Study

09/02/96

Station: Sacaton

Data: Mean Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1908				48.8	51.7	61.0	73.8	74.5	64.7	45.5	44.4	38.9	
1909	40.5	38.3	40.9	46.4	52.6	63.8	72.7	74.2	65.4	50.3	37.5	32.7	51.36
1910	33.1	32.4	49.3	50.5	57.3	65.4	73.5	74.8	68.1	52.5	41.9	35.7	53.00
1911		39.1							65.8	52.4	35.3	27.7	
1912	31.0	34.1	44.3	46.3	55.2	66.9	69.7	70.9	58.9	51.9	39.5	31.8	50.14
1913	29.6	38.4	38.7	49.1	54.3	62.8	70.6	73.1	64.2	50.2	38.2	35.7	50.47
1914	38.8	36.9	44.4	49.8	56.4	67.8	74.3	72.6	68.4	53.9	45.6	37.5	53.96
1915	35.1	38.2	39.2	49.1	52.2	63.7	72.6	72.3	62.6	49.8	38.4	33.6	50.60
1916	41.0	41.4	45.6	50.6	52.6	63.1	73.3	72.9	65.6	49.1	34.9	28.4	51.60
1917	36.5	36.6	36.8	46.6	52.3	62.5	76.1	69.2	68.0	52.6	41.1	30.7	50.79
1918	32.4	38.4	47.5	47.6	53.1	70.6	73.2	69.2	65.1	52.4	39.5	36.0	52.16
1919	31.9	35.9	38.4	48.5	57.2	69.7	74.1	72.6	66.9	49.7	40.1	35.9	51.78
1920	37.9	43.6	41.2	44.2	53.2	60.4	70.4	69.9	61.3	48.4	37.1	27.7	49.65
1921	32.5	36.8	45.3	44.0	53.0	64.0	74.5	72.2	63.8	53.5	38.5	39.7	51.59
1922	31.6	37.9	39.0	44.1	55.5	66.0	75.0	73.7	68.4	52.6	34.6	37.8	51.44
1923	35.7	39.5	40.3	48.6	56.1	58.7	73.6	72.5	61.3	45.8	44.9	40.6	51.51
1924	30.6	36.6	39.5	45.9	57.9	65.5	73.6	71.8	65.5	48.1	38.7	34.2	50.74
1925	27.6	38.4	42.6	48.7	59.0	65.5	72.6	71.0	62.2	53.4	38.2	34.8	51.24
1926	31.7	39.0	47.0	54.4	55.9	65.2	73.2	70.7	67.4	55.5	41.4	38.0	53.36
1927	37.9	43.9	41.9	48.9	54.9	63.7	74.1	72.0	66.2	51.1	43.3	33.1	52.60
1928	30.5	35.7	44.6	46.3	59.4	64.1	73.2	71.4	66.4	52.9	41.8	31.5	51.58
1929	30.3	35.0	40.1	46.3	55.6	62.7	75.5	72.8	66.7	53.6	34.6	31.9	50.53
1930	37.0	38.8	41.5	51.8	50.7	64.9	74.4	71.4	61.9	47.8	42.8	32.4	51.34
1931	32.3	44.4	41.6	52.6	56.9	65.3	76.5	72.7	67.0	51.0	41.3	33.1	52.90
1932	27.3	41.1	42.2	46.4	53.7	61.7	74.4	72.8	66.1	53.3	39.1	33.9	51.06
1933	30.4	30.8	39.7	44.8	50.4	65.3	76.6	73.3	68.8	58.2	39.0	33.4	51.02
1934	32.5	41.4	48.6	53.5	60.9	61.6	76.2	74.9	63.7	52.8	40.4	37.3	53.74
1935	36.4	41.9	41.8	49.3	53.3	64.3	71.8	72.2	65.2	49.8	36.4	34.2	51.41
1936	30.5	39.6	43.9	49.8	57.4	66.5	73.5	73.3	63.3	53.0	41.8	33.3	52.23
1937	26.5	35.6	41.4	45.4	55.4	63.5	73.9	74.3	69.7	52.7	39.7	37.8	51.42
1938	33.5	38.1	41.6	47.9	54.0	64.0	72.3	71.5	67.4	50.6	32.6	35.6	50.84
1939	33.2	30.4	41.1	51.0	56.3	63.9	75.4	74.5	71.5	49.4	46.5	36.0	52.49
1940	35.7	37.3	45.1	50.4	61.0	69.0	72.7	74.3	68.7	56.3	40.8	41.9	54.54
1941	40.1	44.6	44.5	45.1	56.8	61.4	72.4	70.4	61.1	50.4	40.7	37.2	52.12
1942	35.0	33.2	38.2	48.4	52.6	63.1	75.2	72.2	66.4	54.0	43.4	35.7	51.56
1943	34.9	38.2	45.4	50.8	56.8	64.3	72.8	73.2	65.6	54.5	37.9	35.4	52.54
1944	29.6	36.2	39.3	45.6	54.3	58.4	70.2	72.0	64.7	54.4	39.0	32.5	49.77
1945	32.6	37.2	40.6	46.3	55.1	60.5	74.6	74.4	65.6	56.9	35.9	31.3	51.02
1946	34.7	32.5	42.1	54.3	56.7	66.0	74.5	74.1	68.5	48.3	35.9	33.9	51.90
1947	28.4	36.6	43.5	48.2	59.3	63.5	74.6	72.9	68.8	53.8	37.4	32.4	51.67
1948	30.5	35.5	40.1	49.0	54.7	63.8	72.6	72.5	66.9	57.4	34.3	33.5	51.00
1949	32.0	35.5	45.2	51.6	56.1	66.8	74.5	69.0	70.7	50.4	43.3	34.7	52.56

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1950	33.2	40.6	44.3	52.5	54.6	63.7	74.7	70.3	62.9	57.9	42.7	35.2	52.79
1951	33.9	38.5	41.9	48.3	55.5	62.4	73.1	68.6	59.7	50.0	42.0	36.1	50.88
1952	33.9	35.2	39.1	50.1	57.1	61.7	71.7	74.9	67.5	55.6	40.8	35.7	52.05
1953	35.3	33.8	43.3	48.2	51.2	64.2	76.5	71.7	62.6	52.1	41.9	27.6	50.80
1954	33.6	41.8	42.8	52.2	59.2	64.5	75.5	71.5	67.5	53.5	41.3	33.0	53.09
1955	33.8		42.2	45.6	54.9	63.4	71.7	73.3	64.3	55.4	40.3	37.0	
1956	39.5	35.6	41.9	48.6	58.4	70.0	75.1	71.2	67.8	52.3		30.7	
1957	41.7	44.5	45.8	47.8	60.7	71.5	80.0	75.1	64.1	56.9	39.1	35.3	55.29
1958	31.7	40.5	42.0	47.6	61.3	69.5	75.8	76.2	68.6	58.9	40.7	32.7	53.87
1959	32.5	34.5	40.5	52.5	55.9	70.7	79.8	74.1	65.9	54.5	44.6	38.5	53.72
1960	32.8	31.6	44.3	47.9	54.2	67.8	76.3	76.4	68.6	54.5	40.3	31.8	52.33
1961	35.9	37.3	43.4	48.8	56.2	70.6	76.7	73.8	65.0	52.2	41.5	34.9	53.12
1962	32.6	39.1	37.3	50.8	53.9	62.4	73.6	73.8	68.6	52.7	42.8	36.0	52.03
1963	29.2	41.2	40.5	44.9	57.6	61.2	76.8	72.2	68.3	54.7	43.3	28.7	51.58
1964	23.2	26.5	36.7	45.2	51.5	61.2	74.0	70.4	63.3	54.0	36.0	32.5	48.01
1965	33.9	32.7	35.2	42.7	47.9	55.9	73.1	71.2	60.0	50.3	43.1	36.2	48.63
1966	32.4	36.3	42.4	48.7	60.9	65.7	76.6	75.3	67.8	50.7	42.2	31.8	52.66
1967	28.1	35.0	42.8	44.1	54.2	63.6	75.6	73.3	66.5	52.3	44.7	32.6	51.11
1968	33.1	41.1	42.6	45.4	53.0	62.7	71.8	68.5	62.3	50.4	39.8	30.0	50.10
1969	40.2	35.9	37.9	47.5	58.4	64.8	77.3	79.4	69.8	49.8	44.3	35.8	53.53
1970	30.1	38.3	41.5	43.9	57.3	67.0	78.0	76.1	63.9	48.2	39.1	32.0	51.37
1971	28.0	33.6	37.4	44.3	53.0	64.0	76.4	73.6	65.2	50.0	37.5	31.8	49.62
1972	25.7	32.5	45.3	48.9	55.2	70.2	75.9	71.8	64.7	55.9	36.9	33.5	51.49
1973	35.8	39.3	39.2	43.8	58.3	64.4	75.2	73.9	62.0	53.0	38.9	31.4	51.35
1974	38.3	39.9	53.6	49.1	56.3	71.0	75.6	72.1	68.1	58.7	39.7	28.9	54.36
1975	29.9	32.4	40.7	42.9	52.8	62.5	74.6	69.2	64.8	46.2	34.6	30.8	48.51
1976	32.7	38.5	40.1	47.6	59.3	64.2	76.9	70.0	63.5	53.1	42.9	30.7	51.70
1977	36.9	40.9	37.4	48.4	54.0	68.7	77.4	76.2	68.3	58.9	41.9	38.5	54.03
1978	39.7	41.8	48.1	46.3	55.2	66.5	75.4	73.2	67.1			33.5	
1979	35.3	35.8	40.5	45.2	56.9	67.7	74.5	68.8	69.2	53.2	37.1	35.5	51.69
1980	40.2	41.5	40.9	45.3	51.8	61.7	73.7	71.4	61.5	47.3			
1981		38.0	42.6	52.7	56.8	66.8	72.9	67.3	64.2	52.5	44.2	35.6	
1982	36.8	41.0	44.5	48.6	56.0	61.5	74.3	76.5		49.0			
1983					52.9					57.9	42.5	36.8	
1984	35.9	39.5	38.5	44.0	59.3	65.7	74.0	73.1	68.4	50.4	38.9	38.0	52.22
1985	36.2	35.3	41.5	51.3	58.8	67.2	74.5	71.8	60.2	54.5	41.4	33.8	52.32
1986	37.3	40.4	46.7	49.7	56.5	67.4		73.2		51.4	43.4	36.7	
1987	33.7	40.5		54.1	60.2	68.4	70.2	74.4	65.3	59.3	43.4	36.3	50.46
1988	36.0	40.7	42.1	51.9	56.8	70.2	78.1	76.1				34.0	
Mean	33.6	37.6	42.1	48.2	55.6	64.9	74.4	72.7	65.6	52.5	40.2	34.2	51.87

No value indicates no report

No 'Annual Average' indicates incomplete record for that year

Summary of mean minimum temperatures

Station: Sacaton

Data: Mean Minimum Temperature

09/02/96

Summary of total annual precipitation 09/02/96
Gila River Navigability Study Page 1
Station: Sacaton
Data: Total Precipitation (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
1908				0.62	0.05	0.45	2.16	0.49	2.31	0.18	0.13	2.48	
1909	0.40	0.41	1.10	0.00	0.00	0.00	1.59	3.95	0.42	0.00	0.40	0.57	8.84
1910	0.21	0.00	0.38	0.00	0.00	0.00	0.65	1.45	0.00	0.15	2.36	0.25	5.45
1911	1.52	0.69	0.47	0.00	0.00	0.00	4.11	0.82	1.38	1.40	0.00	0.25	10.64
1912	0.00	0.00	2.61	0.85	0.38	0.98	4.27	1.02	0.00	0.96	0.00	1.05	12.12
1913	0.72	1.72	0.00	0.40	0.00	0.07	0.92	0.73	0.04	0.18	2.63	0.81	8.22
1914	0.18	0.39	1.02	0.16	0.10	0.34	3.26	1.77	0.30	2.28	1.79	5.16	16.75
1915	2.45	2.09	1.01	1.16	0.69	0.10	2.44	1.05	0.00	0.00	0.44	3.85	15.28
1916	2.87	0.26	0.71	0.45	0.00	0.00	1.19	0.63	3.61	0.02	0.00	0.65	10.39
1917	1.48	0.67	0.40	0.11	1.29	0.00	3.33	0.05	0.43	0.00	0.00	0.00	7.76
1918	1.15	0.77	1.17	0.19	0.00	0.20	1.49	1.92	0.00	0.29	0.81	2.07	10.06
1919	0.01	1.47	0.55	0.20	0.04	0.00	3.76	1.63	1.80	0.15	2.48	0.89	12.98
1920	2.03	0.98	1.41	0.25	0.17	0.23	0.48	0.89	0.21	1.21	0.00	0.00	7.86
1921	0.44	0.34	0.09	0.08	0.09	0.00	2.41	3.26	0.39	0.23	0.11	0.80	8.24
1922	1.11	0.41	1.23	0.78	0.22	0.11	0.53	3.32	0.55	0.00	1.20	0.26	9.72
1923	0.67	0.64	0.81	0.16	0.00	0.00	3.27	0.97	0.01	0.24	2.36	3.25	12.38
1924	0.00	0.00	1.33	0.25	0.51	0.00	0.39	0.20	0.40	0.49	0.00	1.86	5.43
1925	0.11	0.00	0.18	0.62	0.08	0.14	0.54	3.09	1.78	0.85	0.19	0.93	8.51
1926	0.99	0.19	3.40	1.16	0.42	0.00	2.54	0.94	3.35	0.60	0.00	2.12	15.71
1927	0.14	1.51	1.11	0.54	0.00	0.00	0.05	0.42	2.26	0.15	0.00	0.64	6.82
1928	0.00	1.37	0.13	0.01	0.04	0.00	0.78	1.99	0.23	0.32	0.11	0.61	5.59
1929	0.44	0.37	0.10	0.26	0.00	0.00	1.22	1.66	1.44	0.00	0.00	0.00	5.49
1930	2.27	0.12	2.19	0.25	0.66	0.00	1.79	3.12	0.14	0.10	1.92	0.01	12.57
1931	0.18	3.65	0.02	0.16	0.00	0.00	1.47	4.97	0.69	0.30	2.67	1.62	15.73
1932	0.59	1.07	0.87	0.13	0.00	0.19	1.67	2.69	0.72	0.87	0.00	1.71	10.51
1933	2.59	0.27	0.00	0.70	0.02	0.15	0.46	0.49	1.31	0.09	1.11	0.00	7.19
1934	0.26	0.66	0.04	0.05	0.08	0.75	1.04	2.50	0.07	0.00	0.52	2.34	8.31
1935	0.78	1.45	1.54	0.39	0.64	0.00	1.04	2.10	0.60	0.10	0.88	0.33	9.85
1936	1.01	1.72	1.02	0.00	0.00	0.00	3.32	1.57	0.17	0.46	0.40	2.35	12.02
1937	1.19	0.87	1.22	0.00	0.08	0.00	0.85	0.46	0.46	0.06	0.00	0.84	6.03
1938	0.22	0.59	0.88	0.09	0.00	0.36	0.72	1.59	0.02	0.00	0.00	0.69	5.16
1939	0.53	0.91	0.10	0.25	0.00	0.00	0.30	0.57	3.08	0.06	0.45	0.41	6.66
1940	0.01	0.68	0.00	0.18	0.05	0.00	0.66	0.18	0.84	1.34	0.73	2.67	7.34
1941	0.95	1.86	3.30	2.73	1.26	0.00	1.19	1.31	1.95	0.37	0.91	1.38	17.21
1942	0.79	0.38	0.40	1.17	0.00	0.00	1.16	0.41	0.32	0.36	0.00	0.44	5.43
1943	0.35	0.07	0.70	0.00	0.00	0.04	0.00	3.64	3.33	0.19	0.00	1.41	9.73
1944	0.34	2.39	0.66	0.85	0.91	0.00	0.68	1.25	0.63	0.43	1.79	0.64	10.57
1945	1.18	0.07	1.05	0.00	0.00	0.00	2.31	1.17	0.20	0.47	0.00	0.62	7.07
1946	1.36	0.16	0.08	0.19	0.00	0.00	0.81	1.20	4.92	0.25	1.55	0.42	10.94
1947	0.00	0.59	0.00	0.00	0.12	0.00	0.50	1.44	0.00	0.32	0.75	0.57	4.29
1948	0.00	0.94	0.42	0.00	0.00	0.10	2.90	0.70	0.00	0.57	0.10	1.05	6.78
1949	2.14	0.25	0.39	0.25	0.00	1.01	0.75	1.16	1.54	0.36	0.41	0.88	9.14

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1950	0.77	1.23	0.49	0.00	0.02	0.33	0.79	1.75	1.72	0.00	0.06	0.00	7.16
1951	2.67	0.18	0.14	1.04	0.21	0.00		3.20	0.23	0.96	1.25	0.60	
1952	0.75	0.25	1.93	1.34	0.00	0.69	1.98	1.20	0.63	0.00	4.39	0.73	13.89
1953	0.23	0.75	1.00	0.09	0.00	0.00	3.18	0.23	0.00	0.05	0.19	0.08	5.80
1954	0.87	0.53	1.55	0.00	0.44	0.11	2.11	0.46	0.79	0.28	0.00	0.14	7.28
1955	2.36	0.00	0.00	0.00	0.00	0.14	2.13	3.95	0.00	0.18	0.22	0.29	9.27
1956	0.62	0.88	0.00	0.16	0.00	0.14	0.00	0.00	0.00	0.05	0.00	0.00	1.85
1957	2.32		0.82	0.09	0.33	0.17	1.74	0.23	0.00	3.84	0.06	0.54	
1958	0.03	1.43	1.26	1.15	0.16	0.10	0.72	1.88	0.00	0.38	0.18	0.00	7.29
1959	0.10	0.53	0.00	0.15	0.00	0.00	0.23	2.30	0.00	1.27	0.16	3.00	7.74
1960	1.23	0.26	0.14	0.00	0.08	0.00	0.43	0.68	0.06	1.32	0.00	0.16	4.36
1961	0.48	0.00	0.36	0.00	0.00	0.00	0.77	2.51	0.23	0.21	0.05	1.19	5.80
1962	0.50	0.59	0.43	0.00	0.00	0.87	0.57	0.14	0.87	0.00	0.11	0.36	4.44
1963	0.85	0.00	0.00	0.38	0.00	0.00	0.00	3.84	0.04	0.95	1.43	0.00	7.49
1964	0.00	0.00	0.00	0.00	0.00	0.00	2.35	2.28	0.70	0.69	0.34	0.93	7.29
1965	1.15	1.37	0.75	1.11	0.21	0.28	0.54	0.22	0.46	0.04	0.60	4.33	11.06
1966	0.67	1.78	0.36	0.00	0.00	0.39	1.21	1.07	3.29	0.89	0.22	0.34	10.22
1967	0.24	0.00	0.79	0.36	0.27	0.21	1.67	0.92	0.24	0.50	1.51	3.79	10.50
1968	0.27	1.35	1.96	0.00	0.00	0.00	1.73	2.25	0.06	0.45	1.10	1.12	10.29
1969	1.19	1.30	0.43	0.04	0.26	0.00	0.92	0.30	0.91	0.32	1.03	0.64	7.34
1970	0.00	0.22	2.26	0.01	0.00	0.00	0.19	3.26	1.57	0.06	0.50	0.49	8.56
1971	0.05	0.00	0.00	0.33	0.00	0.00	0.08	3.66	0.70	1.33	0.05	0.80	7.00
1972	0.00	0.00	0.00	0.00	0.06	0.08	0.52	0.33	0.33	3.87	1.26	1.18	7.63
1973	0.19	1.47	2.28	0.00	0.00	0.08	0.09	0.27	0.00	0.00	1.09	0.00	5.47
1974	1.51	0.00	0.89	0.00	0.00	0.00	1.78	1.05	0.31	0.84	0.06	0.46	6.90
1975	0.03	0.87	1.39	0.97	0.00	0.00	2.55	0.06	0.22	1.00	0.97	2.31	10.37
1976	0.00	1.04	0.00	0.80	0.33	0.04	0.34	1.29	0.04	0.69	0.68	0.00	5.25
1977	1.33	0.00	0.52	0.00	0.00	0.00	0.39	1.28	0.39	0.91	0.61	0.42	5.85
1978	2.33	2.74	2.78	0.39	0.34	0.12	0.23	0.77	0.55	1.26	2.34	3.49	17.34
1979	3.25	0.66	1.54	0.00	0.38	0.31	0.39	1.00	0.00	0.12	0.13	0.09	7.87
1980	1.46		1.32	0.33	0.00	0.00	0.46	0.01	0.56	0.10			
1981	0.95	0.85	1.17	0.11	0.08	0.00	0.22	1.16	0.00	0.23	0.83	0.00	5.60
1982	0.58	0.47	1.48	0.00	0.77	0.00	0.89			0.00			
1983					0.00					1.35	0.00	0.66	
1984	0.69	0.00	0.00	1.69	0.26	0.00	6.52	1.29	2.83	0.00	0.96	5.42	19.66
1985	1.05	0.43	0.29	0.06	0.00	0.00	1.32	0.56	1.57	2.49	1.82	0.77	10.36
1986	0.58	1.27	0.86	0.00	0.00	0.00		3.08		1.17	0.31	1.41	8.68
1987	0.83	2.91		0.00	0.00	0.00	0.38	0.15	0.45	0.97	1.06	1.22	7.97
1988	0.72	0.14	0.00	1.06	0.00	0.00	0.74	1.13				0.16	
Mean	0.84	0.76	0.81	0.34	0.15	0.12	1.35	1.45	0.80	0.56	0.70	1.09	8.97

No value indicates no report; 0.00" indicates 'Trace' or no rainfall recorded

No 'Year Total' indicates incomplete record for that year

<u>Summary of total annual precipitation</u>

Station: Sacaton

Data: Total Precipitation (inches)

Summary of mean maximum temperatures
Gila River Navigability Study
Station: Yuma Citrus
Data: Mean Maximum Temperatures

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1920									96.6	85.0	76.4	68.2	
1921	67.1	75.1	81.3	85.1	89.2	102.0	104.3	102.7	99.9	90.3	79.7	69.8	87.26
1922	62.4	69.2	74.1	80.6	94.6	102.7	104.8	103.7	102.4	90.4	74.9	71.3	86.02
1923	73.5	73.3	78.0	83.4	95.8	97.4	103.4	104.0	97.0	88.9	79.0	67.5	86.85
1924	71.3	82.2	76.8	83.9	96.8	105.2	106.1	106.0	102.5	89.1	81.5	67.4	89.06
1925	71.0	79.7	82.5	87.5	95.5	100.4	107.1	104.3	98.9	84.0	76.6	71.1	88.26
1926	69.7	77.5	81.5	87.3	94.1	104.3	106.5	104.8	98.4	92.0	82.0	64.2	88.57
1927	70.3	76.0	79.1	88.0	96.4	101.2	106.5	103.9	98.6	91.0	79.2	65.8	88.06
1928	69.4	73.8	82.6	88.9	96.0	102.9	107.0	105.6	103.5	90.8	77.6	69.3	88.99
1929	67.4	71.8	79.7	83.6	97.0	102.7	107.1	106.2	98.6	92.6	75.9		
1930		78.8	78.2	89.0	87.7	102.7	106.5	105.3	97.6	88.7	78.0	68.3	
1931	69.8	70.9	81.6	88.4	96.6	101.3	108.5	102.6	98.1	88.6	72.1	64.8	87.04
1932	64.0	70.0	80.5	87.6	93.7	101.3	105.4	106.2	103.4	87.5	80.7	63.2	86.98
1933	63.4	65.9	80.7	81.4	88.6	102.2	108.3	106.4	102.0	94.5	80.7	71.4	87.25
1934	72.4	77.8	90.3	92.6	98.0	99.0	107.0	104.5	101.3	92.8	78.9	69.8	90.44
1935	67.0	72.4	75.1	84.9	90.0	105.6	105.1	102.6	101.4	87.4	74.1	69.0	86.27
1936	69.2	73.4	82.8	89.9	97.7	103.8	106.0	105.8	99.4	88.6	77.3	69.0	88.61
1937	56.8	71.3	77.7	80.0	94.5	102.0	107.3	107.7	103.5	93.1	80.9	72.6	87.37
1938	71.5	70.6	74.7	85.9	93.5	101.5	104.6	105.0	103.2	87.1	73.5	69.6	86.81
1939	66.9	64.8	79.0		94.9	102.4	106.7	106.1	95.2	88.1	79.3	74.5	
1940	72.5	72.1	82.2	87.0	98.4	104.4	107.6	106.0	98.8	89.0	75.4	69.9	88.67
1941	66.4	73.8	76.7	79.8	94.9	98.8	106.2	101.4	96.9	84.3	78.4	68.9	85.61
1942	69.9	69.5	76.9	82.2	92.4	102.6	109.3	104.2	102.1	90.3	81.0	72.7	87.86
1943	70.3	76.2	81.6	89.1	96.7	99.8	108.5	104.9	104.3	91.4	79.5	67.8	89.24
1944	67.5	66.8	76.4	83.0	92.3	97.1	106.8	107.3	101.1	91.7	71.3	69.3	85.96
1945	66.6	72.0	73.1	84.7	93.1	99.8	107.6	104.5	100.9	90.8	76.9	67.8	86.56
1946	68.3	73.9	79.4	90.2	94.0	104.9	104.9	104.5	101.2	85.4	73.1	70.6	87.59
1947	67.9	78.8	81.0	87.0	95.5	99.9	107.2	103.4	102.1	91.3	74.2	67.4	88.02
1948	72.6	71.5	73.9	88.5	94.2	100.8	106.3	107.0	103.0	89.9	74.8	65.3	87.35
1949	56.7	68.3	77.6	89.5	92.9	102.3	106.3	106.0	104.5	87.6	84.6	67.8	87.07
1950	66.3	76.6	81.7	90.2	92.0	100.0	102.7	107.1	99.3	95.6	82.9	76.6	89.31
1951	68.8	70.9	77.5	84.8	94.6	100.8	106.8	103.6	104.0	90.9	76.2	66.6	87.21
1952	65.0	72.3	72.8	85.6	99.2	99.0	106.5	107.7	103.6	99.2	75.3	66.7	87.79
1953	73.6	74.0	80.0	84.2	88.0	101.3	107.4	105.7	103.7	91.6	80.4	69.6	88.36
1954	69.7	81.2	77.1		95.9	100.6	105.6	104.1	103.4	93.9	82.5	68.5	
1955	63.0	69.6	79.6	84.4	92.6	101.8	102.3	102.4	102.8	95.0	78.6	72.6	87.15

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1956	72.8	68.9	82.4	84.8	94.3	103.6	104.5	105.9	106.1	90.1	77.9	71.8	88.65
1957	66.9	77.9	79.0	86.0	89.7	104.4	108.1	103.4	101.7	85.8	73.4	71.4	87.34
1958	71.8	74.3	73.6	88.2	99.7	102.3	109.1	105.1	102.6	94.7	77.4	77.0	89.74
1959	73.0	71.0	83.4	90.8	90.9	105.4	106.5	103.3	98.9	92.2	77.3	67.3	88.42
1960	63.2	69.8	83.1	88.0	93.5	106.1	107.9	105.0	101.5	88.5	76.5	67.5	87.59
1961	70.0	74.8	78.7	87.9	91.6	103.3	104.0	103.5	96.9	89.1	72.3	66.6	86.62
1962	67.7	72.2	73.4	92.5	90.7	101.1	106.8	108.7	101.1	91.0	82.2	70.4	88.21
1963	69.3	80.4		80.9	95.1	97.2	106.7	102.5	102.4	91.3	76.6	70.9	
1964	66.0	69.3	74.8	83.5	90.4	99.5	106.0	102.8	99.2	93.9	72.2	69.4	85.64
1965	68.1	72.8	75.0	83.5	91.0	95.1	104.7	105.0	96.9	94.5	77.4	64.7	85.80
1966	63.8	67.9	79.6	88.7	95.9	101.2	105.3	105.9	101.5	88.9	79.4	70.6	87.49
1967	68.3	75.6	80.5	77.1	92.0	97.2	106.2	106.9	97.4	93.2	82.4	63.2	86.74
1968	68.4	77.7	80.2	85.0	94.3	103.7	105.0	102.2	102.2	91.3	78.4	65.9	87.87
1969	71.0	70.4	77.2	86.6	96.1	98.0	106.3	109.2	102.8	86.9	76.4	69.3	87.62
1970	68.5	74.9	77.3	81.3	95.4	102.6	107.5	106.4	99.5	87.4	78.2	67.4	87.27
1971	69.0	74.5	80.5	83.2	88.1	100.7	107.1	102.8	101.4	83.3	75.7	64.4	85.94
1972	68.2	76.9	88.9	88.8	94.7	101.7	108.8	102.7	99.2	83.6	72.4	66.0	87.69
1973	65.3	71.0	72.3	83.0	96.1	104.7	105.3	106.1	100.1	91.6	76.8	71.1	87.04
1974	66.5	72.8	79.9	85.9	95.3	106.6	103.5	107.0	102.8	90.0	77.3	66.4	87.90
1975	69.0	71.3	75.9	77.4	92.2	101.3	104.4	107.6	102.4	88.1	78.2	69.2	86.50
1976	69.3	73.3	77.0	81.8	94.9	103.6	103.6	104.1	94.7	88.7	79.0	70.2	86.72
1977	67.0	77.9	74.8	88.0	86.7	105.1	107.6	103.9	100.4	92.7	80.4	71.9	88.06
1978	66.2	72.0	79.7	83.5	94.6	107.6	108.6	105.8	98.3	93.9	73.9	63.0	87.34
1979	60.8	70.5	76.7	87.1	91.7	103.6	107.5	103.0	105.5	93.2	75.3	72.1	87.33
1980	69.8	74.3	75.9	85.3	88.2	103.3	107.6	105.3	101.1	91.5	79.1	73.9	87.97
1981	72.6	75.4	77.2	88.6	92.7	106.5	106.9	107.7	102.2	86.3	80.2	64.9	88.48
1982	66.4	73.3	75.4	85.5	92.1	99.5			98.4	87.3	73.0	65.6	
1983	69.7	70.9	76.5	81.4	94.8	101.3	106.8	101.6	101.3	88.7	76.7	70.6	86.78
1984	69.3	73.6	81.7	83.8	100.1	100.1	103.3	102.0	101.1	84.7	74.0	62.8	86.41
1985	65.5	69.1			94.5	104.6	105.8	105.3	92.8	86.0	72.3	68.1	
1986	73.8	74.0	82.7	85.7	93.7	103.1	101.8	104.6	93.5	85.7	76.1	67.3	86.91
1987	66.0	72.4	75.5	90.0	91.7	103.0	103.2	103.1	99.8	91.7	73.4	62.4	86.07
1988	65.6	74.6	80.6	83.5	92.6	100.7	104.3	103.2	99.5	93.6	77.4	67.3	86.94
Mean	68.0	73.2	78.7	85.6	93.7	101.9	106.1	104.8	100.6	90.0	77.3	68.6	87.45

No value indicates no report

No 'Annual Average' indicates incomplete record for that year

Summary of mean maximum temperatures

Station: Yuma Citrus

Data: Mean Maximum Temperatures

09/02/96

Summary of mean maximum temperatures 09/02/96

Gila River Navigability Study Page 1

Station: Yuma Citrus

Data: Mean Minimum Temperatures

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1920									65.3	53.4	43.9	35.5	
1921	38.2	43.5	50.3	49.3	57.7	69.2	80.1	77.9	68.5	61.0	46.5	44.9	57.36
1922	37.4		44.0	47.9	58.5	69.8	79.6	78.5	73.3	57.2	41.4	42.5	
1923	40.5	41.8	43.2	51.5	59.7	61.6	77.2	76.3	67.7	53.2	48.7	52.2	56.24
1924	36.4	42.6	42.7	50.9	61.3	70.3	76.4	75.0	70.2	50.7	44.7	38.2	54.97
1925	36.7	42.7	46.6	51.7	61.0	68.3	78.5	76.7	66.3	57.1	45.0	43.0	56.23
1926	35.9	43.6	50.1	57.7	60.2	69.1	75.8	76.9	71.5	58.1	46.9	40.5	57.26
1927	40.5	46.1	45.6	51.5	57.9	67.1	77.4	77.8	68.7	57.8	50.5	40.8	56.87
1928	41.5	42.8	50.6	51.7	63.4	67.9	75.9	77.0	71.2	57.4	47.2	41.2	57.37
1929	36.7	39.1	46.1	50.2	61.0	66.6	80.0	80.4	70.2	60.0	43.8	43.2	56.57
1930	40.9	46.4	49.5	56.5	55.5	67.5		75.5	67.5	54.7	48.9	37.9	
1931	38.5	46.5	47.9	56.6	62.4	68.6	81.7	78.0	67.8	56.6	44.4	40.5	57.53
1932	36.1	45.2	48.6	51.3	59.6	66.6	78.0	78.1	71.7	57.8	48.6	37.3	56.60
1933	37.0	37.4	45.2	50.2	55.9	67.6	80.0	78.1	73.4	63.1	48.1	41.3	56.56
1934	40.0	48.0	54.6	57.8	63.5	64.7	79.2	79.6	69.4	58.8	47.0	44.4	59.00
1935	42.8	47.9	45.1	53.6	57.7	70.1	76.7	79.5	74.0	56.5	43.7	42.6	57.56
1936	40.0	44.6	49.7	54.8	62.2	70.6	78.0	78.6	69.3	57.2	48.0	41.1	57.88
1937	31.2	41.5	45.5	52.9	60.1	67.1	80.0	80.5	76.9	59.4	47.6	47.7	57.63
1938	43.5	44.2	47.2	59.7	58.9	68.1	76.1	77.4	73.2	56.5	41.3	44.4	57.62
1939	41.2	37.6	46.8		60.5	66.3	76.7	80.1	71.3	56.6	50.8	44.7	
1940	43.7	43.6	49.4	54.5	63.8	71.5	74.7	78.2	71.5	60.9	44.8	46.5	58.65
1941	43.2	48.3	50.1	51.3	62.3	65.0	77.7	74.3	62.6	55.5	47.9	42.8	56.82
1942	42.8	40.3	45.2	51.5	56.9	65.4	79.4	77.4	66.1	58.0	47.4	41.9	56.14
1943	41.0	44.9	49.1	54.0	61.4	65.9	77.0	78.7	73.4	59.3	46.1	42.0	57.82
1944	39.2	40.1	47.2	49.9	59.3	61.7	72.5	76.2	72.1	59.1	48.3	43.0	55.78
1945	39.4	41.3	45.0	51.1	58.8	64.6	78.0	78.9	71.9	62.3	44.6	39.5	56.39
1946	38.8	35.7	44.5	54.7	57.6	65.7	76.0	78.4	70.7	51.9	42.5	41.9	54.99
1947	36.1	42.6	46.7	51.4	61.5	64.6	73.5	74.5	72.1	56.8	42.3	38.1	55.09
1948	39.1	39.8	41.0	51.5	55.8	63.0	74.5	76.4	69.7	59.8	42.3	36.7	54.18
1949	33.2	36.2	43.7	53.4	57.5	68.9	75.7	72.6	74.7	54.0	49.4	38.0	54.85
1950	35.0	42.7	47.0	54.8	56.4	64.3	77.0	72.4	65.4	58.4	48.8	42.7	55.48
1951	37.9	41.0	44.6	52.0	57.3	62.5	77.0	75.0	69.8	57.3	47.0	39.8	55.19
1952	36.0	40.0	42.8	53.6	62.0	63.1	74.9	77.0	70.3	60.1	42.6	38.9	55.17
1953	41.5	37.6	44.0	49.9	53.7	62.0	79.2	74.0	64.3	54.3	48.5	37.3	53.97
1954	37.5	46.8	42.8		58.4	63.7	75.9	72.7	69.2	56.7	46.7	40.0	
1955	37.0	36.8	42.8	46.3	55.7	62.8	71.8	77.0	68.3	58.5	45.1	40.8	53.69

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1956	39.9	34.8	42.4	49.9	57.3	66.6	73.1	70.0	69.3	55.0	42.8	38.2	53.33
1957	41.5	46.4	47.5	50.5	54.6	67.6	76.1	74.9	65.8	56.5	43.2	41.5	55.57
1958	37.8	44.5	44.7	50.5	62.1	65.3	71.6	77.8	69.9	60.6	44.2	41.0	55.91
1959	39.7	37.9	46.2	54.1	56.4	67.9	78.4	76.0	65.2	55.6	46.7	40.9	55.53
1960	34.9	37.9	47.9	50.8	56.0	67.9	74.2	75.5	68.6	55.4	43.4	36.4	54.12
1961	39.7	40.4	43.4	49.3	54.5	67.6	75.8	75.4	63.3	52.3	42.5	38.2	53.62
1962	36.9	40.8	40.6	52.5	52.8	63.0	71.9	73.6	70.4	54.4	45.5	39.9	53.58
1963	34.2	44.9		46.2	57.8	60.9	73.2	75.4	69.7	59.1	46.8	35.8	
1964	31.3	33.3	39.5	47.4	53.6	62.7	74.7	75.5	65.3	60.0	40.8	37.9	51.91
1965	38.6	38.2	42.7	50.3	54.4	58.7	71.8	73.6	62.5	55.0	48.2	40.7	52.99
1966	35.4	36.5	44.4	52.2	60.2	65.4	75.1	78.0	69.5	55.6	46.8	39.9	55.03
1967	36.3	40.0	46.4	45.2	55.8	63.0	77.6	76.6	67.9	55.3	48.6	36.5	54.19
1968	36.1	46.1	45.7	48.3	56.0	62.4	71.6	68.7	61.4	52.2	42.8	32.4	51.99
1969	44.1	40.1	42.7	51.2	58.5	63.3	74.4	77.1	69.0	52.0	48.9	41.3	55.31
1970	37.7	43.3	44.4	45.1	56.6	64.3	75.6	77.3	66.0	53.2	45.3	38.5	54.02
1971	37.9	39.1	43.4	49.1	52.6	62.1	75.1	77.2	68.0	52.6	41.5	37.3	53.08
1972	34.3	39.3	48.8	50.0	56.5	66.4	74.7	71.6	65.4	57.1	42.2	38.8	53.81
1973	36.9	42.9	44.1	48.2	58.5	66.5	73.4	71.7	61.9	53.5	44.5	38.4	53.44
1974	40.3	38.0	47.1	55.7	58.7	68.7	72.9	68.8	71.8	57.8	40.5	35.4	54.73
1975	35.6	38.5	44.1	47.4	53.8	64.1	76.0	71.6	69.2	52.4	40.5	38.5	52.73
1976	37.5	43.2	43.6	47.6	56.6	63.5	73.5	69.5	68.0	56.9	47.1	37.0	53.69
1977	38.9	39.1	41.2	50.3	53.6	66.6	75.2	75.7	68.2	59.4	46.5	43.6	54.95
1978	42.3	41.8	50.8	52.6	57.6	66.8	75.5	72.5	67.8	60.0	45.4	35.4	55.80
1979	36.6	37.3	43.6	49.2	59.6	65.7	69.8	67.8	67.3	52.0	40.1	38.8	52.40
1980	43.6	46.0	45.1	49.3	55.6	63.6	75.7	72.6	65.1	55.4	43.1	42.3	54.83
1981	43.3	41.3	46.3	53.5	58.6	70.9	77.4	77.1	70.8	53.1	45.8	41.1	56.69
1982	38.2	44.1	45.2	51.4	56.8	61.8	74.2	76.1	68.5	52.6	44.9	40.4	54.58
1983	40.0	42.4	48.0	47.9	57.3	64.6	74.9	75.5	75.5	59.8	47.1	42.8	56.40
1984	42.0	39.7	46.3	50.6	62.2	67.7	77.5	76.4	73.3	54.4	43.6	42.8	56.44
1985	40.6	40.7			60.5	68.1	77.1	74.7	63.9	58.8	45.6	41.1	
1986	44.9	43.5	49.8	52.8	59.7	69	74.0	79.5	63.9	54.4	48.0	41.2	56.81
1987	38.1	42.0	45.2	55.5	61.2	67.6	71.4	74.6	68.2	62.8	46.7	38.7	56.08
1988	40.3	43.7	46.4	52.0	58.3	67.0	76.8	74.6	66.5	64.1	48.0	38.8	56.42
Mean	38.7	41.6	45.8	51.4	58.2	65.9	75.9	75.7	68.8	56.7	45.5	40.4	55.46

No value indicates no report

No 'Annual Average' indicates incomplete record for that year

Summary of mean maximum temperatures

Station: Yuma Citrus

Data: Mean Minimum Temperatures

09/02/96

Summary of total annual precipitation
Gila River Navigability Study

Station: Yuma Citrus
Data: Total Precipitation (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
1920									2.31	0.01	0.00		
1921	0.88	0.00	0.00	0.00	0.00	0.00	0.42	1.58	3.48	0.00	0.00	0.89	7.25
1922	0.73	0.31	0.15	0.00	0.14	0.00	0.00	1.23	1.43	0.00	0.81	0.14	4.94
1923	0.01	0.00	0.11	0.29	0.00	0.00	0.35	0.06	1.14	0.00	0.24	1.34	3.54
1924	0.00	0.00	0.12	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.51
1925	0.00	0.00	0.38	0.25	0.00	0.00	0.10	0.47	0.22	1.70	0.20	0.64	3.96
1926		0.00	0.00	0.61	0.00	0.00	0.00	2.51	0.33	0.00	0.00	3.93	
1927	0.14	0.12	0.37	0.11	0.00	0.00	1.58	0.16	0.00	0.78	0.60	1.19	5.05
1928	0.00	0.27	0.09	0.00	0.00	0.00	0.08	0.00	0.11	0.00	0.00	0.00	0.55
1929	0.13	0.00	0.07	0.00	0.00	0.00	0.32	1.55	0.20	0.00	0.00	0.00	2.27
1930	0.40	0.00	1.13	0.00	0.10	0.00	0.33	0.00	0.00	0.20	0.00	0.00	2.16
1931	0.11	1.57	0.00	0.48	0.00	0.00		0.67	1.29	0.18	0.34	0.65	
1932	0.00	1.15	0.00	0.00	0.00	0.00	0.08	0.00	0.00	2.08	0.00	0.45	3.76
1933	1.14	0.20	0.00	0.89	0.00	0.00	0.00	0.08	0.00	2.87	0.05	0.00	5.23
1934	0.00	0.00	0.16	0.00	0.00	0.00	0.00	1.19	0.00	0.00	0.30	0.62	2.27
1935	0.80	0.69	0.16	0.00	0.00	0.00	0.00	1.80	0.20	0.00	0.00	0.41	4.06
1936	0.49	0.20	0.00	0.00	0.00	0.00	0.88	0.05	0.00	0.00	0.10	0.07	1.79
1937	0.15	0.13	0.49	0.00	0.00	0.15	0.22	0.00	0.58	0.00	0.00	0.44	2.16
1938	0.00	0.71	0.60	0.00	0.00	0.00	0.20	0.33	0.16	0.40	0.00	1.03	3.43
1939	0.79	0.16	0.03	0.00	0.00	0.00	0.06	0.15	3.79	0.00	0.43	0.00	5.41
1940	0.00	0.47	0.02	0.22	0.00	0.06	0.00	0.00	1.54	0.43	0.05	1.55	4.34
1941	0.63	0.36	1.21	0.81	0.00	0.00	0.43	1.97	0.11	0.15	0.45	0.48	6.60
1942	0.17	1.02	0.25	0.00	0.00	0.00	0.00	0.78	0.00	0.10	0.00	0.03	2.35
1943	0.21	0.00	0.39	0.00	0.00	0.00	0.00	0.80	0.00	0.05	0.00	0.75	2.20
1944	0.22	1.56	0.19	0.00	0.00	0.00	0.00	0.00	0.23	0.66	0.97	0.21	4.04
1945	0.62	1.28	0.29	0.00	0.00	0.00	0.46	1.72	0.00	0.03	0.00	0.00	4.40
1946	0.10	0.00	0.00	0.01	0.00	0.00	0.13	0.30	0.40	0.04	0.26	1.02	2.26
1947	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.26	0.07	0.00	0.00	0.26	0.61
1948	0.00	0.02	0.18	0.00	0.00	0.15	0.32	0.00	0.02	1.27	0.00	0.34	2.30
1949	2.55	0.01	0.02	0.00	0.25	0.00	0.05	0.00	0.14	0.46	0.00	0.49	3.97
1950	0.04	0.13	0.00	0.00	0.00	0.00	1.70	0.02	0.05	0.00	0.00	0.00	1.94
1951	0.35	0.03	0.00	0.41	0.00	0.00	0.05	0.90	0.00	0.38	0.15	0.15	2.42
1952	0.40	0.08	0.85	0.37	0.00	0.00	0.25	0.00	0.01	0.00	0.35	0.75	3.06
1953	0.02	0.12	0.26	0.03	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.47
1954	0.04	0.09	0.32	0.00	0.00	0.00	0.18	0.00	0.10	0.00	0.00	0.00	0.73
1955	1.41	0.03	0.00	0.00	0.00	0.00	0.42	2.29	0.00	0.00	0.00	0.01	4.16

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1956	0.00	0.03	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.20
1957	0.77	0.04	0.29	0.18	0.00	0.00	0.00	0.73	0.00	3.49	0.00	0.05	5.55
1958	0.00	1.40	0.80	0.00	0.02	0.02	0.17	0.01	0.00	0.07	0.12	0.00	2.61
1959	0.00	0.22	0.00	0.02	0.00	0.00	0.14	0.30	0.18	0.02	0.01	1.19	2.08
1960	0.79	0.06	0.00	0.00	0.00	0.10	0.00	0.12	0.78	0.00	0.00	0.10	1.95
1961	0.21	0.00	0.02	0.13	0.01	0.01	0.11	0.69	0.35	0.36	0.08	1.17	3.14
1962	0.54	0.04	0.14	0.00	0.00	0.00	0.00	0.00	0.20	0.01	0.00	0.39	1.32
1963	0.55	0.16	0.14	0.00	0.00	0.00	0.06	0.07	2.08	1.05	0.78	0.00	4.89
1964	0.00	0.10	0.05	0.00	0.00	0.00	0.02	0.28	0.00	1.22	0.20	0.07	1.94
1965	0.71	0.45	0.14	1.19	0.00	0.22	0.01	0.08	0.00	0.00	0.69	1.60	5.09
1966	0.39	0.17	0.20	0.00	0.00	0.00	0.15	0.13	0.31	0.04	0.00	0.00	1.39
1967	0.31	0.00	0.06	0.00	0.00	0.00	0.03	0.29	2.40	0.00	0.92	0.70	4.71
1968	0.00	0.44	0.26	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.07	1.63
1969	0.61	0.00	0.01	0.09	0.07	0.00	0.00	0.00	0.00	0.00	1.63	0.85	3.26
1970	0.01	0.72	1.05	0.00	0.00	0.00	0.00	0.70	0.17	0.05	0.02	0.00	2.72
1971	0.00	0.03	0.00	0.30	0.11	0.00	0.02	0.23	1.35	0.04	0.00	0.27	2.35
1972	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.39	0.00	3.86	0.25	0.05	4.71
1973	0.09	0.67	1.30	0.00	0.00	0.00	0.00	1.24	0.00	0.00	0.13	0.00	3.43
1974	0.77	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.16	0.21	0.00	0.18	1.60
1975	0.00	0.01	0.38	0.31	0.00	0.00	0.00	0.00	0.08	0.00	0.03	0.52	1.33
1976	0.02	2.08	0.03	0.36	0.00	0.00	0.15	0.00	0.62	0.66	0.22	0.00	4.14
1977	0.79	0.03	0.04	0.00	0.03	0.00	0.00	5.47	0.49	0.34	0.00	0.73	7.92
1978	1.59	0.46	0.79	0.05	0.00	0.00	0.00	0.06	0.11	0.64	0.42	0.89	5.01
1979	2.44	0.11	0.41	0.00	0.42	0.00	0.45	1.69	0.00	0.00	0.00	0.05	5.57
1980	0.49	0.87	0.49	0.16	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.16	2.21
1981	0.27	0.11	0.71	0.05	0.06	0.00	0.00	1.27	0.00	0.03	0.10	0.00	2.60
1982	0.31	0.16	1.16	0.00	0.00	0.00	0.08	1.39	0.26	0.00	0.26	1.66	5.28
1983	0.39	0.75	0.32	0.00	0.00	0.00	0.00	2.79	0.22	0.44	0.07	1.00	5.98
1984	0.26	0.00	0.00	0.43	0.00	0.00	3.12	0.63	0.14	0.00	0.45	1.77	6.80
1985	0.07	0.19			0.00	0.00	0.05	0.00	1.42	0.43	0.62	0.35	
1986	0.08	0.33	0.16	0.00	0.00	0.11	0.27	0.06	0.40	0.07	0.13	0.22	1.83
1987	0.10	0.35	0.02	0.00	0.08	0.00	0.00	0.49	0.11	0.44	1.07	0.66	3.32
1988	0.23	0.03	0.05	1.01	0.00	0.37	0.00	0.45	0.00	0.23	0.00	0.00	2.37
Mean	0.38	0.30	0.26	0.13	0.02	0.02	0.22	0.60	0.43	0.37	0.20	0.48	3.28
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total

No value indicates no report; 0.00" indicates 'Trace' or no rainfall recorded
No 'Year Total' indicates incomplete record for that year

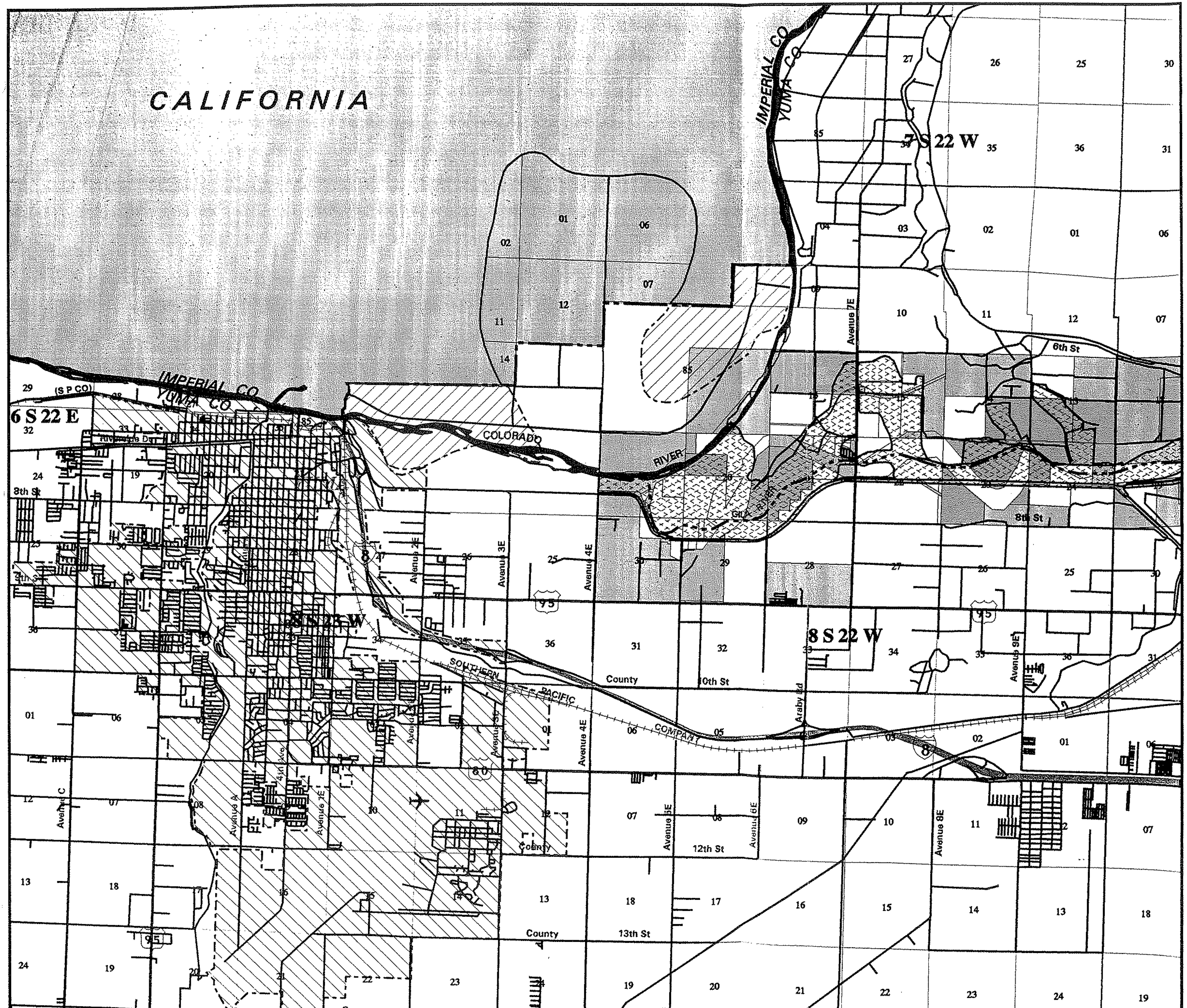
Summary of total annual precipitation
Station: Yuma Citrus
Data: Total Precipitation (inches)

Summary of mean minimum temperatures 09/02/96
Gila River Navigability Study Page 1
Station: Buckeye
Data: Mean Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1893			42.3	46.5	55.0	62.7	73.6	73.9	60.5	45.8	38.9	35.6	
1894	29.6	31.6	41.6	45.7	53.5	57.5	73.7	72.9	60.9	50.2	38.5	36.0	49.44
1895	34.6	35.8	38.9	48.0	55.5	60.2	68.0	71.8	60.0	51.5	38.2	26.9	49.20
1896	37.0	39.4	42.1	45.6	56.5	67.8	75.7	75.2	68.7	59.1	43.4	37.4	54.05
1897	37.7	33.9	35.9	47.1	56.5	61.6	72.0	75.2	67.9	48.2	36.7	27.7	50.13
1898	31.1	36.8	38.4	51.9	56.3	64.9	78.0	77.3	65.6	47.8	35.3	32.1	51.38
1899	32.9	32.9	37.6	47.1	48.7	63.8	74.6	67.9	66.2	47.4	40.6	32.5	49.43
1900	35.1	33.1	43.9	46.7	56.5	63.5	70.4	64.6	57.7	50.3	41.4	31.5	49.62
1901	36.0	39.9	38.9	43.6	53.2	58.4	74.6	71.5	56.5	48.8	41.4	28.3	49.33
1902	31.3	35.0	37.2	46.1	53.8	61.6	67.4	71.0	60.9	49.9	38.3	32.5	48.83
1903	29.9	29.2	36.7	41.2	51.6	56.2	67.7	72.4	62.7	47.5			
1904			51.5	55.4	60.9	64.0	64.1	71.1	60.4	48.3	36.7	33.8	
1905	37.2	46.0	48.1	47.4	46.2	58.3	64.9	73.1	63.8	47.6	44.8	33.5	50.92
1906	32.4	43.0	41.8	44.6	49.5	56.8	71.7		55.9	46.9	37.9	37.8	
1907	36.2	39.4	41.5	46.1	49.6	54.9	70.0	71.1	61.2	55.4	41.7	31.4	49.95
1908	33.1	36.9	41.3	47.2	48.8	57.0	74.3	73.9	62.1	45.2	39.0	35.2	49.55
1909	37.4	36.1	38.5	43.2	48.3	60.0	71.7	75.4	64.3	45.3	36.0	32.0	49.10
1910	32.3	32.2	41.9	45.6	55.5	60.4	72.1	73.8	65.6	51.0	42.1	35.0	50.75
1911	40.6	37.2	43.9	45.6	50.0	61.1	74.1	69.7	64.1	47.7		23.8	
1912	28.0	29.6	42.1	45.4	53.7	66.2	71.9	71.4	57.0	51.5	39.5	30.7	48.99
1913	28.5	37.9	37.0	47.3	51.6	61.5	70.6	73.4	66.3	47.0	47.8	34.4	50.32
1914	37.4	37.5	45.7	50.0	54.8	66.0	75.5	74.9	67.4	55.7	47.6	36.8	54.20
1915	34.5	38.0	40.8	49.0	52.5	61.6	72.3	71.6	60.7	48.0	37.7	34.8	50.20
1916	39.3	41.2	45.3	47.8	51.5	59.0	73.1	72.0	64.8	47.6	32.6	27.9	50.21
1917	34.3	34.7	34.1	44.8	50.5	61.6	76.1	69.9	67.0	49.4	37.6	29.7	49.22
1918	30.4	36.7	44.3	46.9	51.5	70.3	72.6	69.9	64.8	52.5	38.9	33.9	51.13
1919	31.9	34.5	39.6		55.4		74.6	74.4	67.0	49.0	39.7	35.6	
1920	37.9	43.8	39.4	44.7	54.9	64.6	72.5	72.7	63.0	47.3	42.9	29.7	51.13
1921	33.2			46.3	58.2	66.8	75.2	78.3	61.5		35.2	42.4	
1922	27.7	39.4	38.0	43.5	56.3	67.3	78.2	76.4	70.6	52.3	36.1	39.2	52.16
1923	36.5	39.8	40.5	50.0	58.5	61.3	76.2	75.1	65.5	47.7	47.2	40.5	53.31
1924	30.4	33.8	38.5	46.6	58.6	68.0	75.9	74.8	67.0	48.7	41.0	34.4	51.53
1925	30.5	38.1	43.4	50.5	61.2	60.9	77.3	74.3	64.5	54.2	42.1	37.2	52.95
1926	30.8	38.9	47.8	56.8	58.0	67.4	74.2	73.3	67.8	55.5	42.3	37.9	54.30
1927	37.7	43.2	40.3	48.9	54.2	64.2	74.8	74.2	66.0	50.2	43.9	34.0	52.68
1928	32.3	36.2	42.6	44.7	57.6	62.7	72.0	70.9	64.2	53.7	41.4	32.6	50.96
1929	32.9	34.8	38.3	44.2	54.3	60.3	75.4	74.5	64.8	52.4	35.0	32.0	50.02
1930	35.1	37.9	40.5	49.0	50.7	63.7	74.2	70.3	59.2	45.4	42.0	29.6	49.86
1931	30.1	41.0	40.2	50.2	55.8	63.0	78.9	73.6	65.2	49.1	39.9	31.2	51.57
1932	26.9	39.9	40.4	43.7	52.5	60.1	74.7	73.1	64.6	50.9	37.2	32.8	49.77
1933	30.0	28.7	37.5	42.3	48.5	63.9	77.4	73.7	67.9	56.6	38.8	33.3	50.02
1934	31.5	38.8	45.3	51.8	59.4	60.9	76.2	74.6	63.9	50.4	40.4	38.5	52.74
1935	38.2	42.5	39.6	48.8	53.4	64.3	72.3	74.2	65.7	48.8	36.9	35.0	51.69
1936	31.5	38.2	42.6	49.1	56.0	67.2	75.8	74.8	64.0	51.5	44.0	35.1	52.52
1937	26.5	36.1	41.6	45.6	55.1	62.5	75.1	74.2	69.1	49.3	38.9	39.1	51.18
1938	35.2	40.7	41.8	37.6	54.4	62.8	72.6	74.1	66.8	49.5	31.4	36.5	50.37
1939	35.5	32.2	41.6	50.2	55.7	61.8	74.0	74.3	67.5	47.6	41.2	35.3	51.52
1940	36.1	38.0	41.6	49.7	58.6	67.5	71.4	74.0	67.7	54.1	37.6	42.5	53.29
1941	41.2	45.1	43.7	45.7	55.9	58.0	69.8	67.6	58.2	50.5	41.1	36.8	51.19

Appendix I

Land Ownership Maps



LEGENDS

Ownership

- Private
- State Trust
- BLM
- Indian
- Az Game & Fish
- Military
- Other
- Parcel line

Water Features

- Floodplain (Study Area)
- GILA RIVER
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- Streams

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- Indian Reservations

Transportation

- Interstate Highway
- Primary Highways
- Road or Street
- Railroad

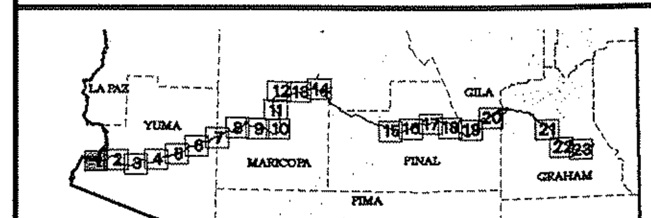
Survey System

- Township
- Section

N
W E
S

1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND OWNERSHIP MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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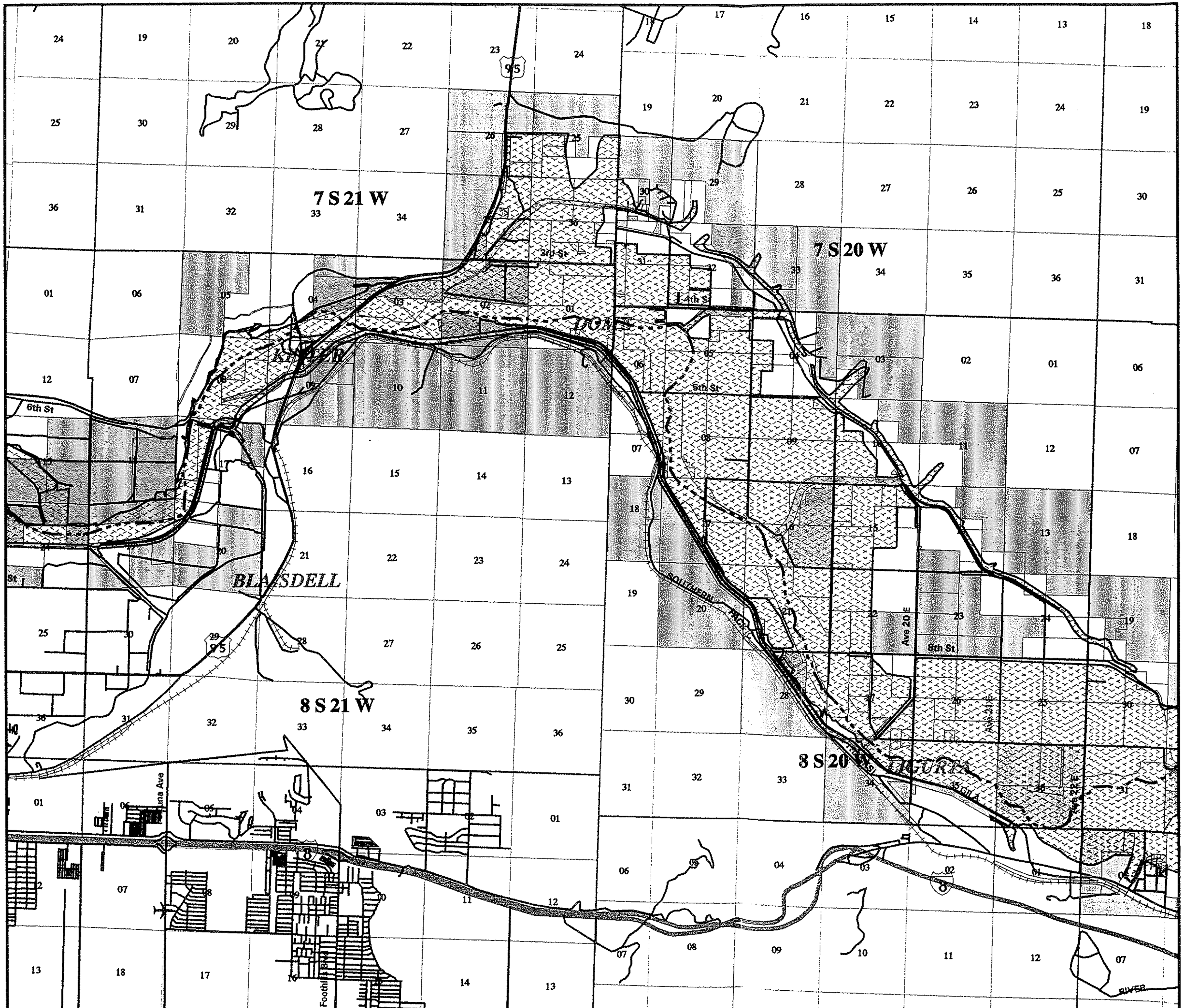

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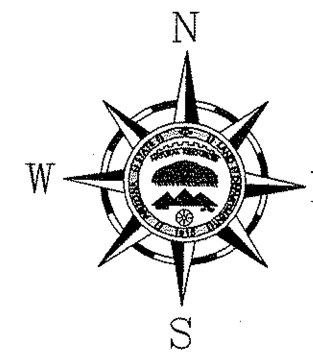

1 0 1 2 MILES

5000 0 5000 10000 FEET

1 0 1 2 3 KILOMETERS

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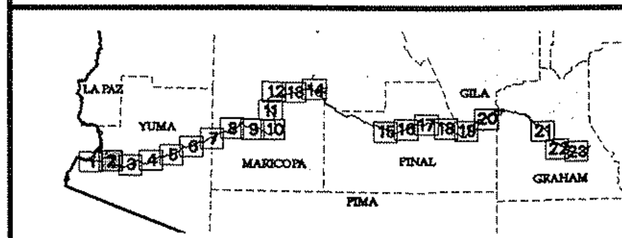

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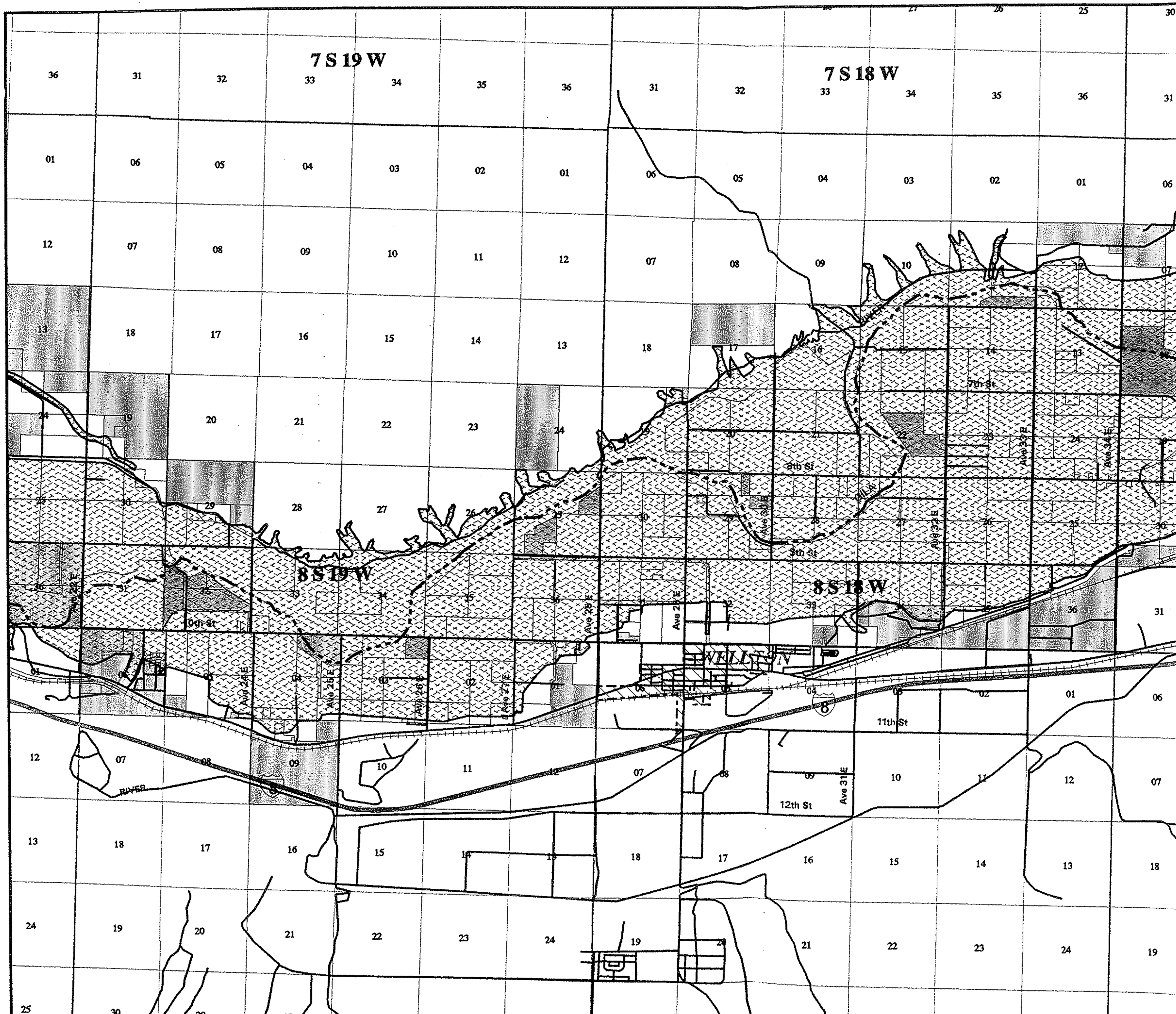

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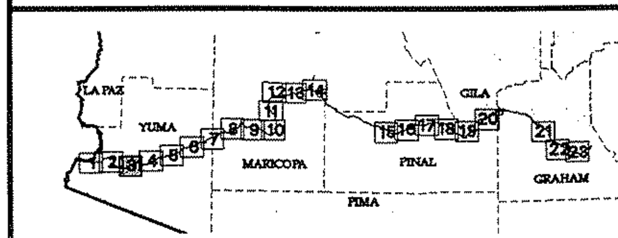
N
W
E
S

1 0 1 2 MILES

5000 0 5000 10000 FEET

1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND OWNERSHIP MAP
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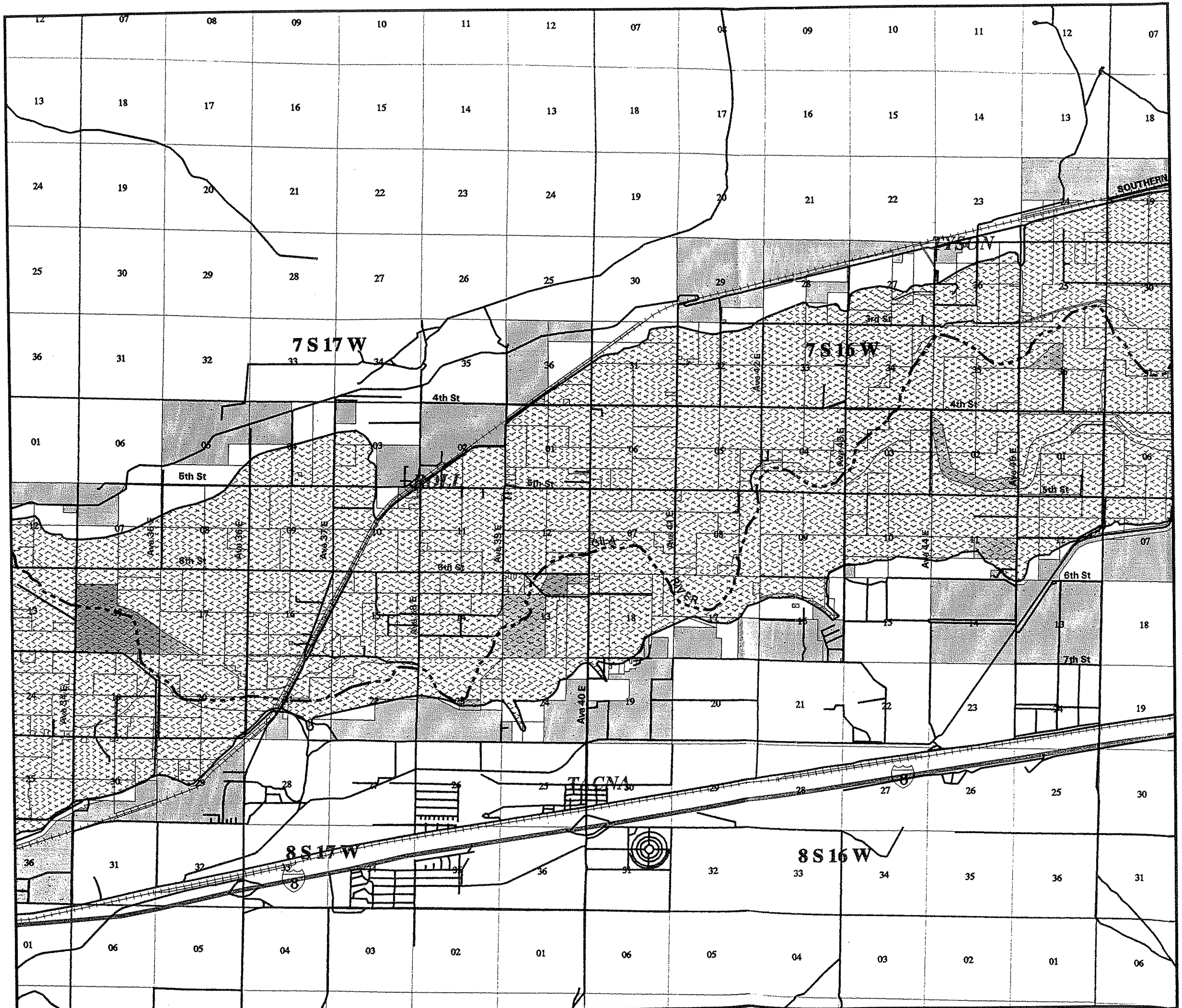

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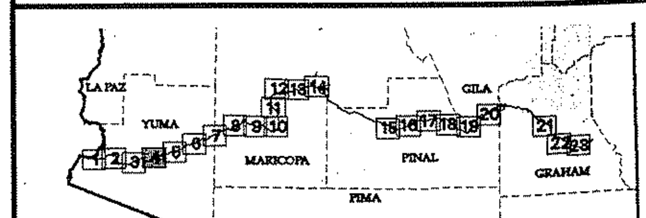
N W E S

1 0 1 2 MILES

5000 0 5000 10000 FEET

1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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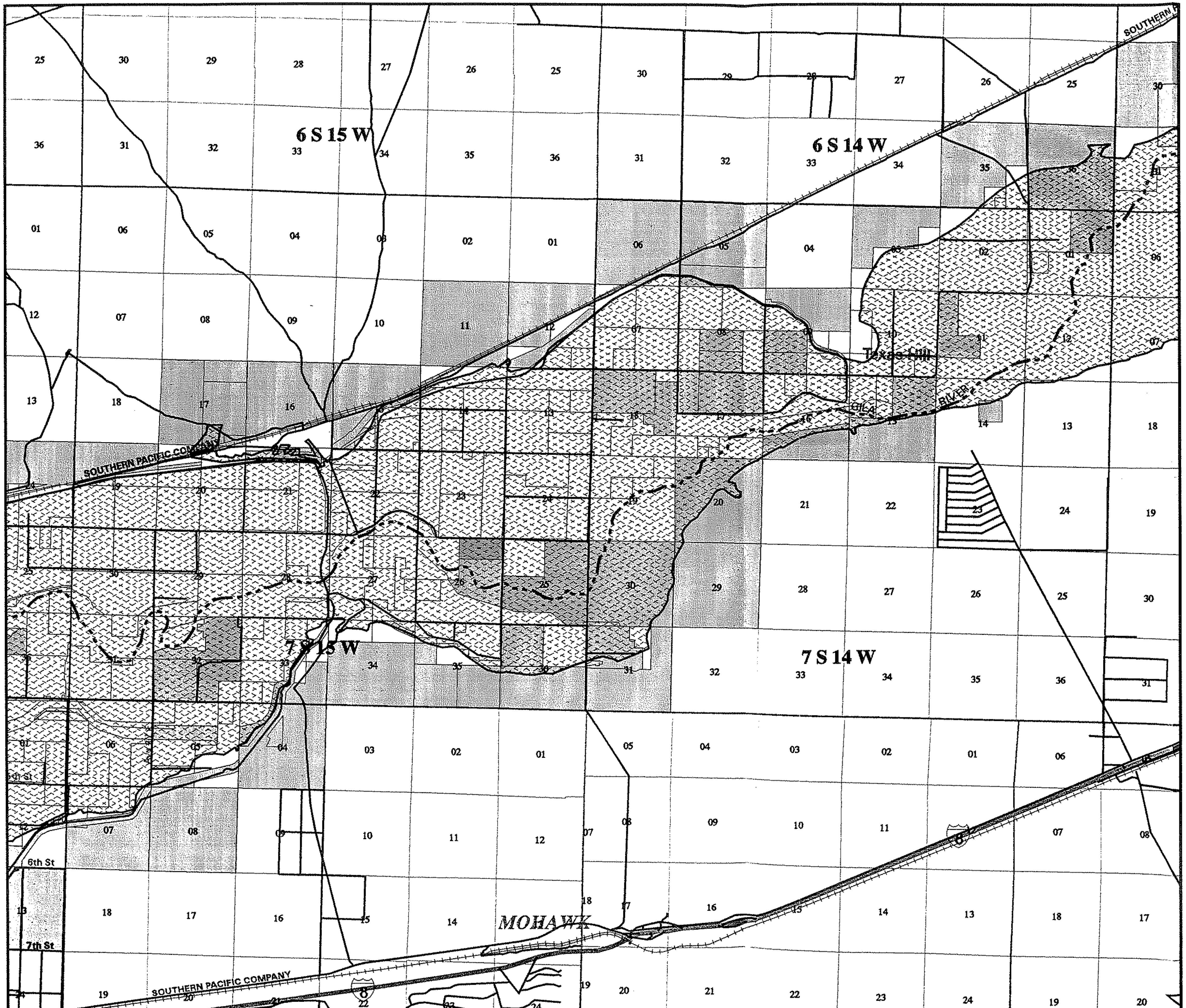

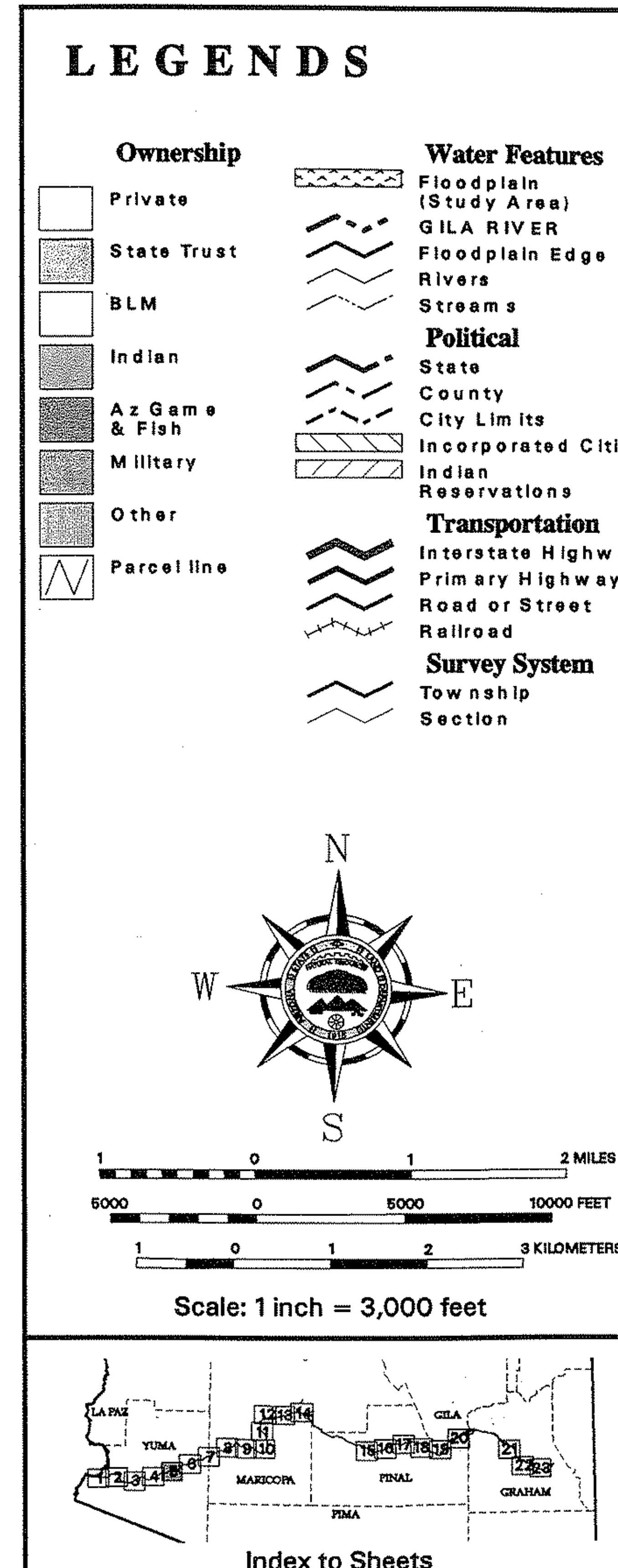

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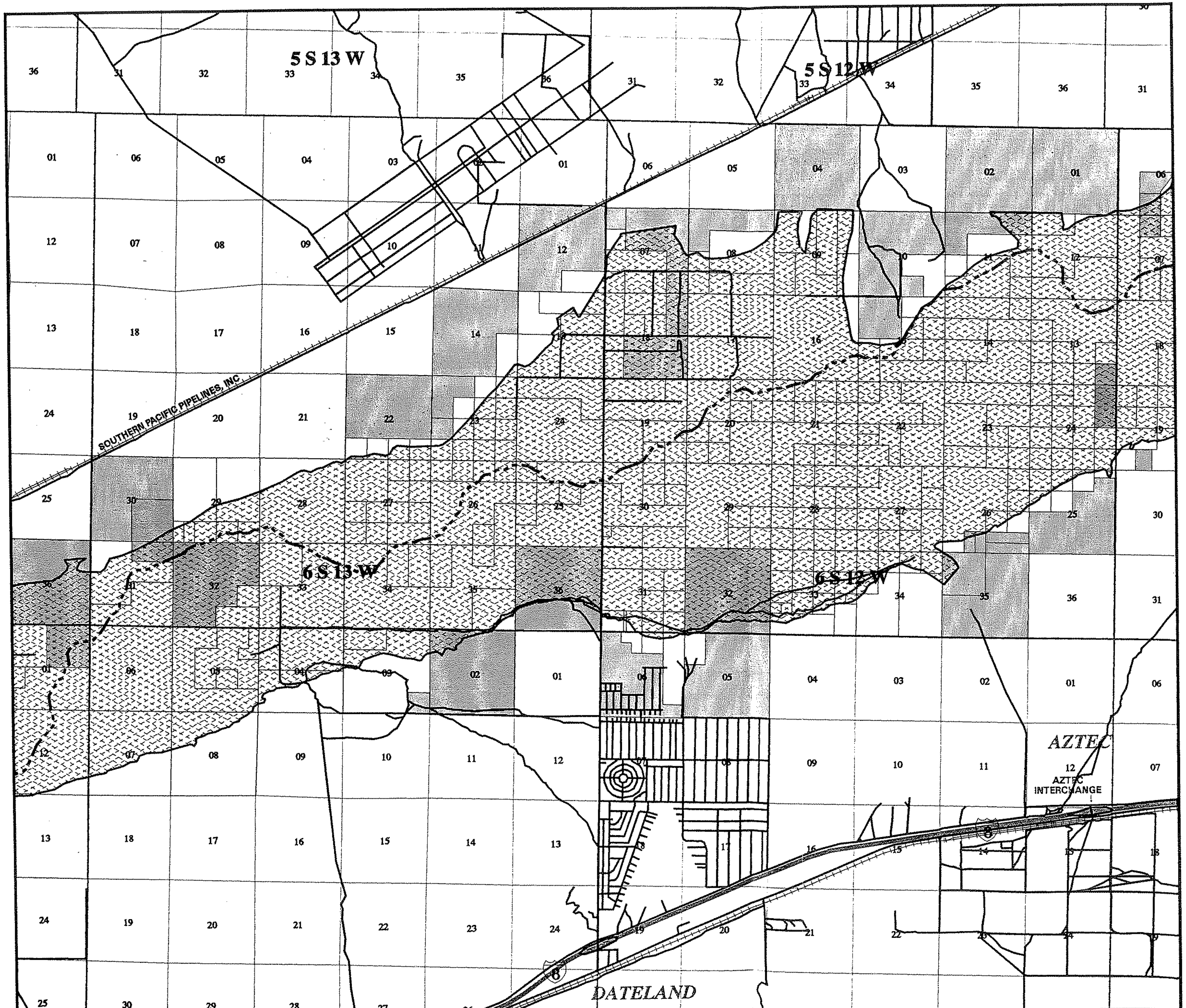

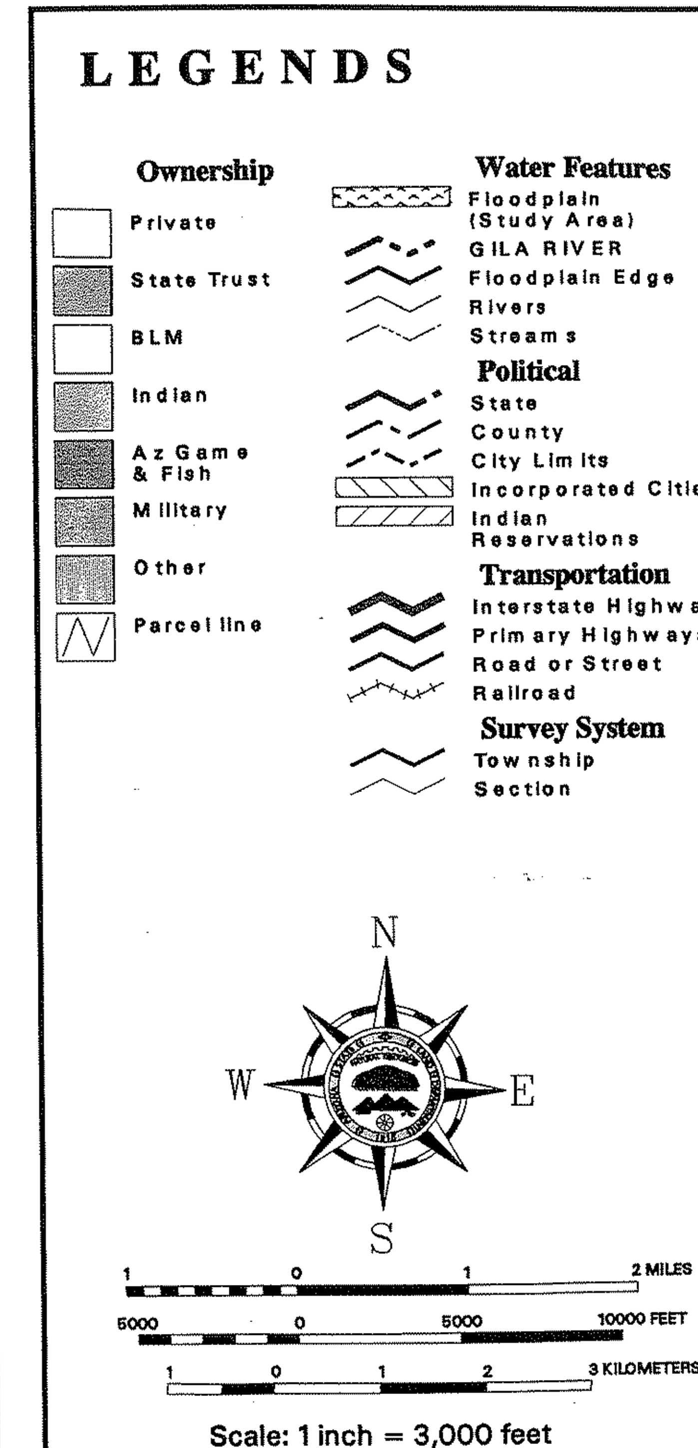

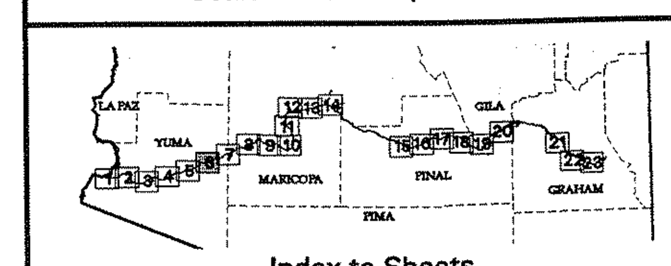

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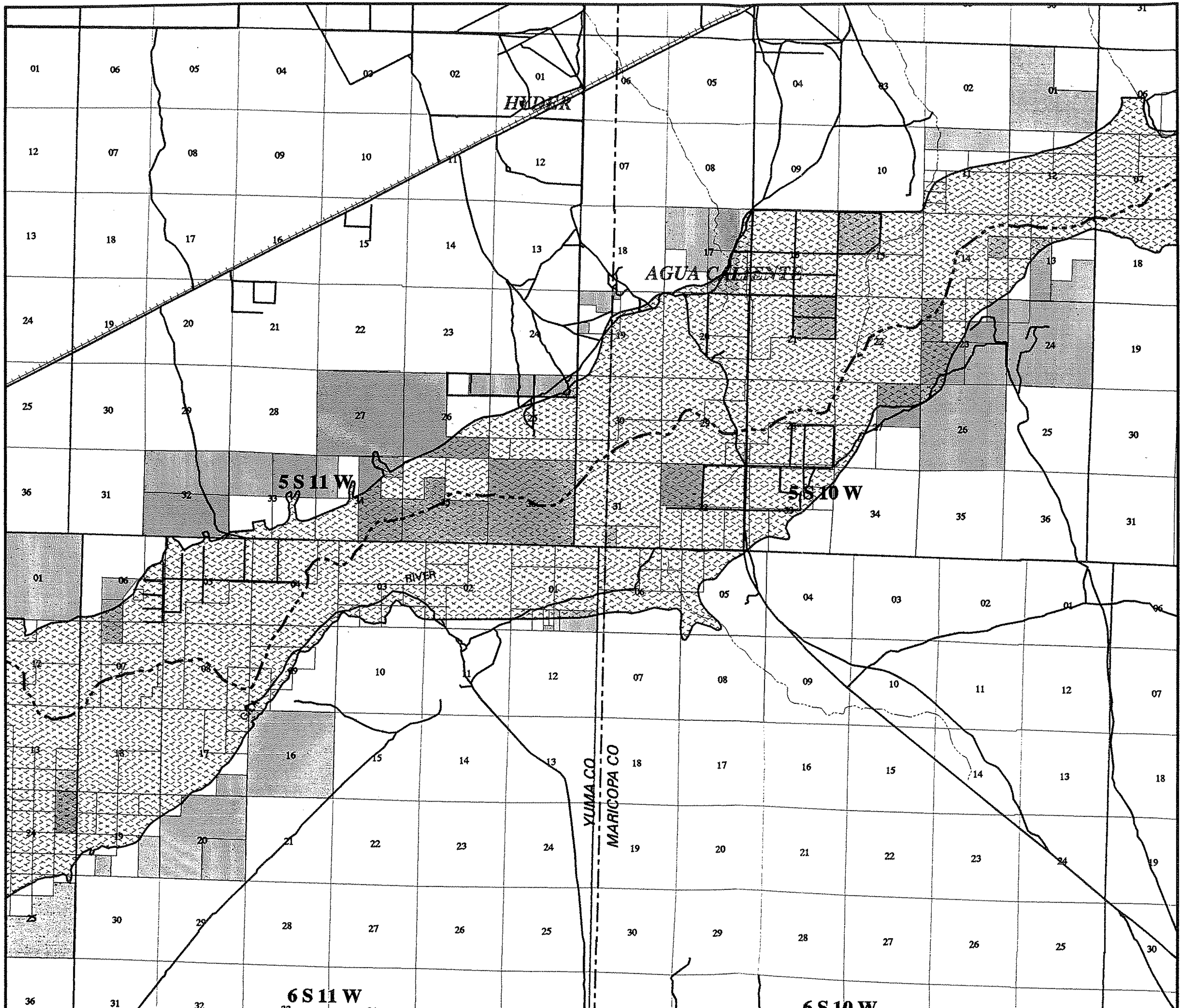

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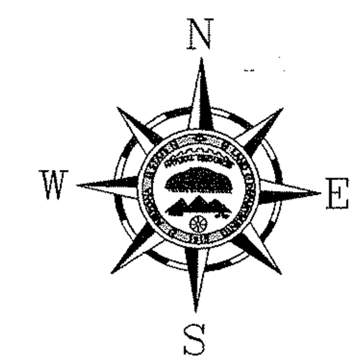
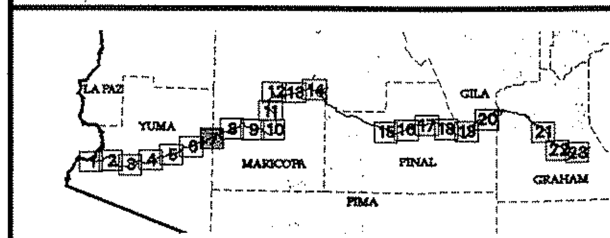


1 0 1 2 MILES

5000 0 5000 10000 FEET

1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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For the GILA RIVER NAVIGABILITY STUDY

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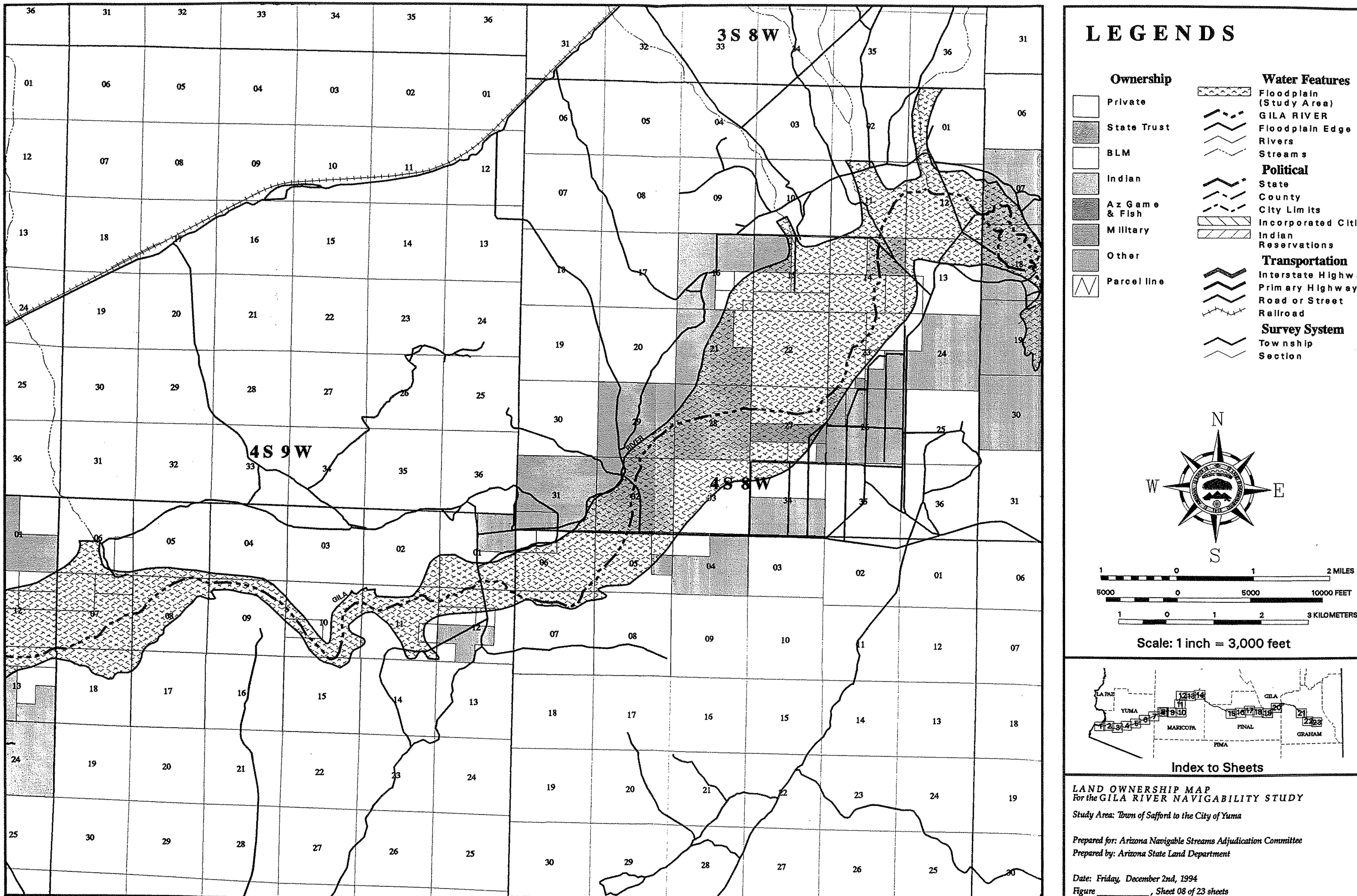

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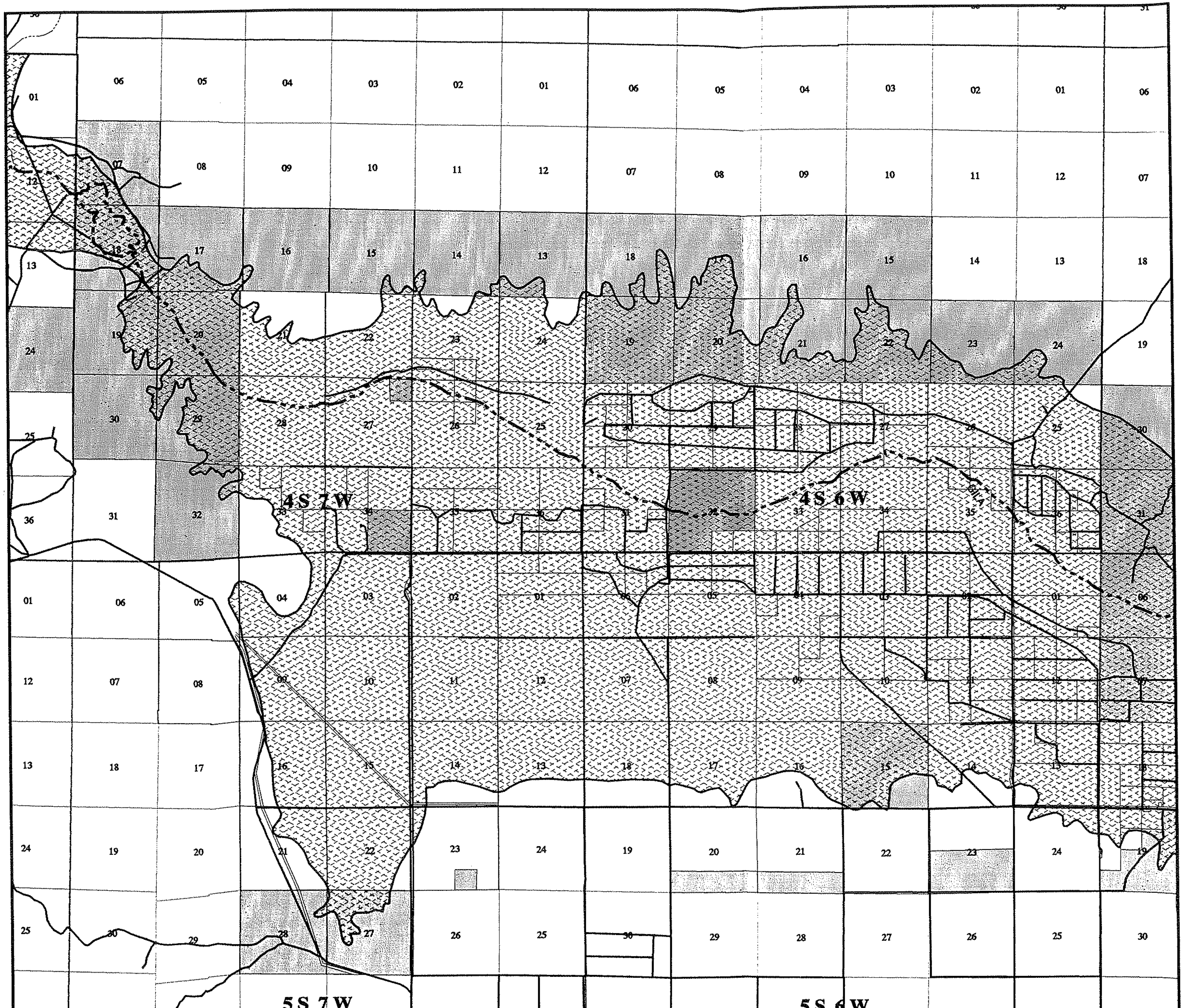

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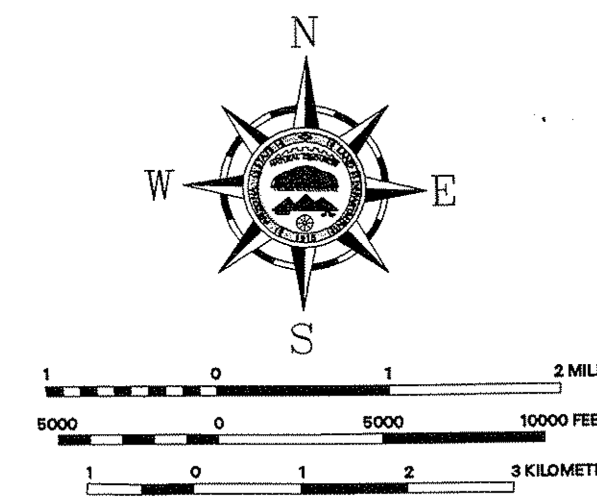

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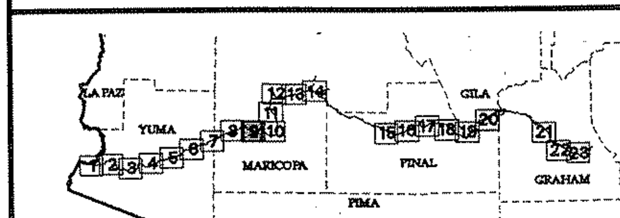

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LAND OWNERSHIP MAP
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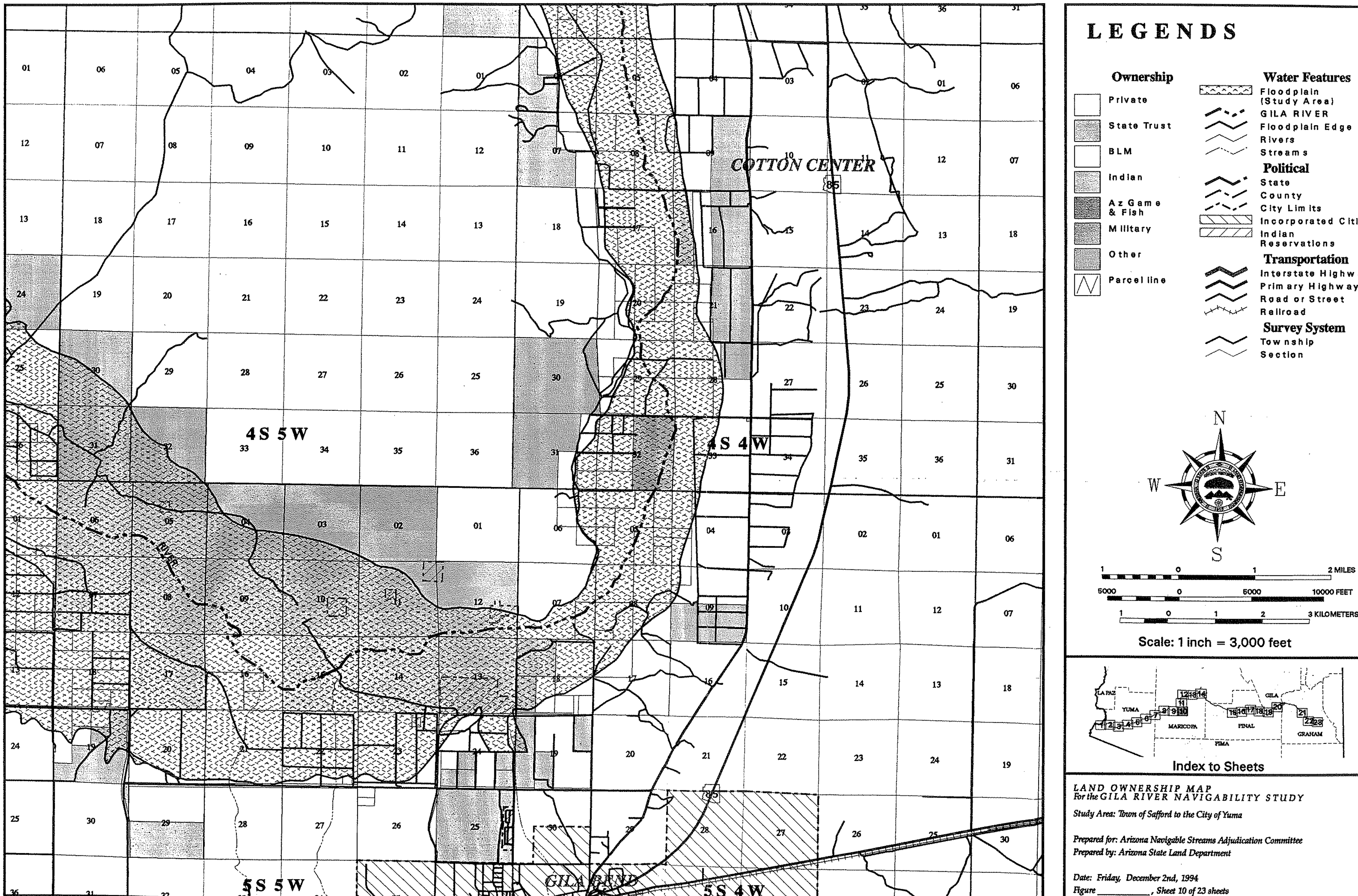
COTTON CENTER
GILA BEND
4S 5W
4S 4W
5S 5W
5S 4W
RIVER
LEGENDS
Ownership
Private
State Trust
BLM
Indian
Az Game & Fish
Military
Other
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Interstate Highway
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N
S
E
W
2 MILES
10000 FEET
3 KILOMETERS
Scale: 1 inch = 3,000 feet
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YUMA
MARICOPA
PINAL
GILA
PIMA
GRAHAM
LAND OWNERSHIP MAP
For the GILA RIVER NAVIGABILITY STUDY
Study Area: Town of Safford to the City of Yuma
Prepared for: Arizona Navigable Streams Adjudication Committee
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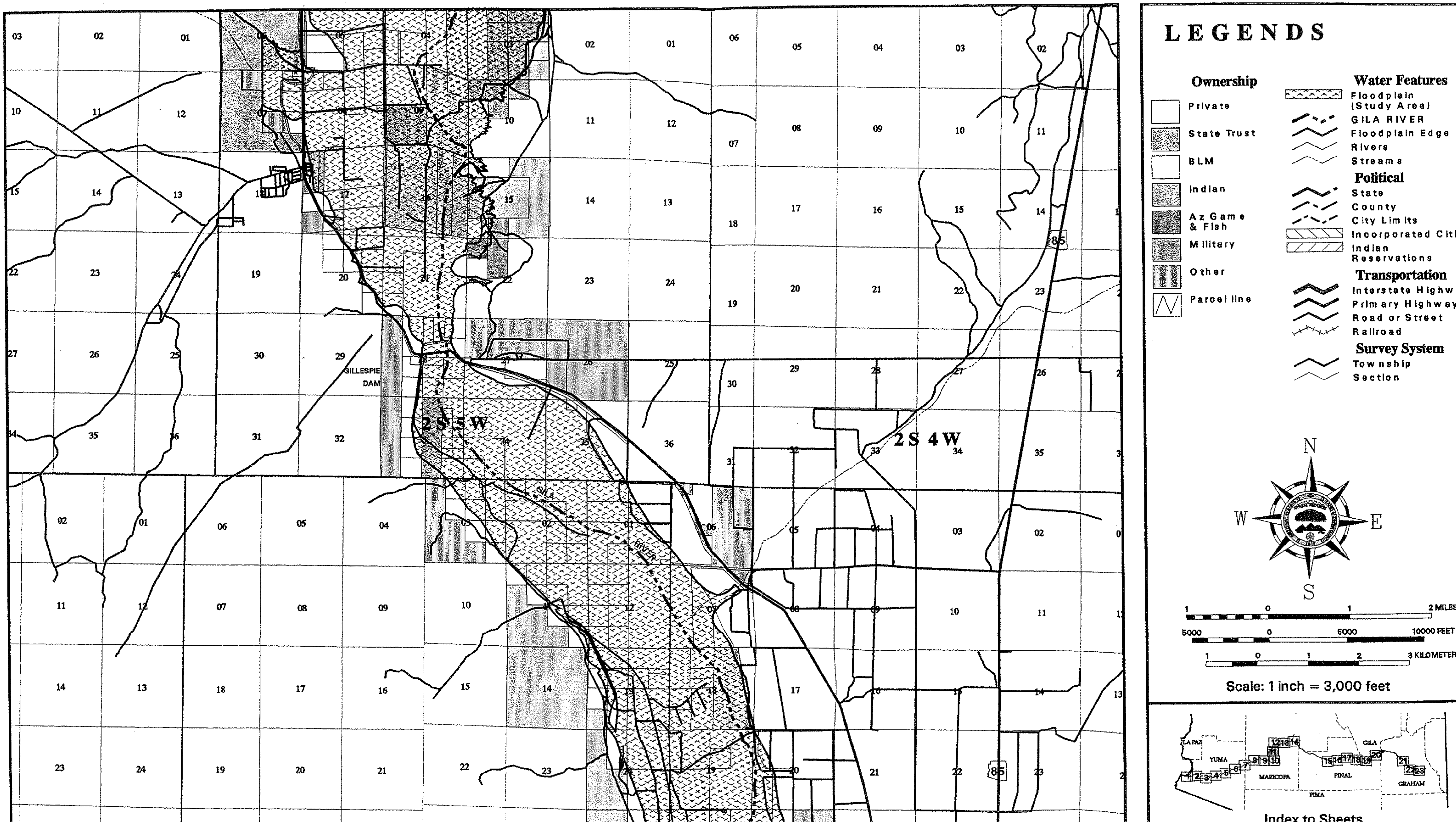

LAND OWNERSHIP MAP For the GILA RIVER NAVIGABILITY STUDY

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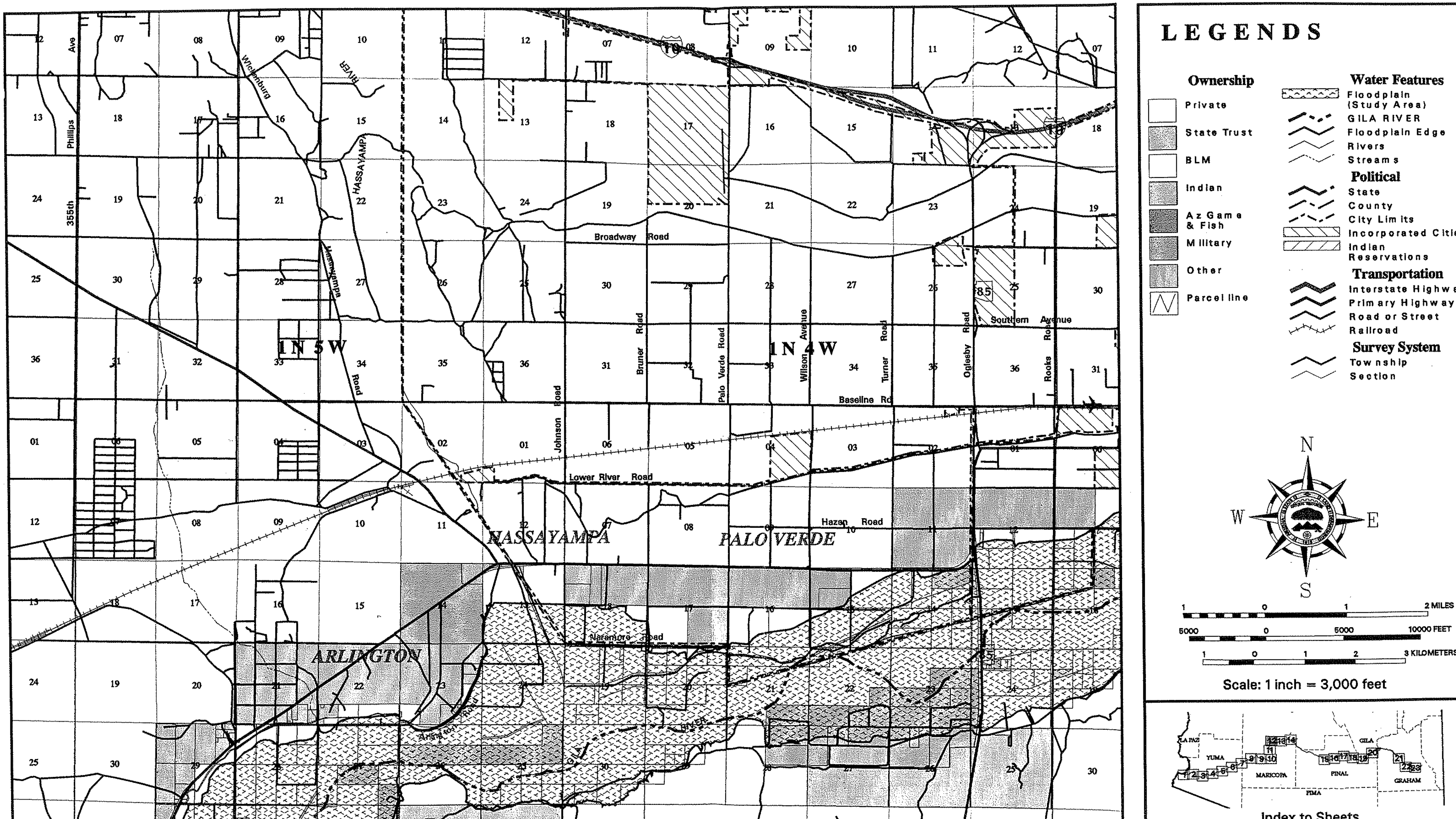

LAND OWNERSHIP MAP
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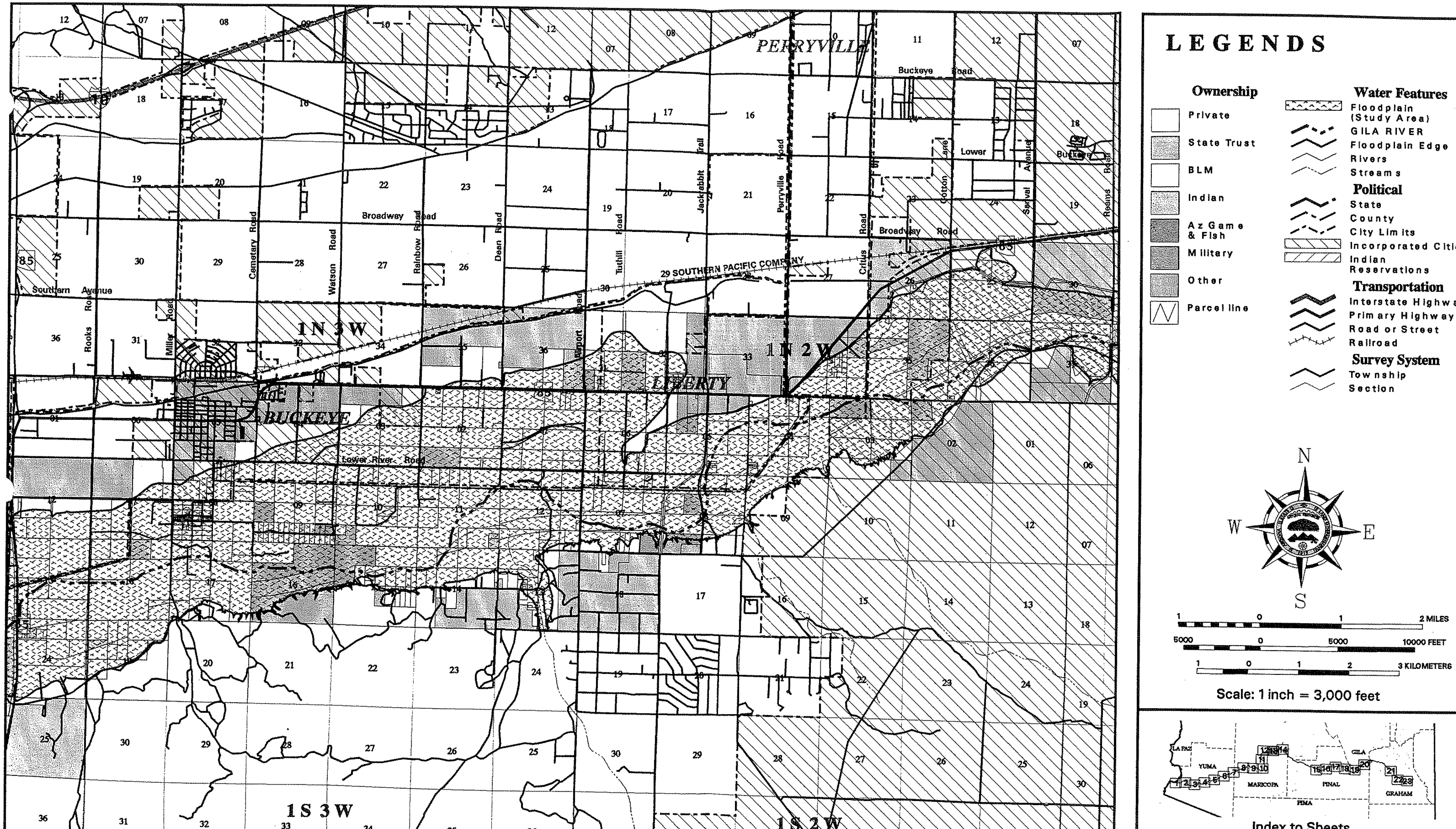

LAND OWNERSHIP MAP
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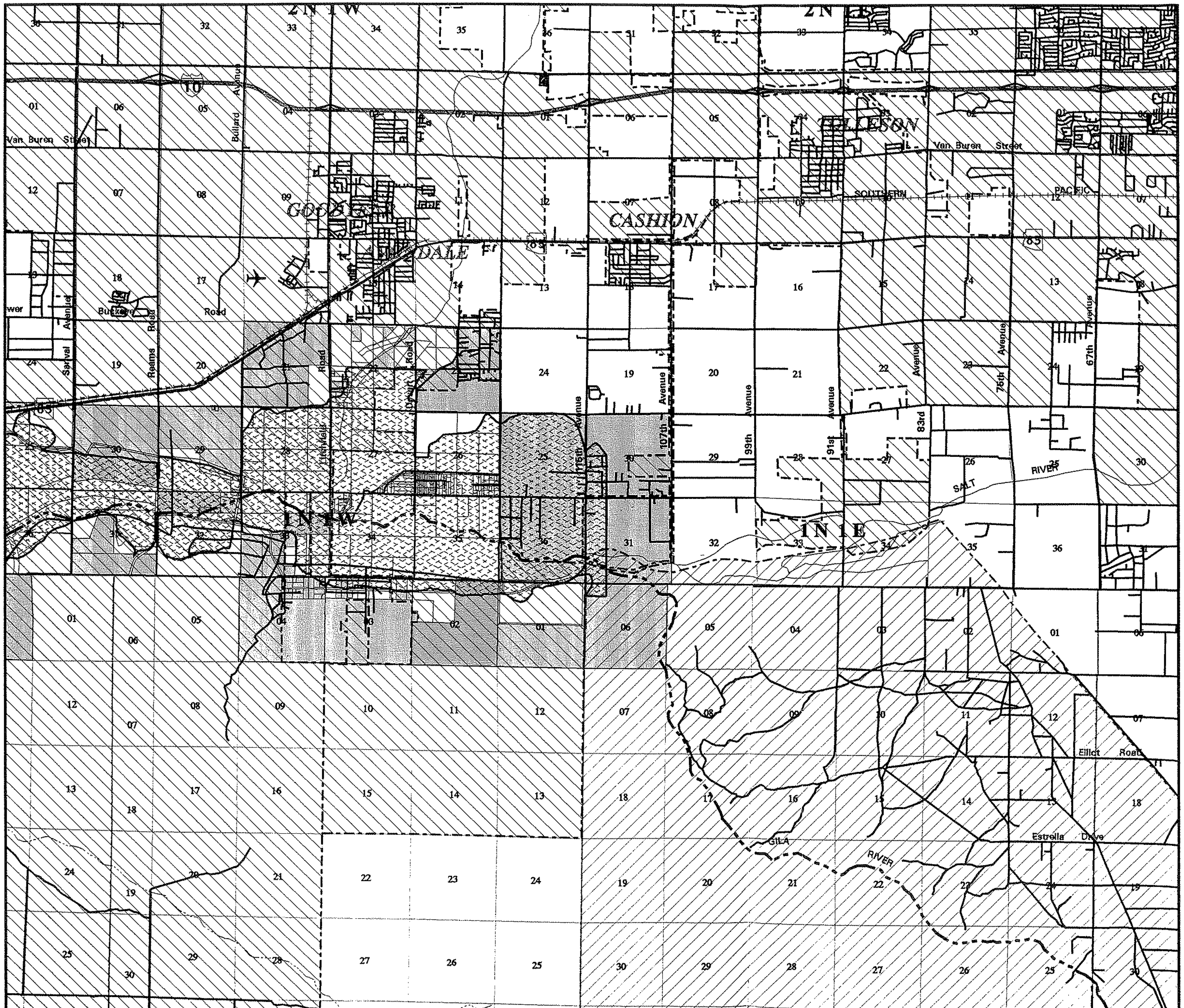

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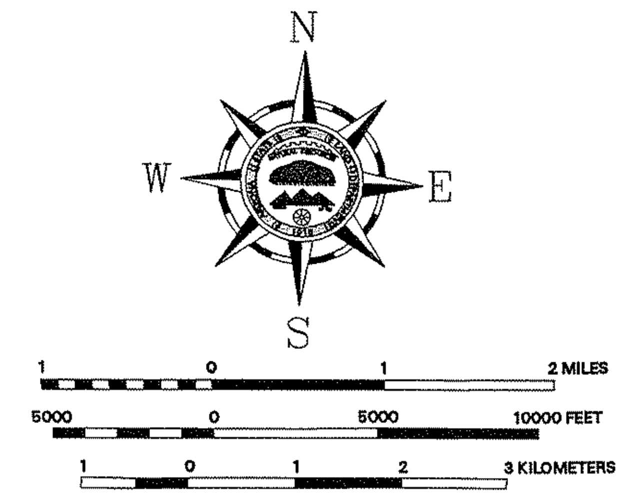
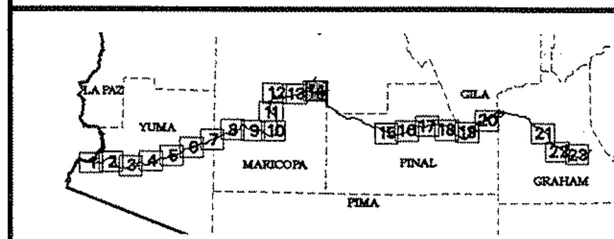


Scale: 1 inch = 3,000 feet



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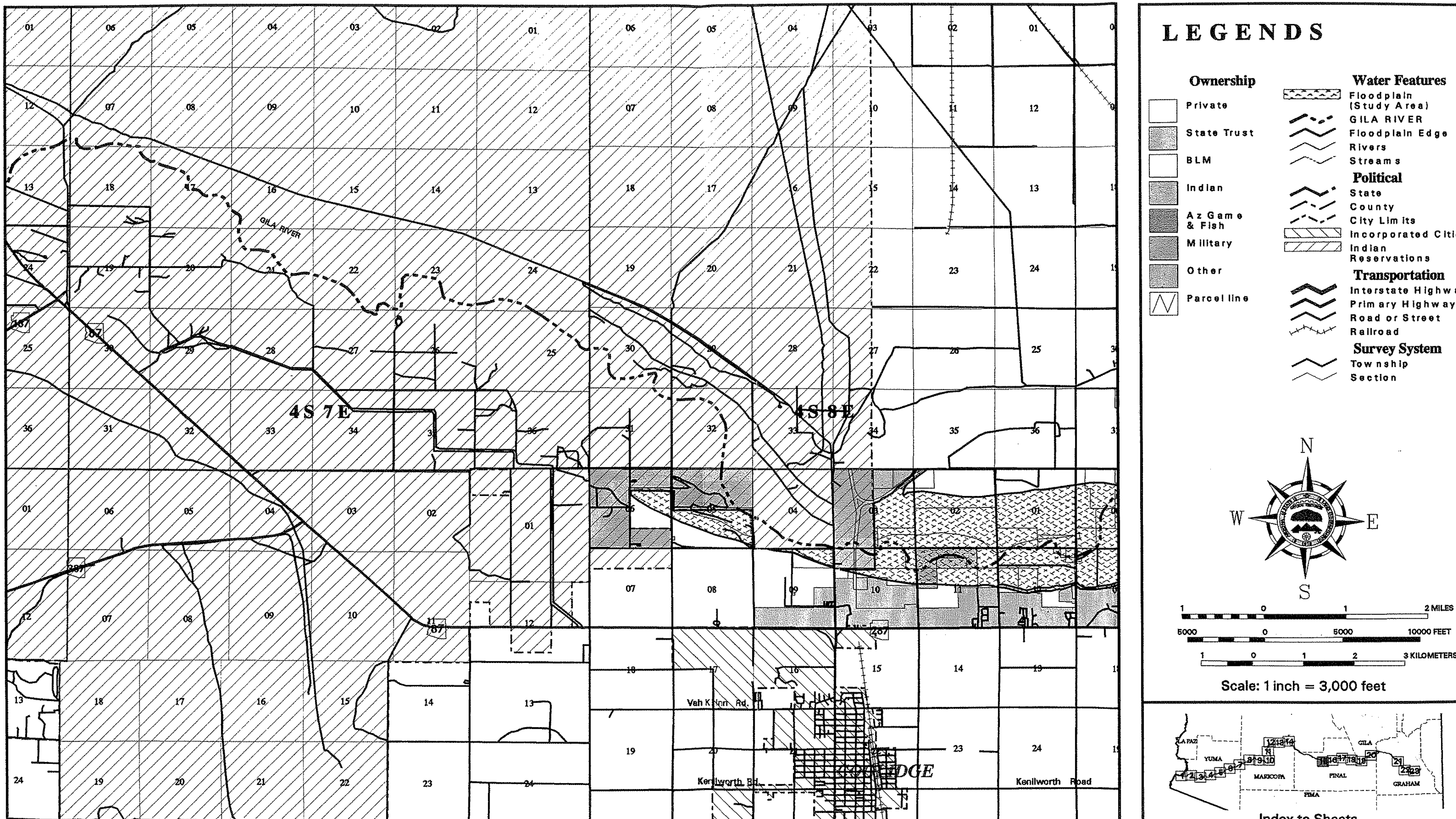

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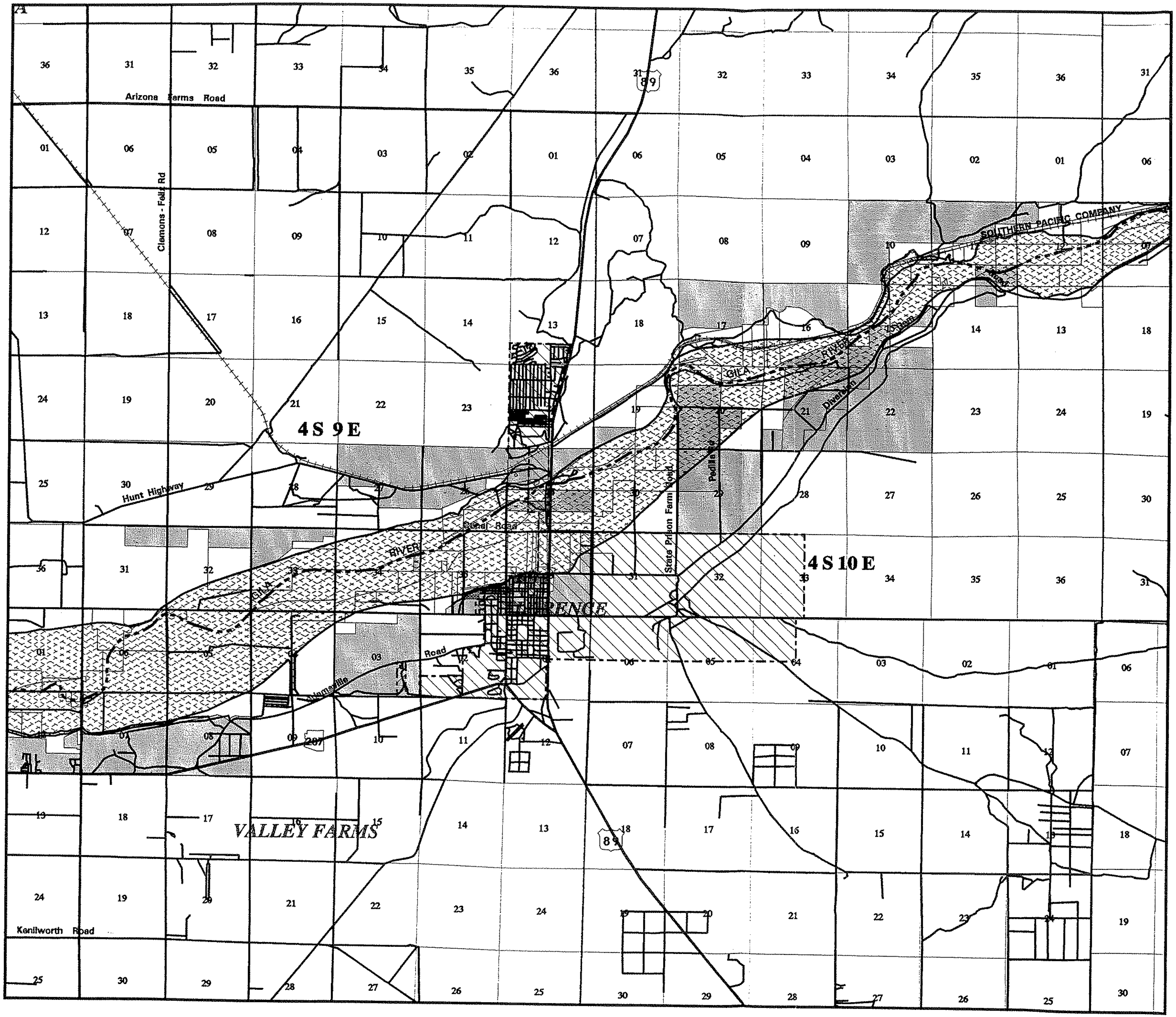

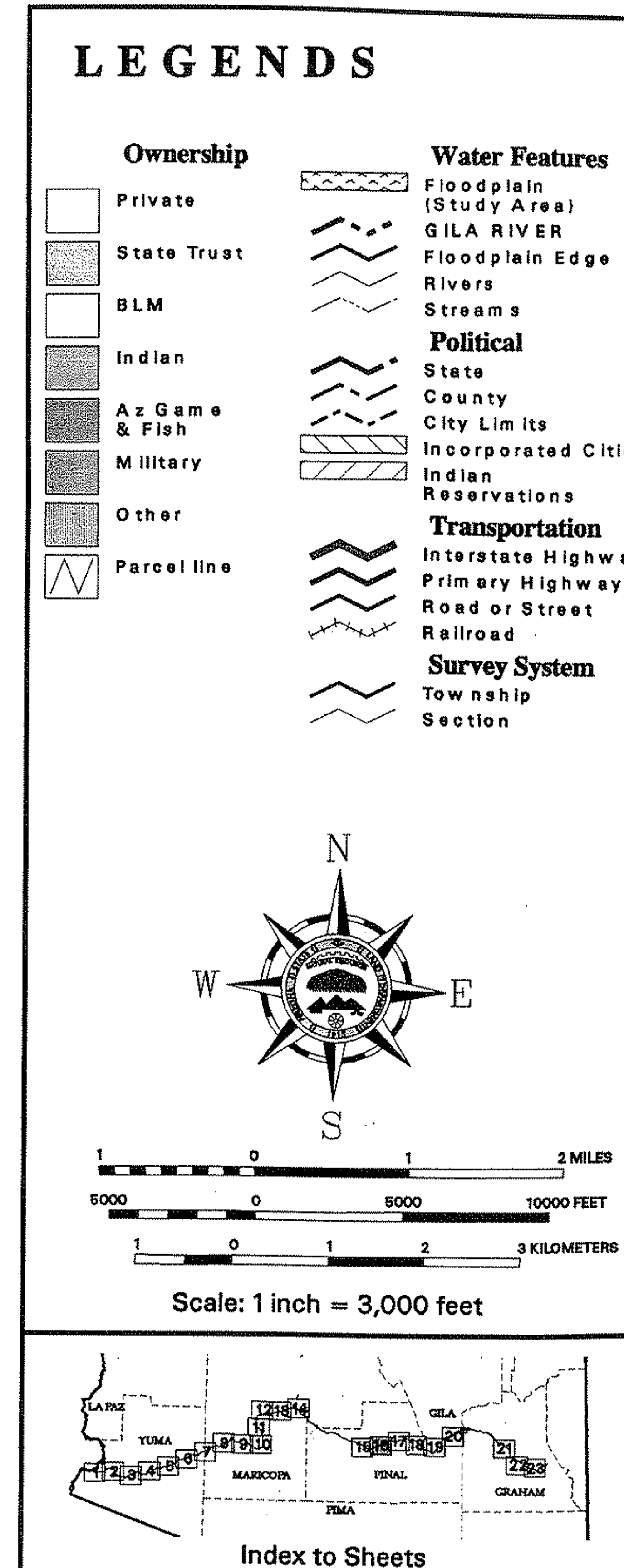

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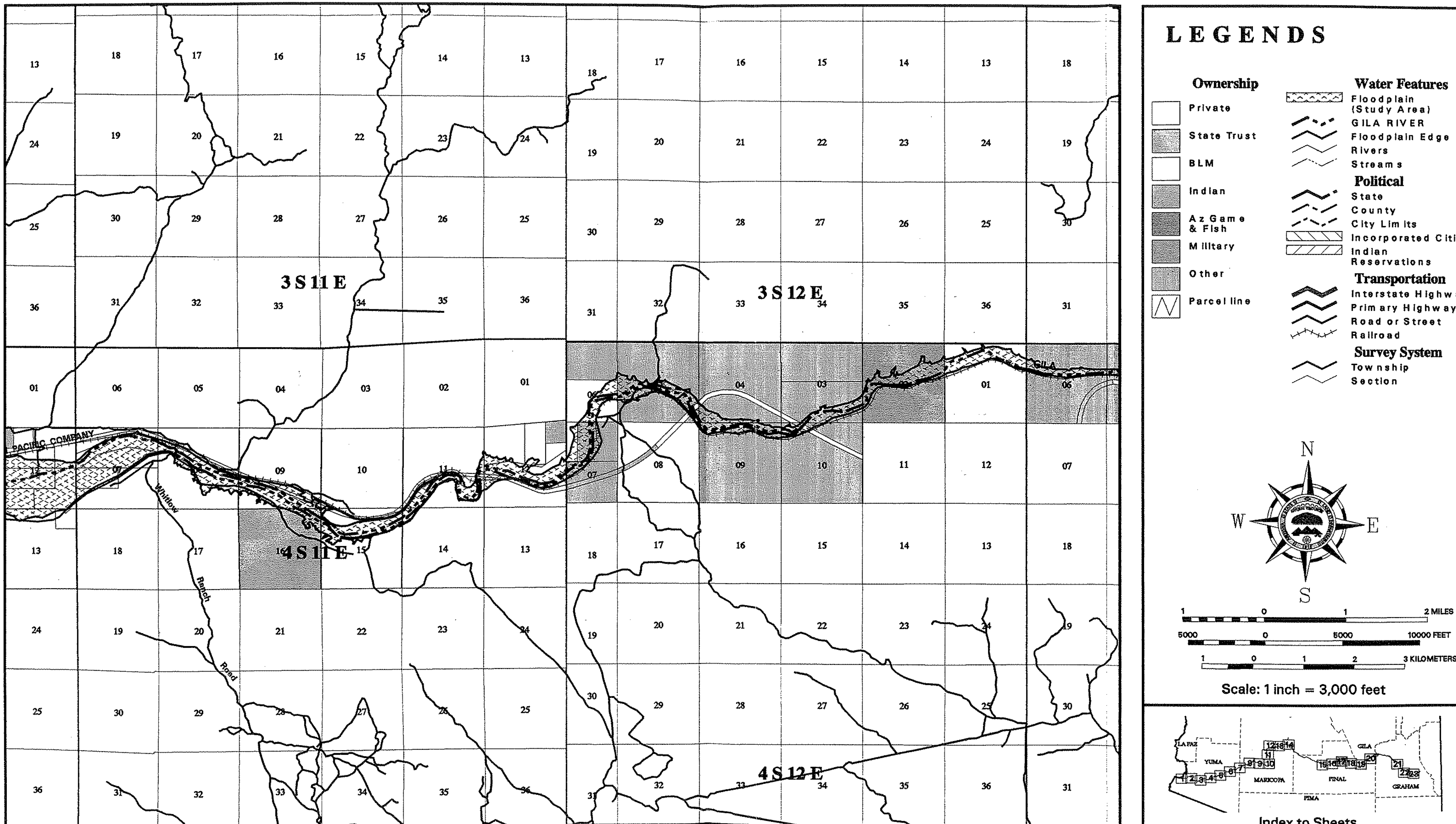

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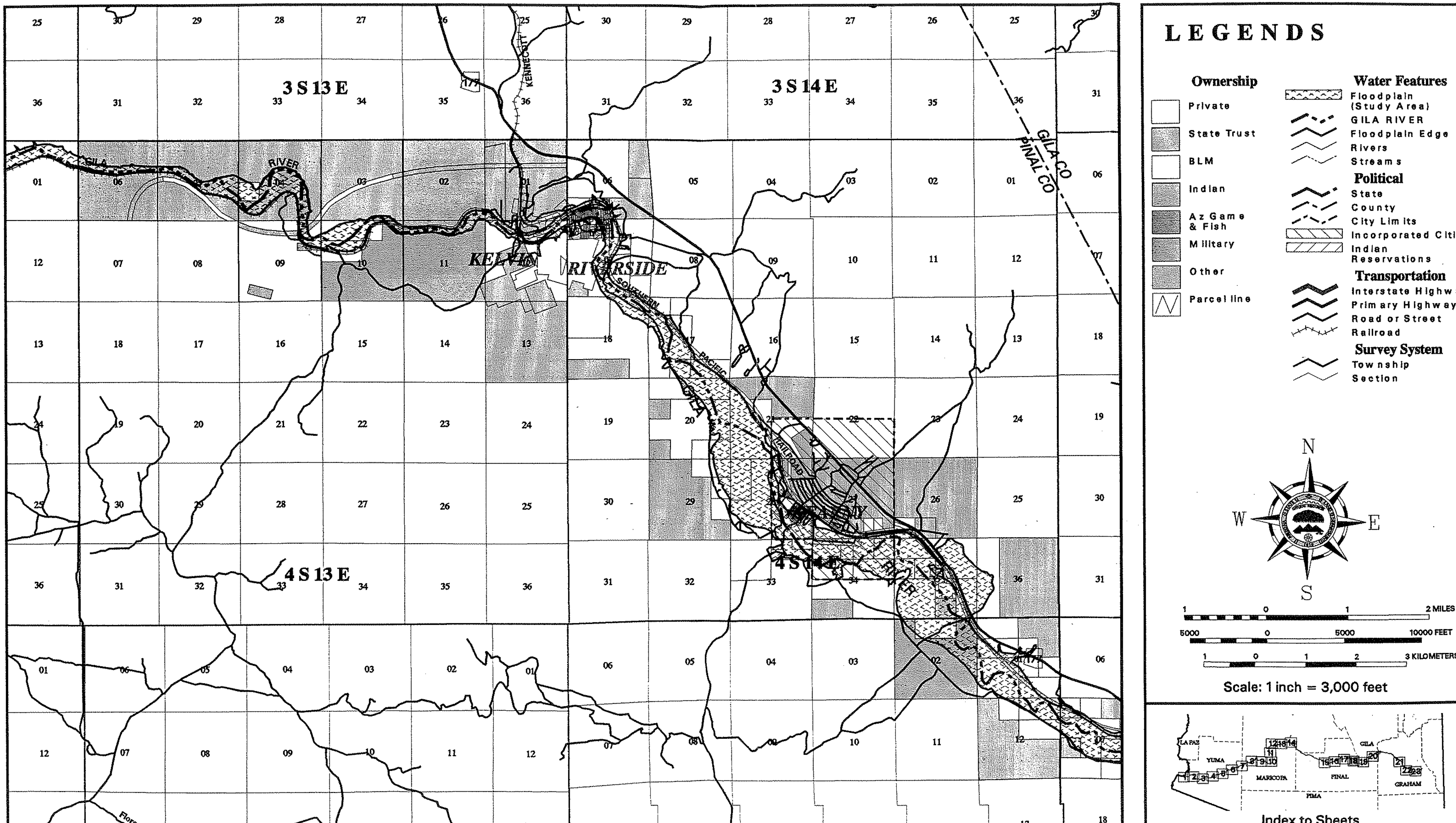

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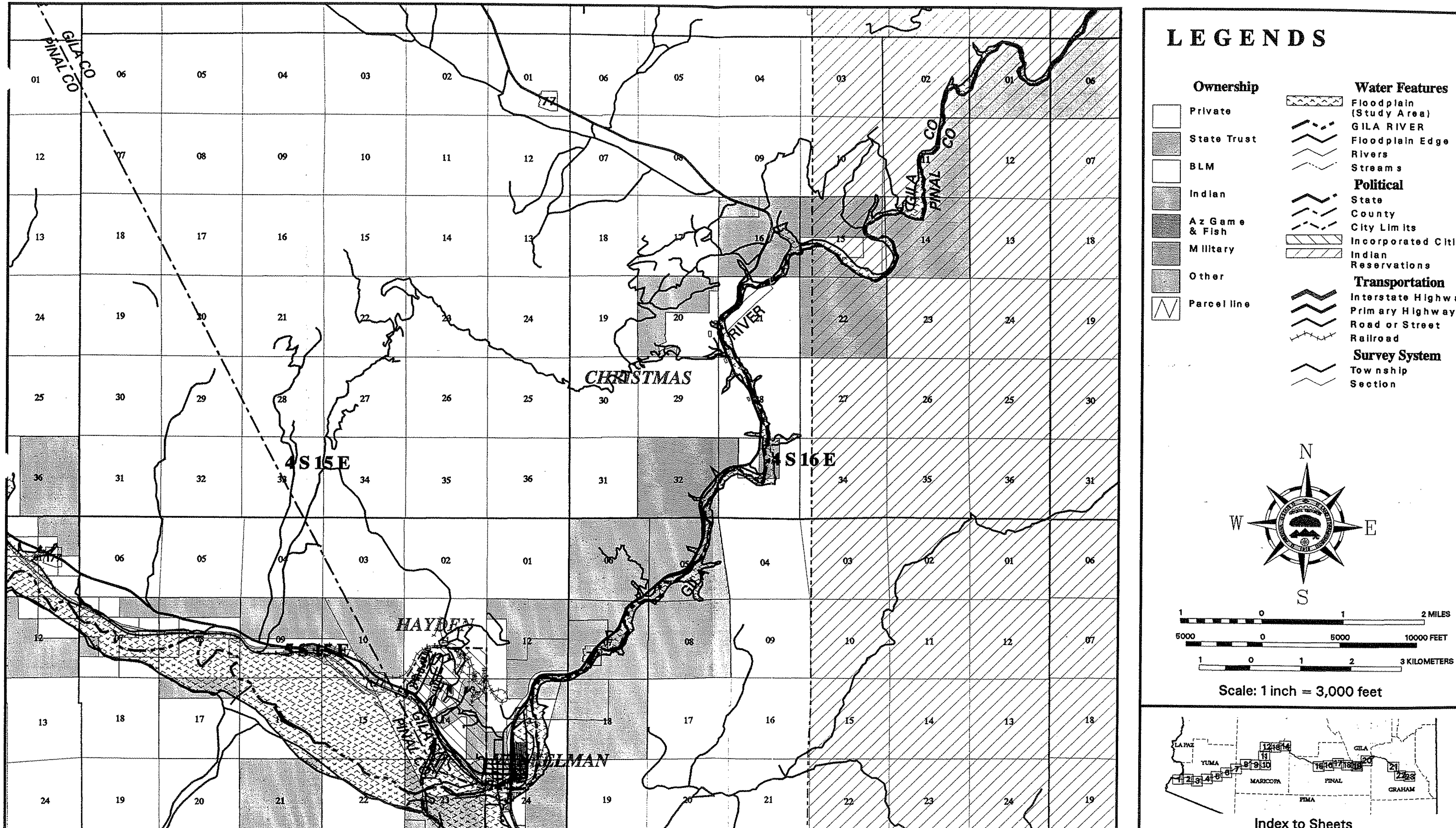

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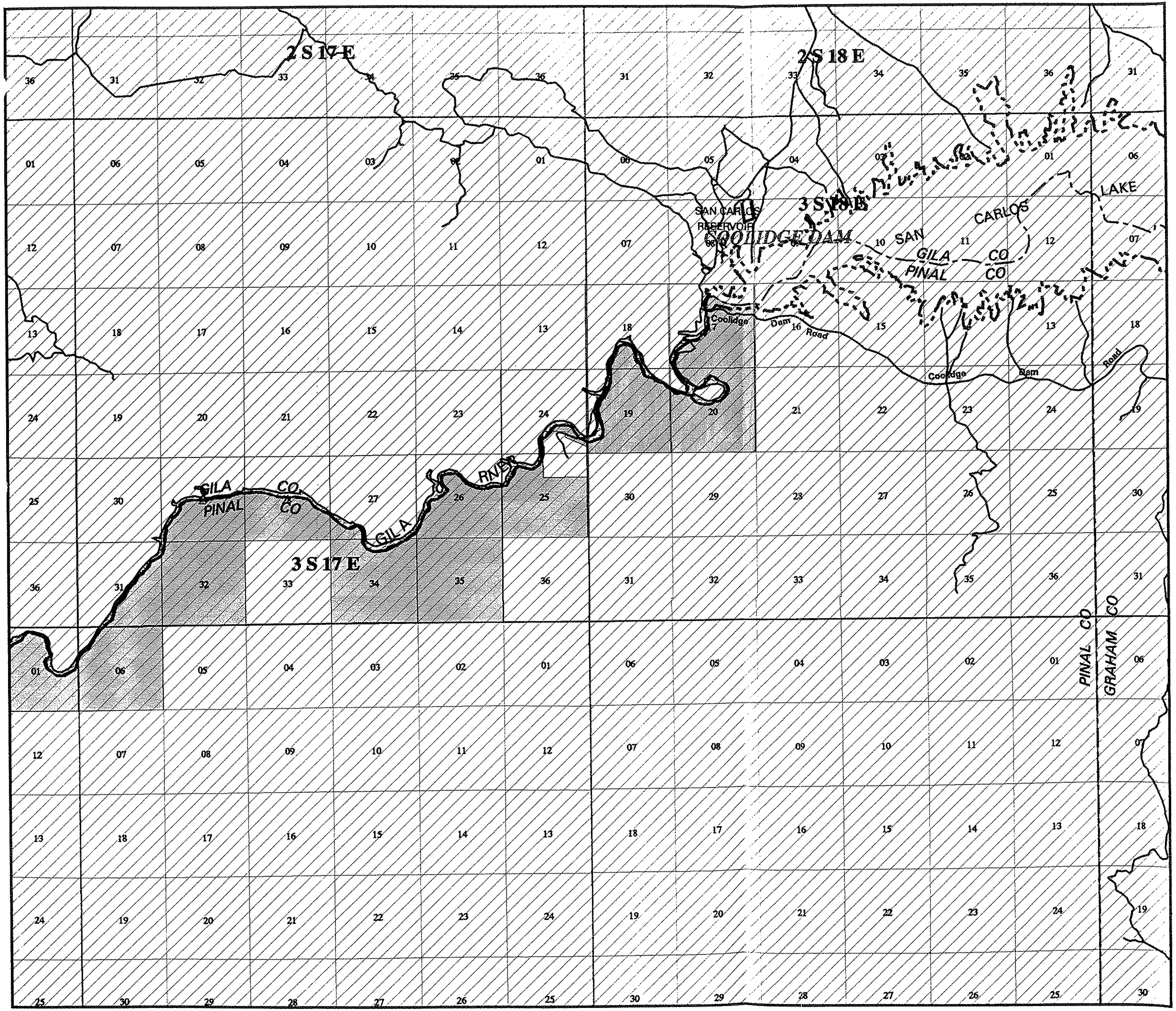


LEGENDS

Ownership

- Private
- State Trust
- BLM
- Indian
- Az Game & Fish
- Military
- Other
- Parcel line

Water Features

- Floodplain (Study Area)
- GILA RIVER
- Floodplain Edge
- Rivers
- Streams

Political

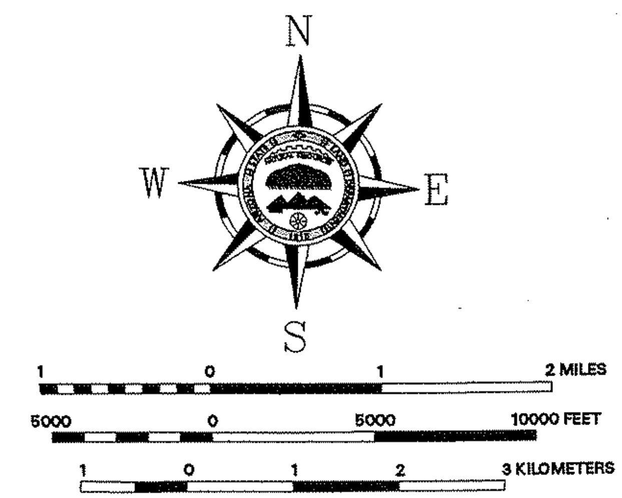
- State
- County
- City Limits
- Incorporated Cities
- Indian Reservations

Transportation

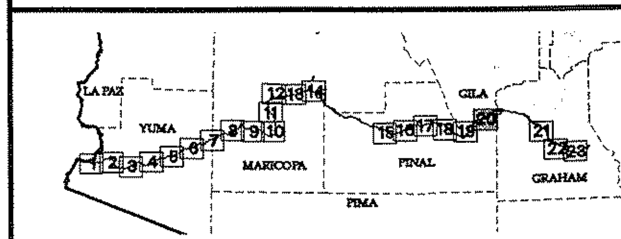
- Interstate Highway
- Primary Highways
- Road or Street
- Railroad

Survey System

- Township
- Section



Scale: 1 inch = 3,000 feet



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LAND OWNERSHIP MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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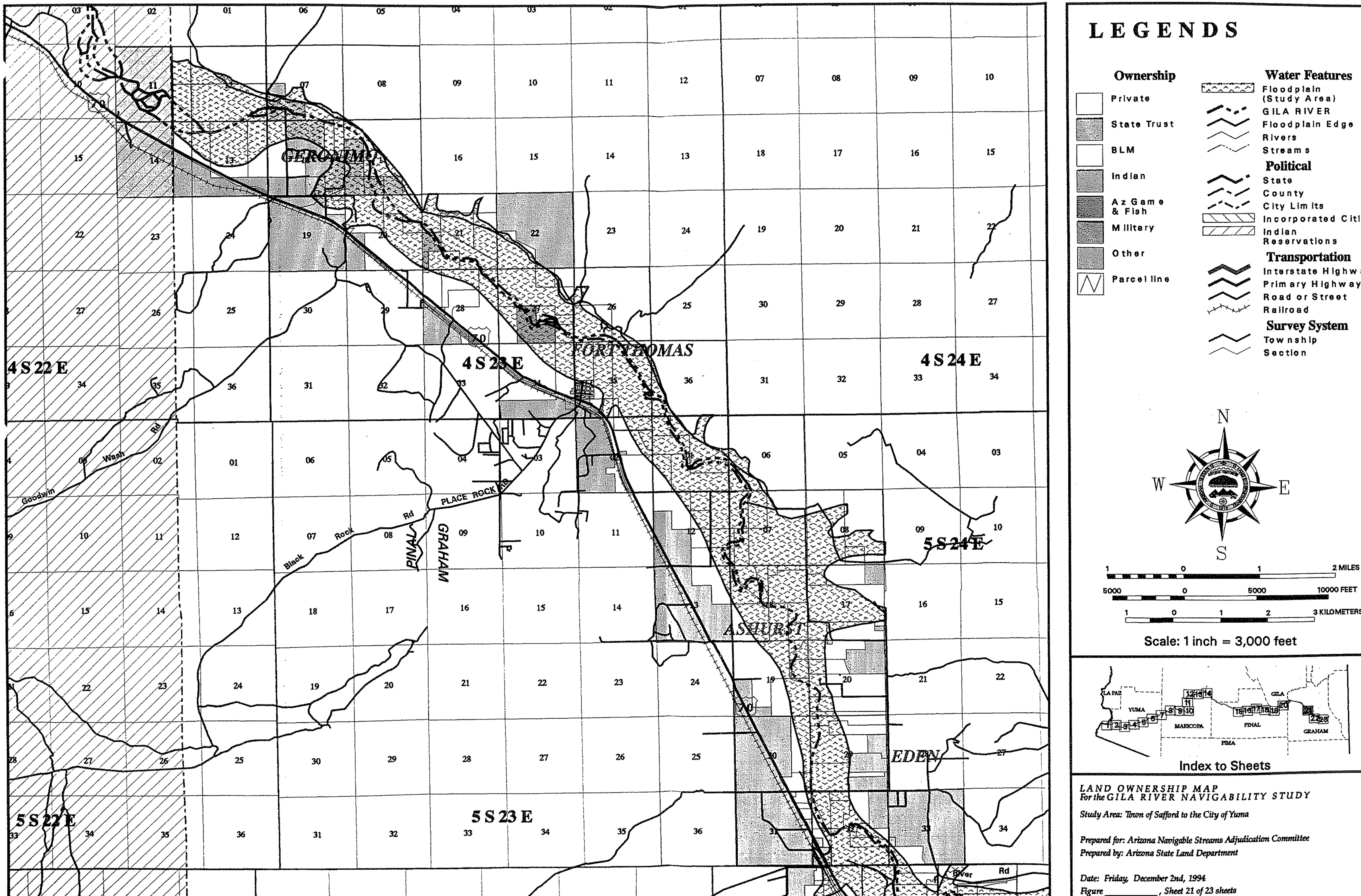

LAND OWNERSHIP MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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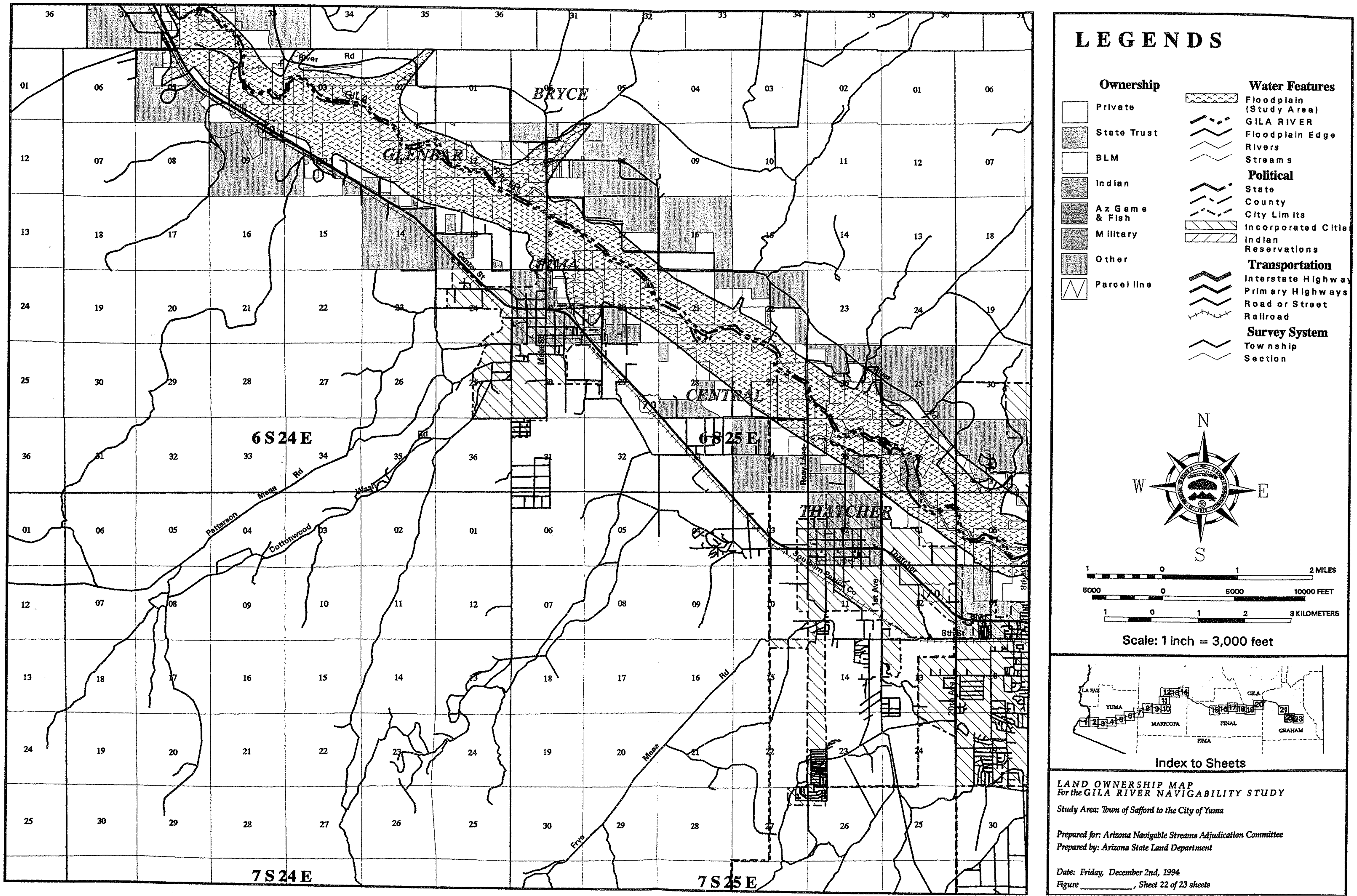
LEGENDS
Ownership
Private
State Trust
BLM
Indian
Az Game & Fish
Military
Other
Parcel line
Water Features
Floodplain (Study Area)
GILA RIVER
Floodplain Edge
Rivers
Streams
Political
State
County
City Limits
Incorporated Cities
Indian Reservations
Transportation
Interstate Highway
Primary Highways
Road or Street
Railroad
Survey System
Township
Section
N
W
E
S
1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS
Scale: 1 inch = 3,000 feet
Index to Sheets
BRYCE
GLENBAR
PIMA
CENTRAL
THATCHER
6 S 24 E
6 S 25 E
7 S 24 E
7 S 25 E
River Rd
Center St
Patterson Mesa Rd
Cottonwood Wash
Frye Mesa Rd
Southern Pacific Co
1st Ave
Thatcher
Reay Lane
8th St
LAND OWNERSHIP MAP
For the GILA RIVER NAVIGABILITY STUDY
Study Area: Town of Safford to the City of Yuma
Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department
Date: Friday, December 2nd, 1994
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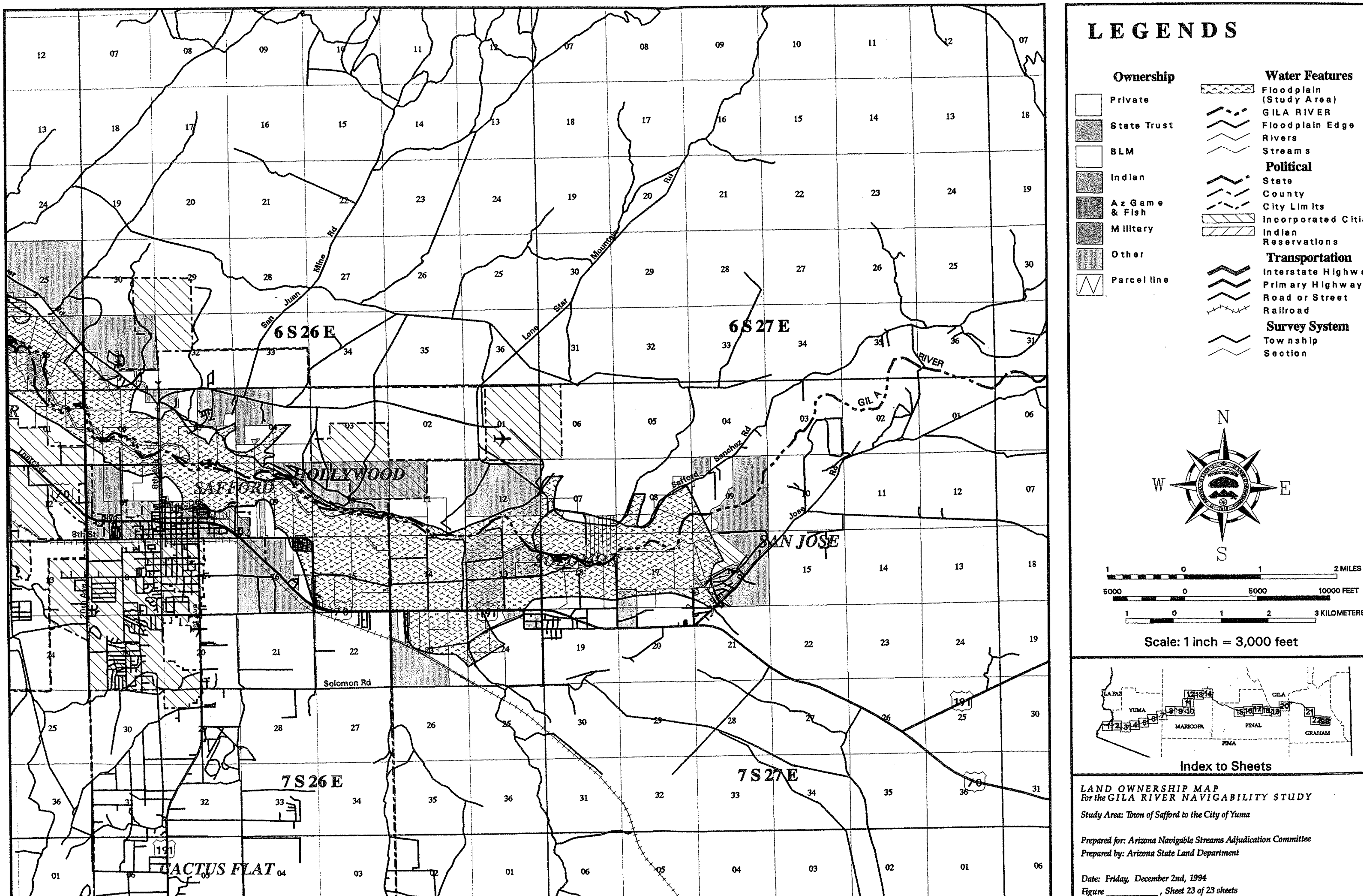

LAND OWNERSHIP MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

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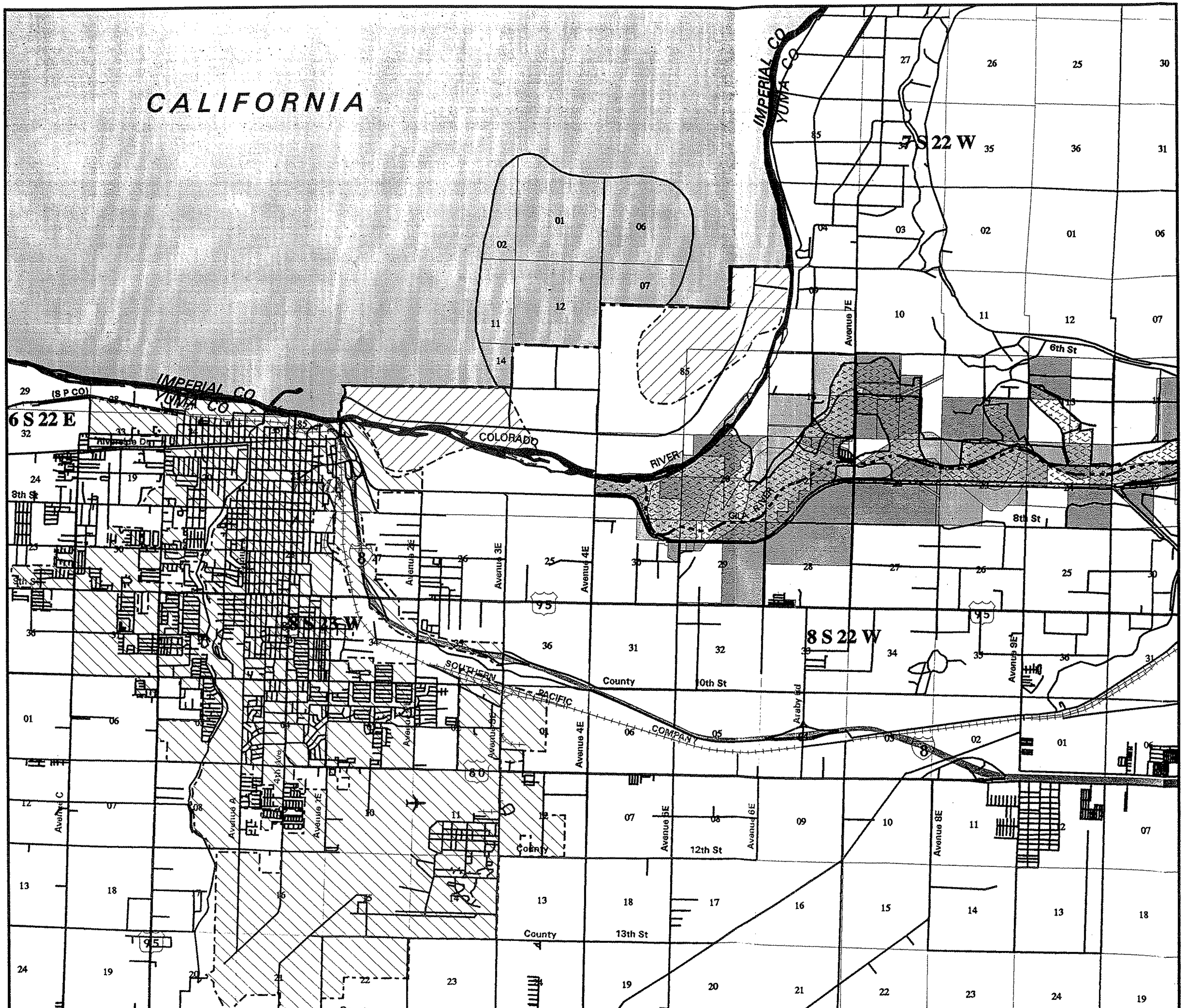
Appendix J

Land Use Maps



LEGENDS

Land Use

- Vacant Land
- Residential - Single Family
- Residential - Multiple Family
- Hotel - Motel - Resorts
- Condominiums
- Commerical Property
- Industrial Property
- Farm /Ranch Property
- Public Utilities
- Natural Resources
- Special Use Property
- General Service Use
- Parcel line

Water Features

- Floodplain (Study Area)
- GILA RIVER
- Floodplain Edge
- Rivers
- Streams

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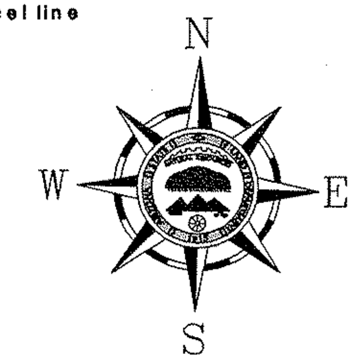
- County
- City Limits
- Incorporated Cities
- Indian Reservations

Transportation

- Interstate Highway
- Primary Highways
- Road or Street
- Railroad

Survey System

- Township
- Section

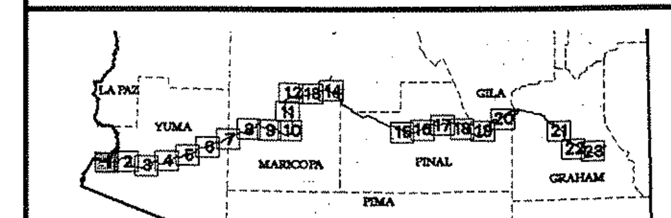


1 0 1 2 MILES

5000 0 5000 10000 FEET

1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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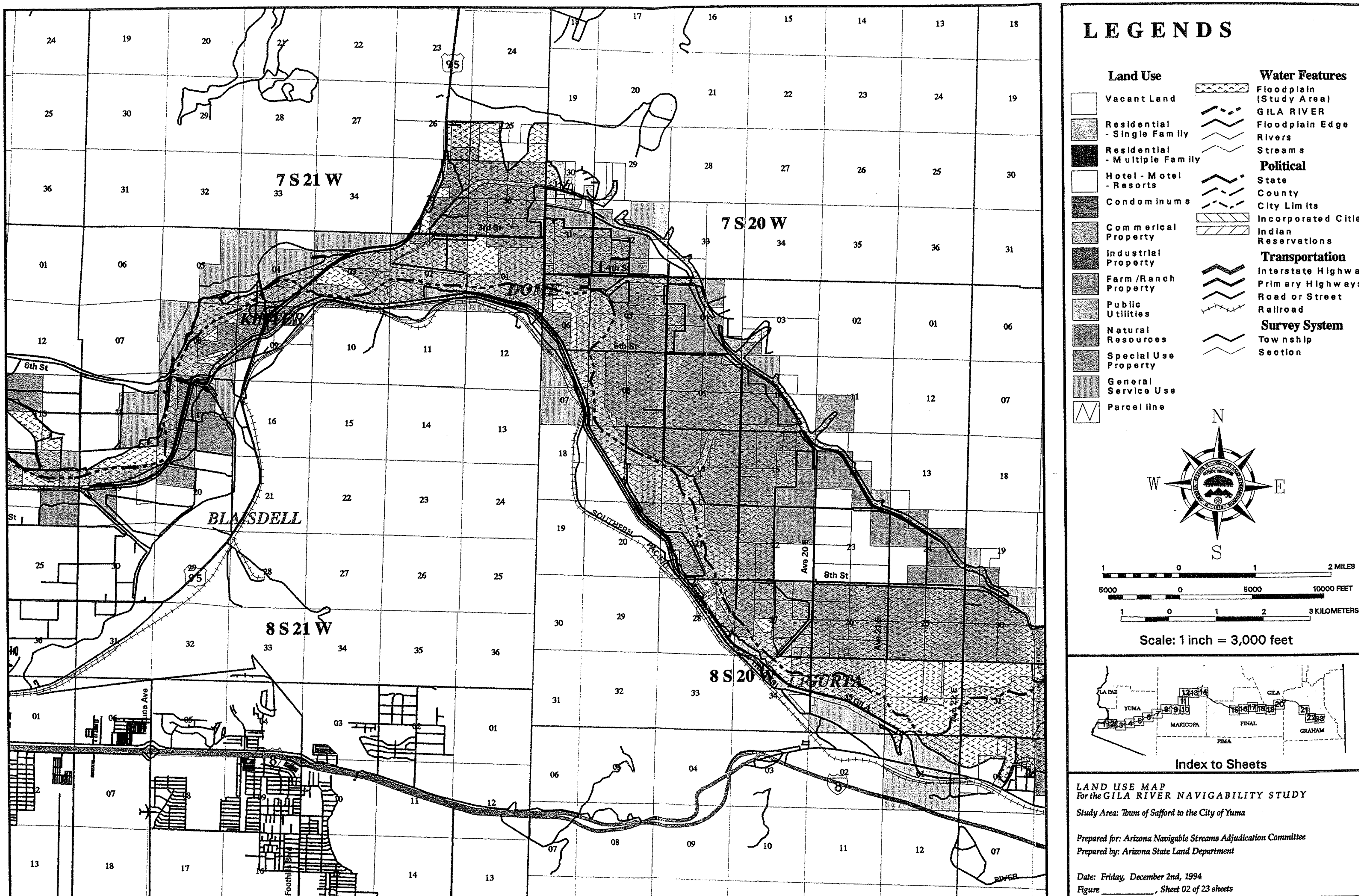

7 S 21 W
7 S 20 W
8 S 21 W
8 S 20 W
KINTER
DOME
BLAISDELL
LIGURTA
3rd St
4th St
6th St
8th St
Ave 20 E
Ave 21 E
Ave 22 E
Fortuna Ave
Foothill Blvd
SOUTHERN PACIFIC
GILA RIVER
95
8
LEGENDS
Land Use
Vacant Land
Residential - Single Family
Residential - Multiple Family
Hotel - Motel - Resorts
Condominiums
Commerical Property
Industrial Property
Farm /Ranch Property
Public Utilities
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Primary Highways
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Railroad
Survey System
Township
Section
N
S
W
E
2 MILES
10000 FEET
3 KILOMETERS
Scale: 1 inch = 3,000 feet
LA PAZ
YUMA
MARICOPA
PINAL
PIMA
GILA
GRAHAM
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For the GILA RIVER NAVIGABILITY STUDY
Study Area: Town of Safford to the City of Yuma
Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department
Date: Friday, December 2nd, 1994
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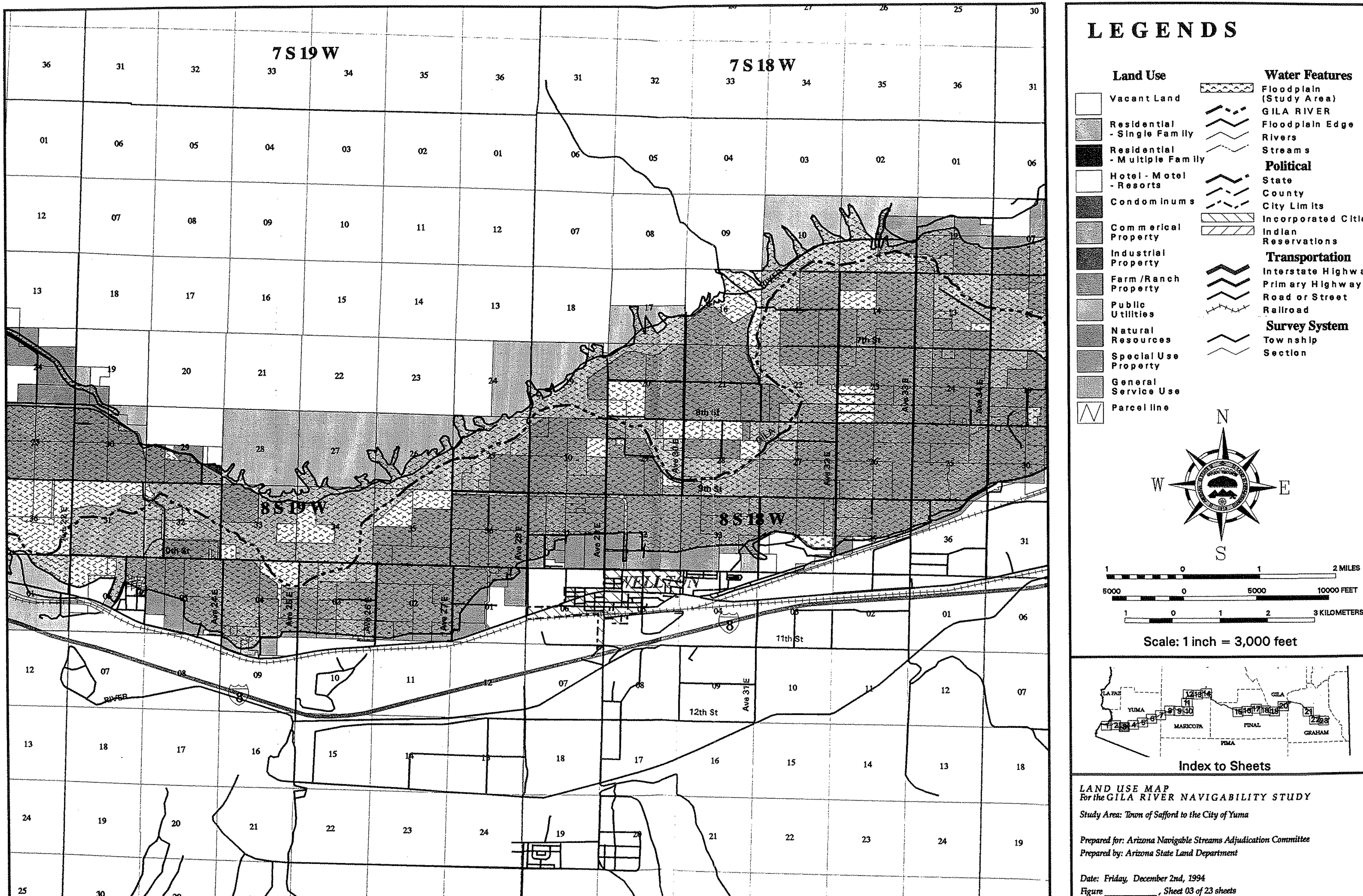

LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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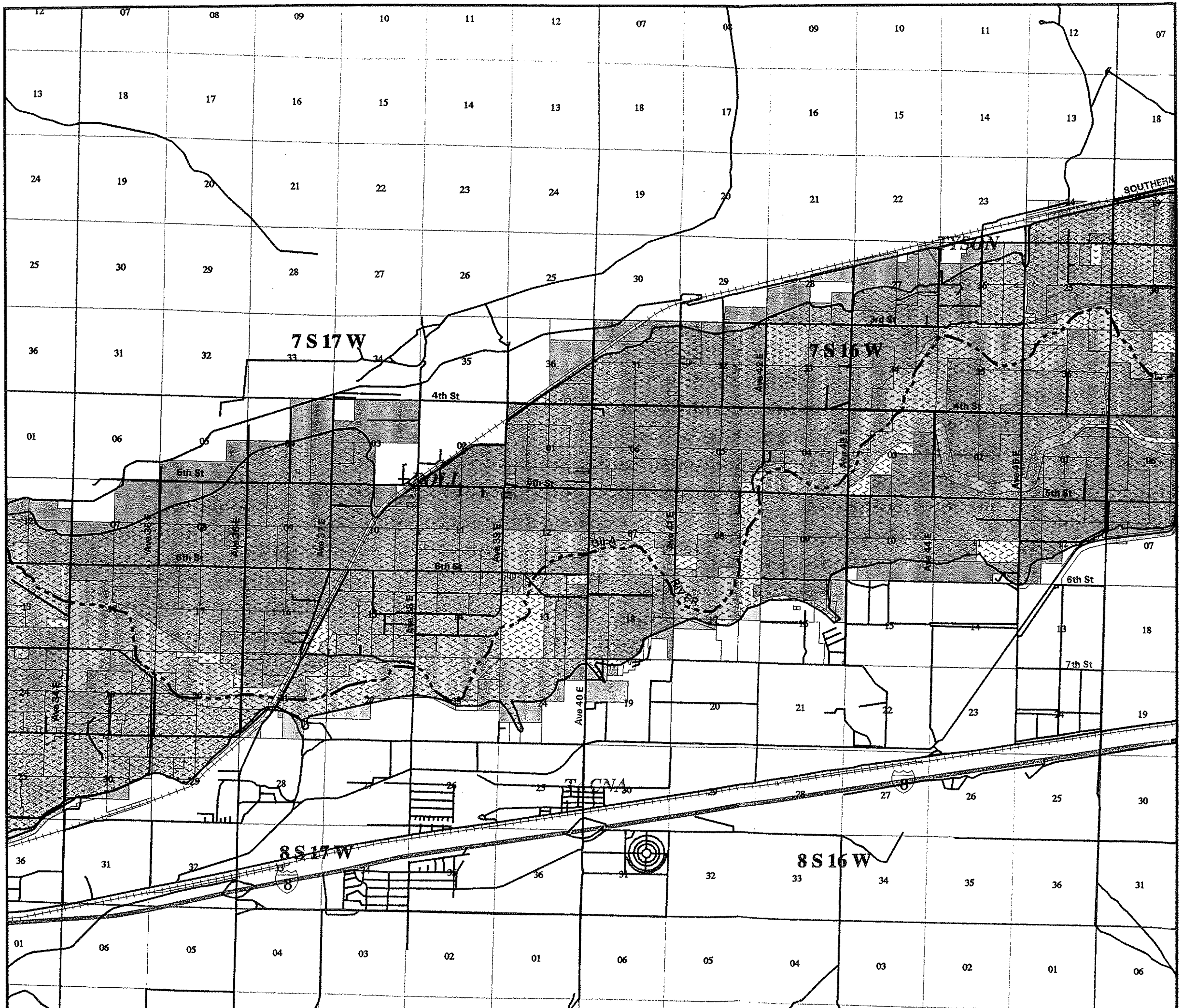

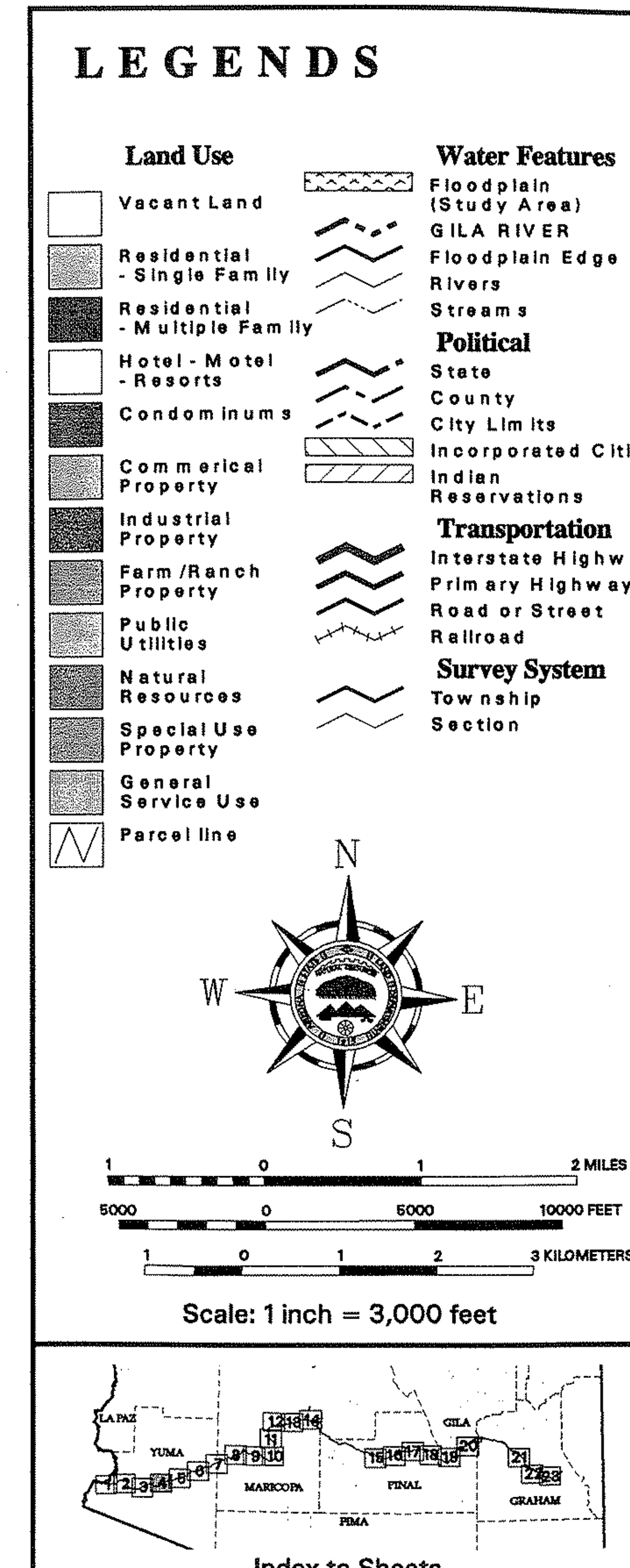

LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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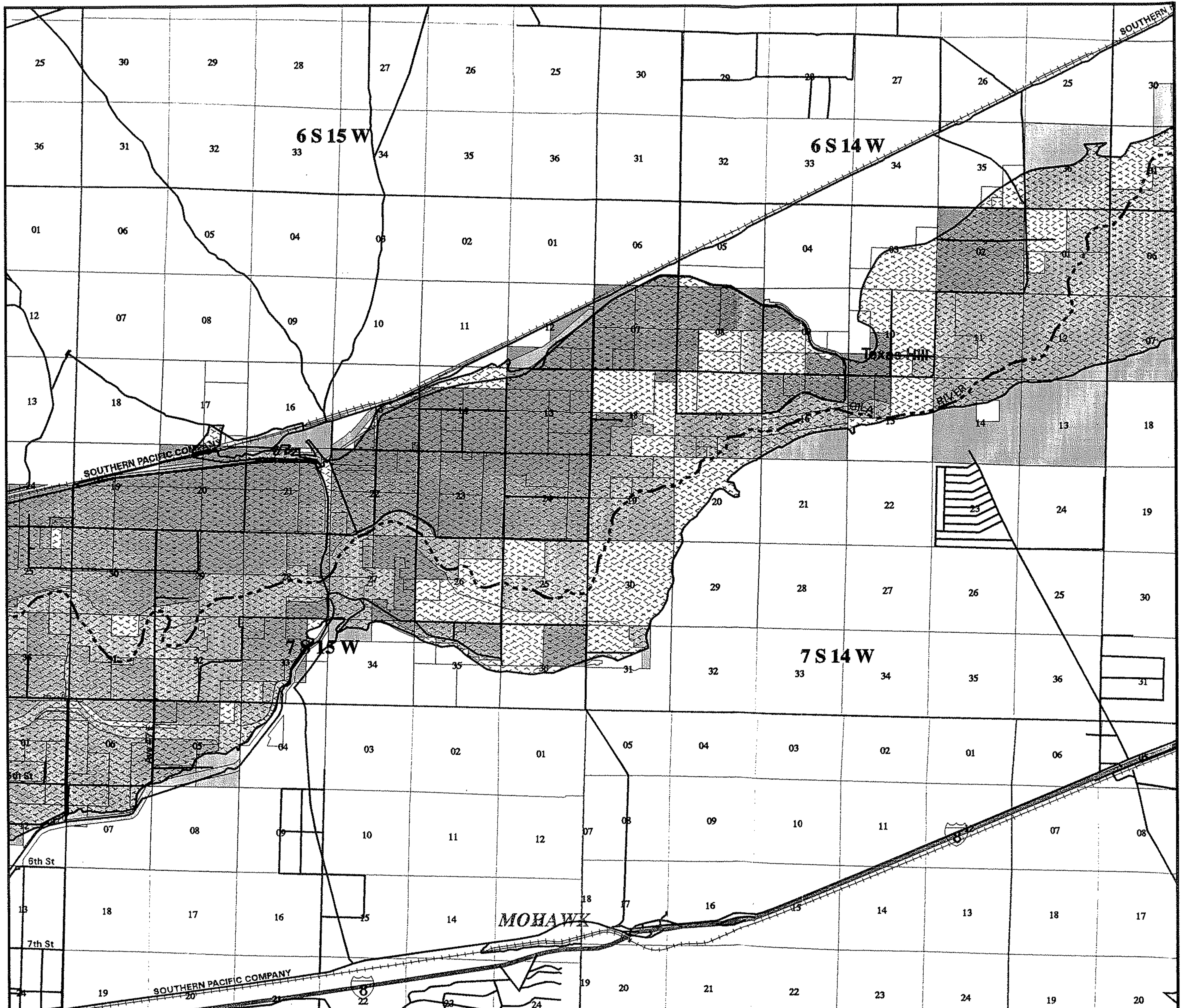

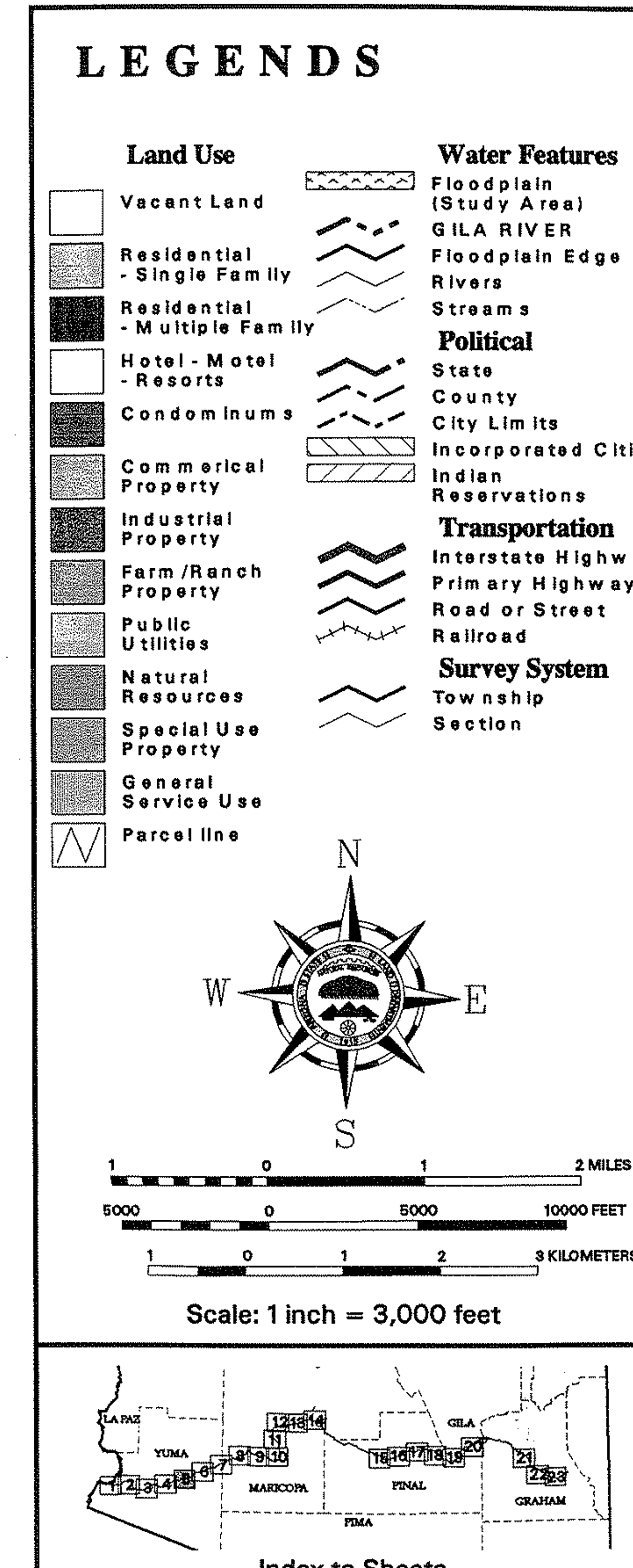

LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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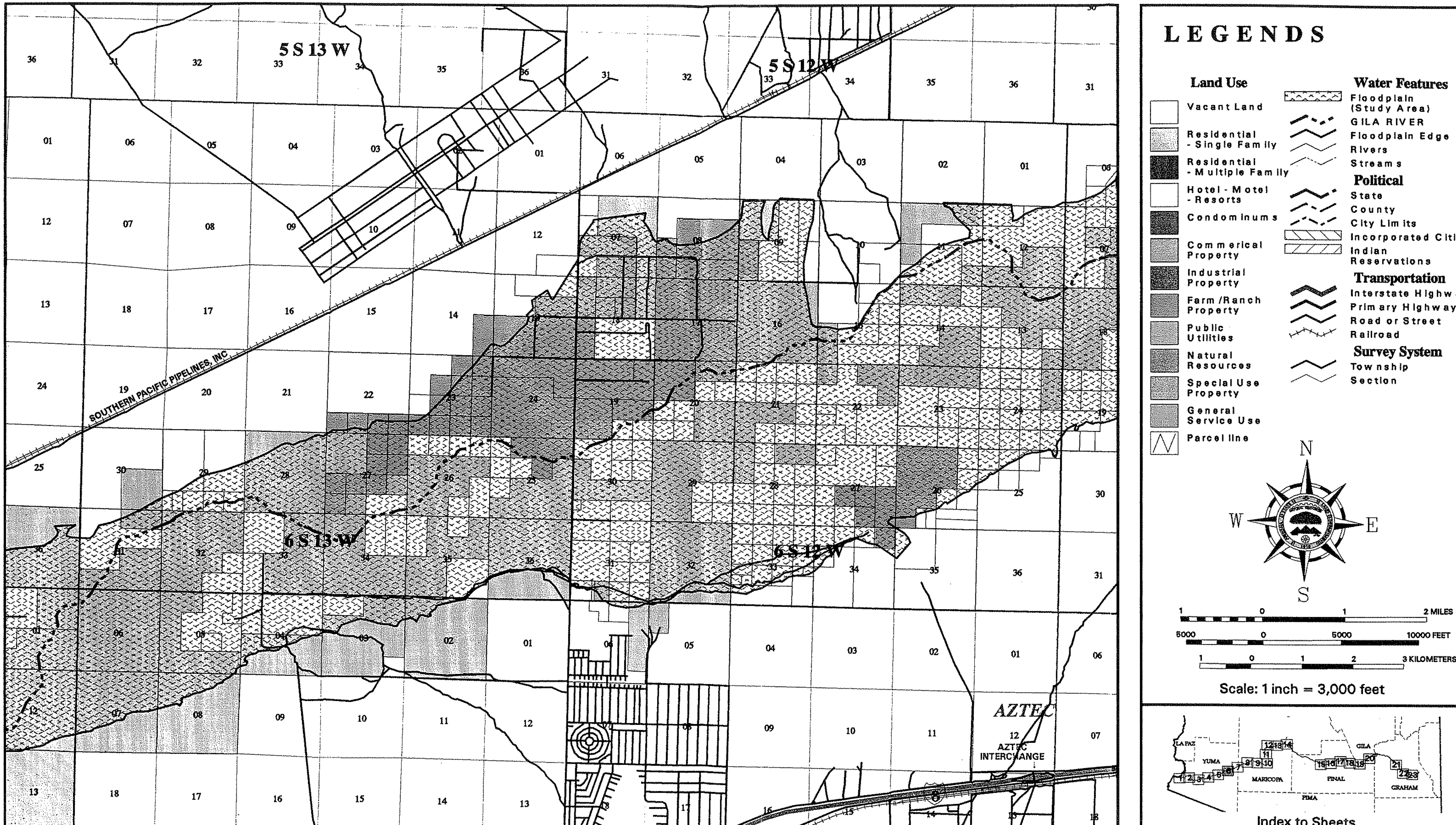

LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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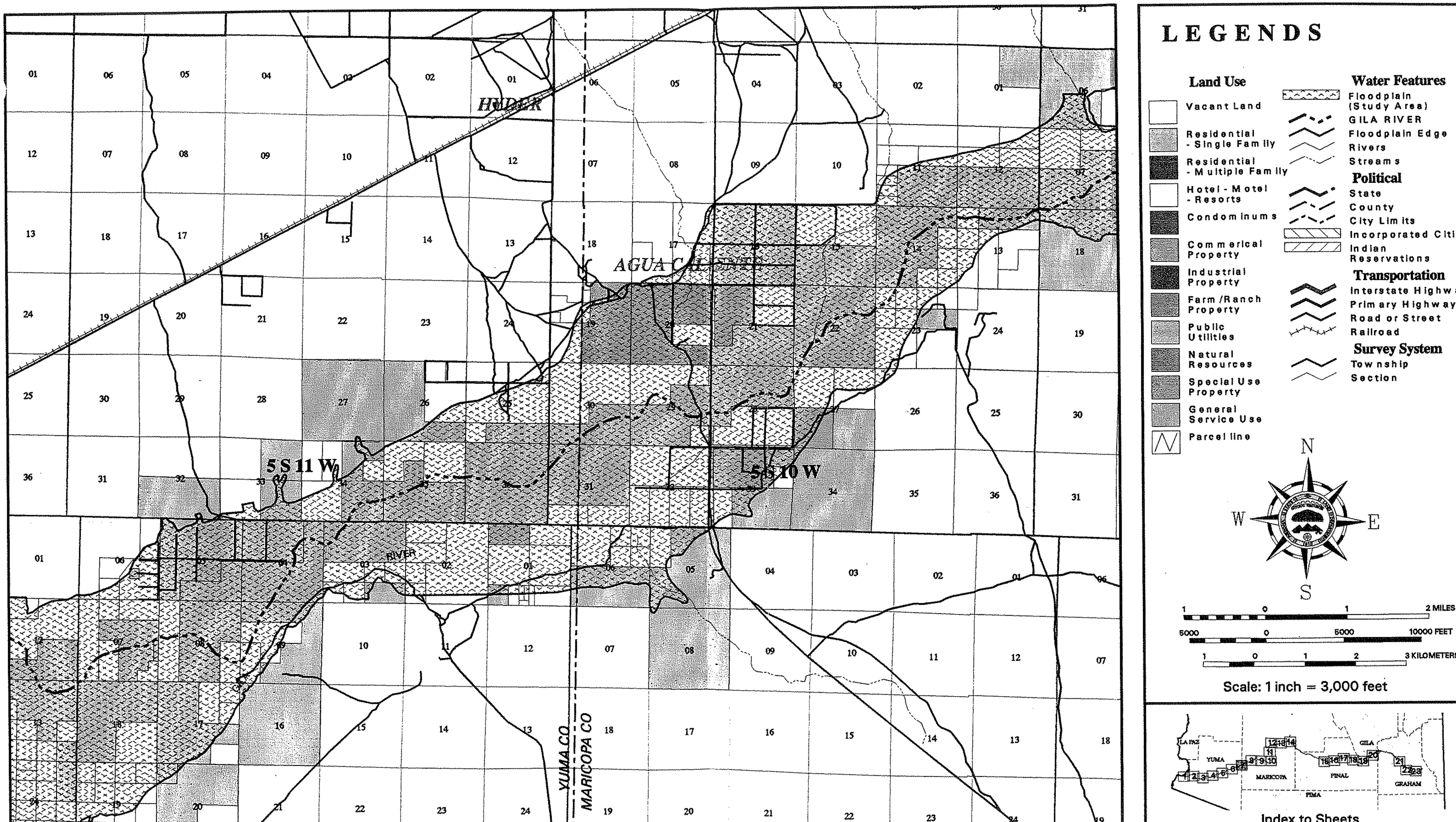

LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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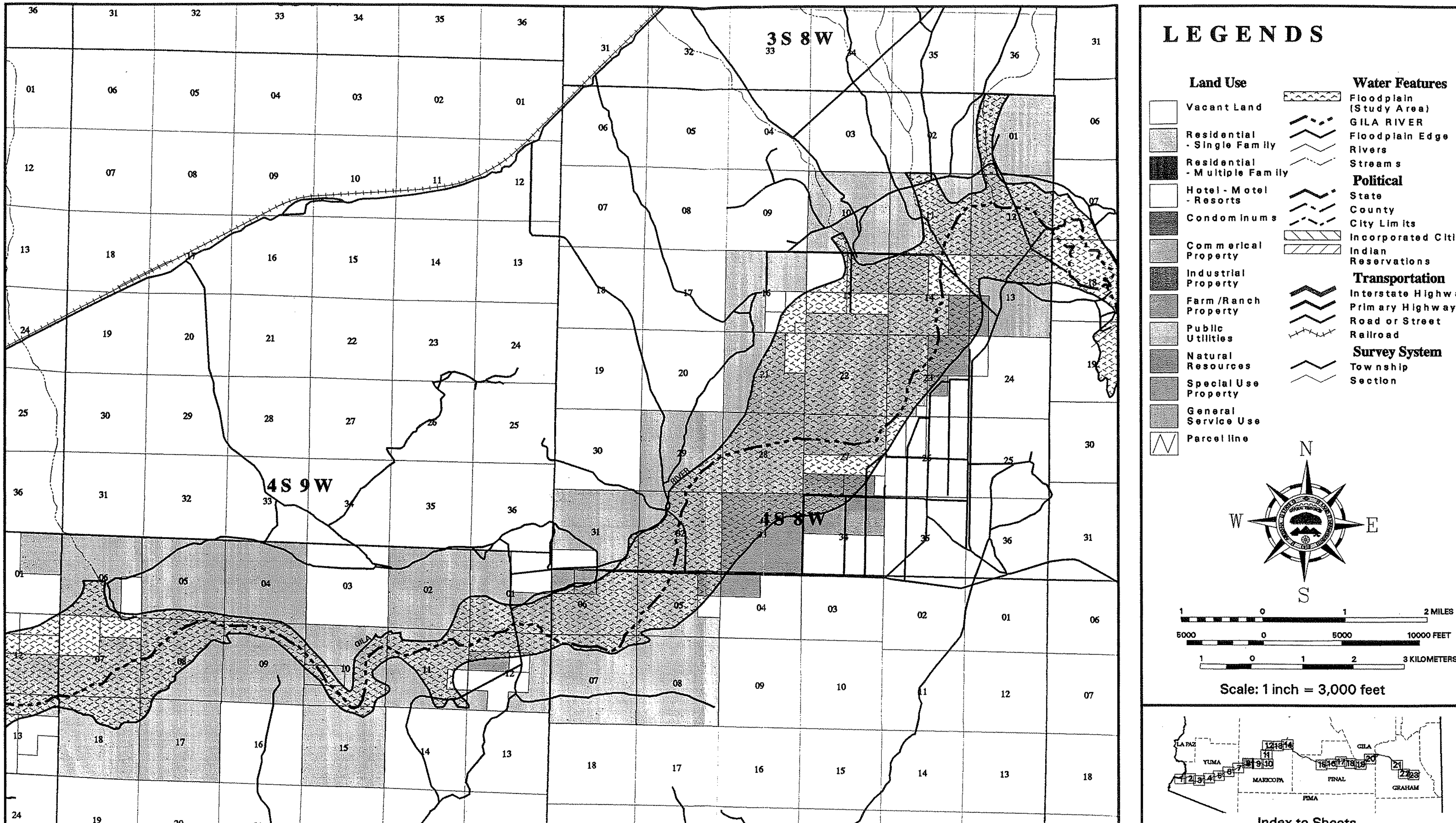

LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY
Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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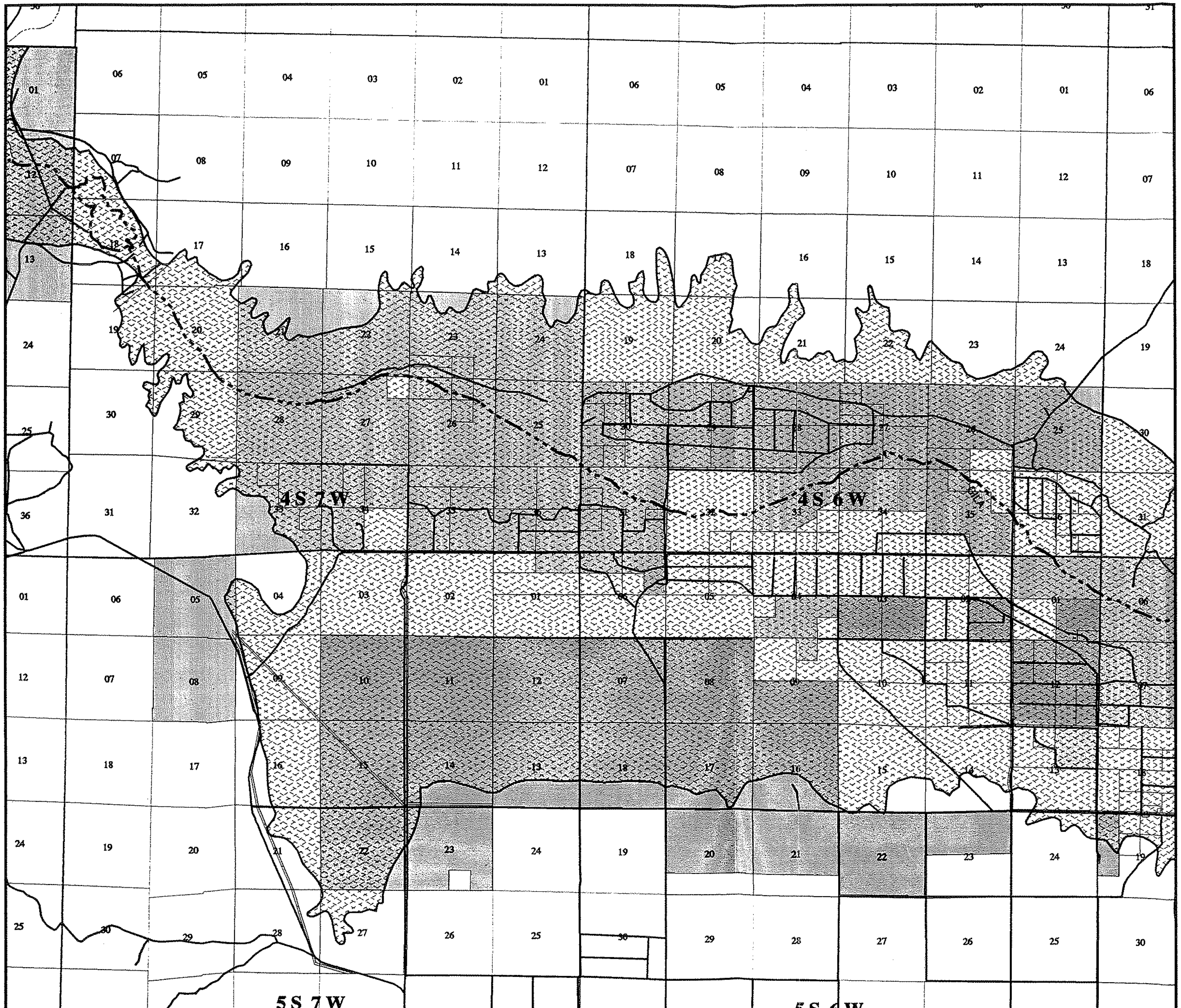

LEGENDS

Land Use

- Vacant Land
- Residential - Single Family
- Residential - Multiple Family
- Hotel - Motel - Resorts
- Condominiums
- Commerical Property
- Industrial Property
- Farm /Ranch Property
- Public Utilities
- Natural Resources
- Special Use Property
- General Service Use
- Parcel line

Water Features

- Floodplain (Study Area)
- GILA RIVER
- Floodplain Edge
- Rivers
- Streams

Political

- State
- County
- City Limits
- Incorporated Citie
- Indian Reservations

Transportation

- Interstate Highwa
- Primary Highways
- Road or Street
- Railroad

Survey System

- Township
- Section

N
W
E
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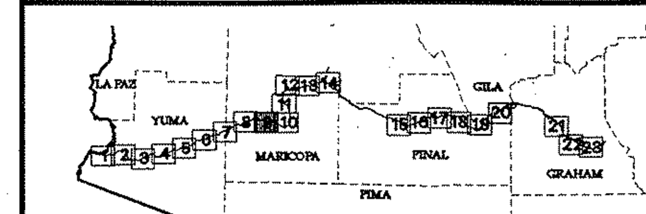
1 0 1 2 MILES

5000 0 5000 10000 FEET

1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

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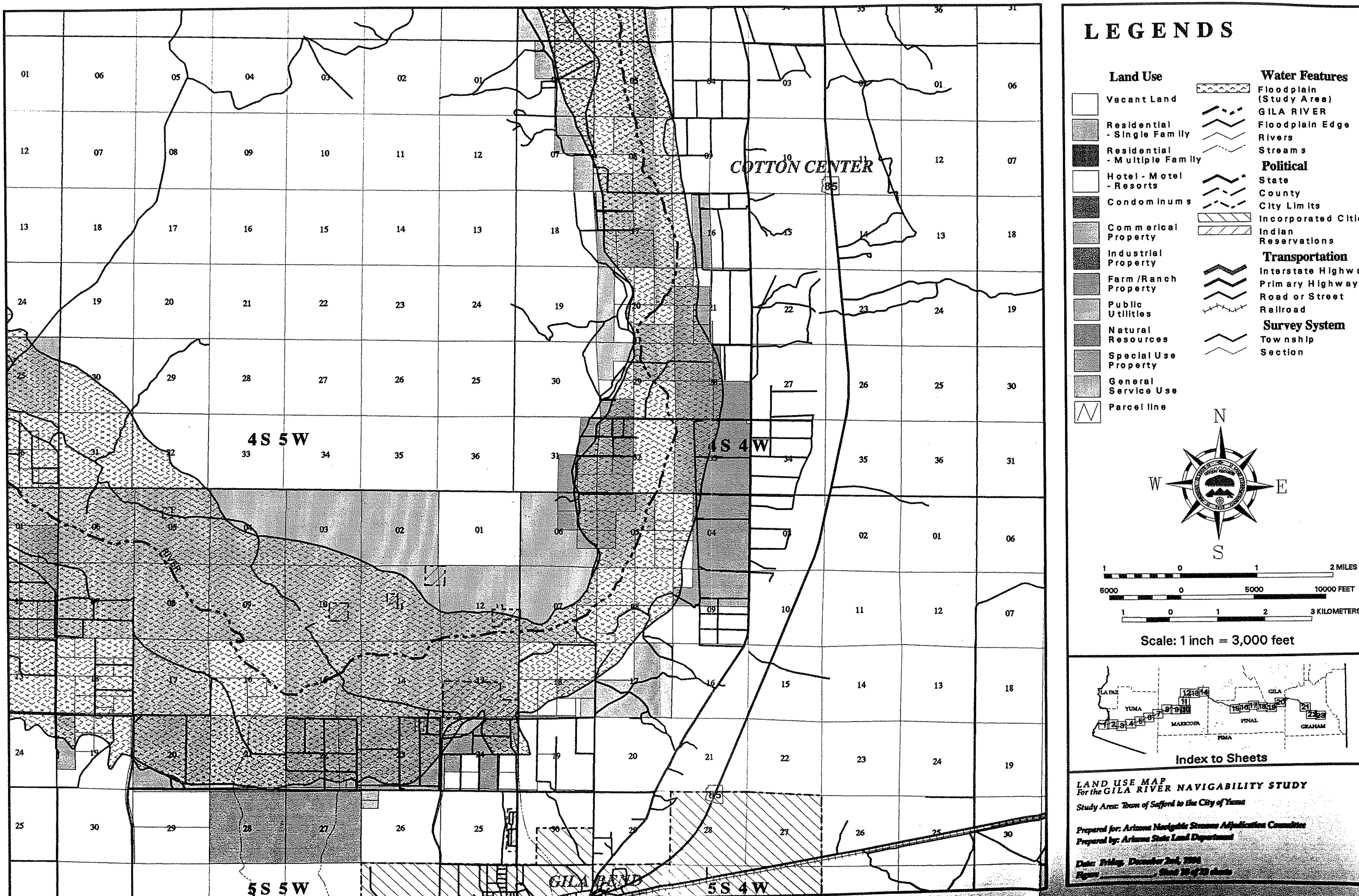

LEGENDS
Land Use
Vacant Land
Residential - Single Family
Residential - Multiple Family
Hotel - Motel - Resorts
Condominiums
Commerical Property
Industrial Property
Farm/Ranch Property
Public Utilities
Natural Resources
Special Use Property
General Service Use
Parcel line
Water Features
Floodplain (Study Area)
GILA RIVER
Floodplain Edge
Rivers
Streams
Political
State
County
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Incorporated Cities
Indian Reservations
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Interstate Highway
Primary Highways
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Railroad
Survey System
Township
Section
N
S
W
E
2 MILES
10000 FEET
3 KILOMETERS
Scale: 1 inch = 3,000 feet
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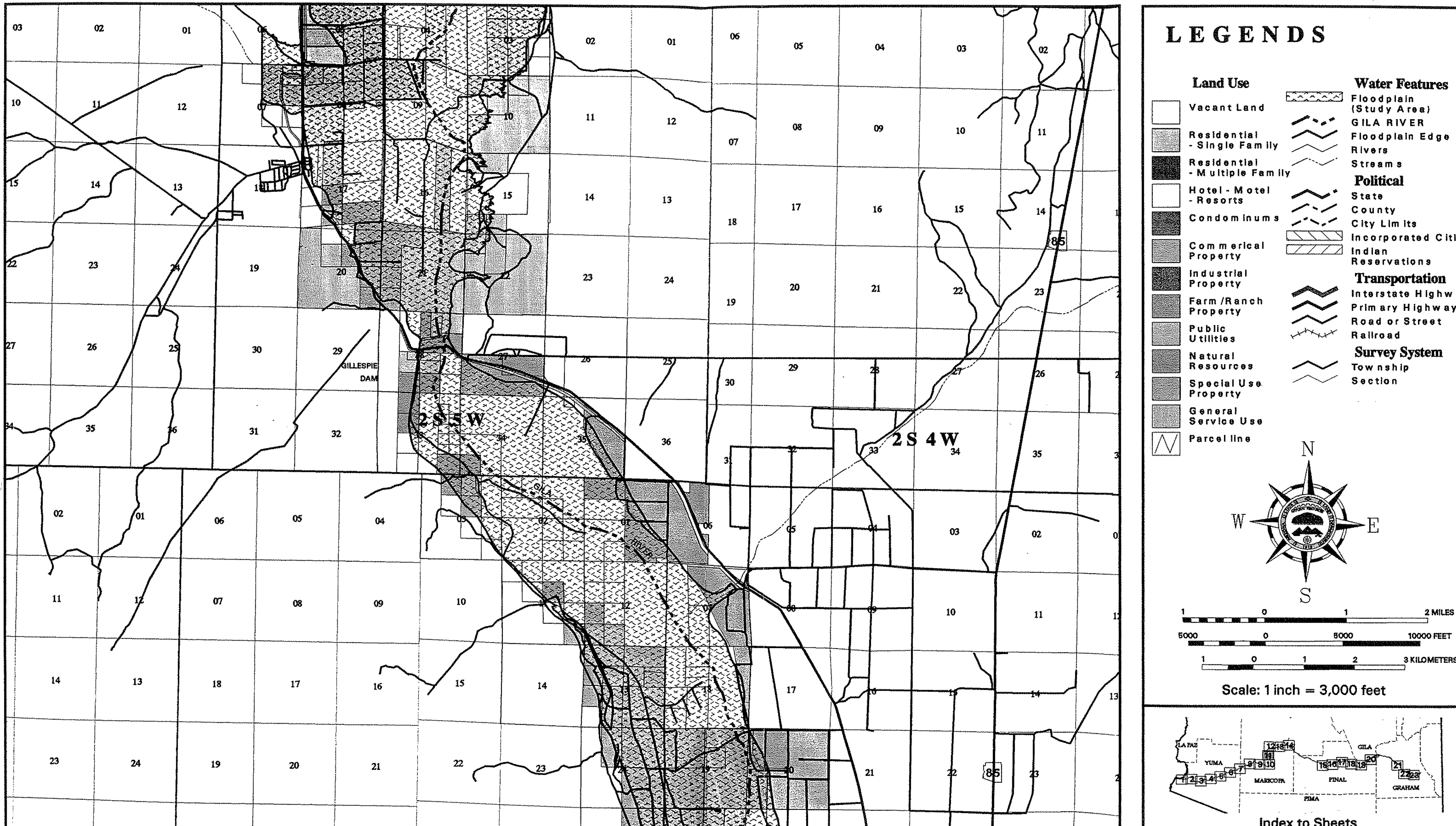
LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY
Study Area: Town of Safford to the City of Yuma
Prepared for: Arizona Navigable Streams Adjudication Commission
Prepared by: Arizona State Land Department
COTTON CENTER
4S 5W
4S 4W
5S 5W
5S 4W
GILA BEND



LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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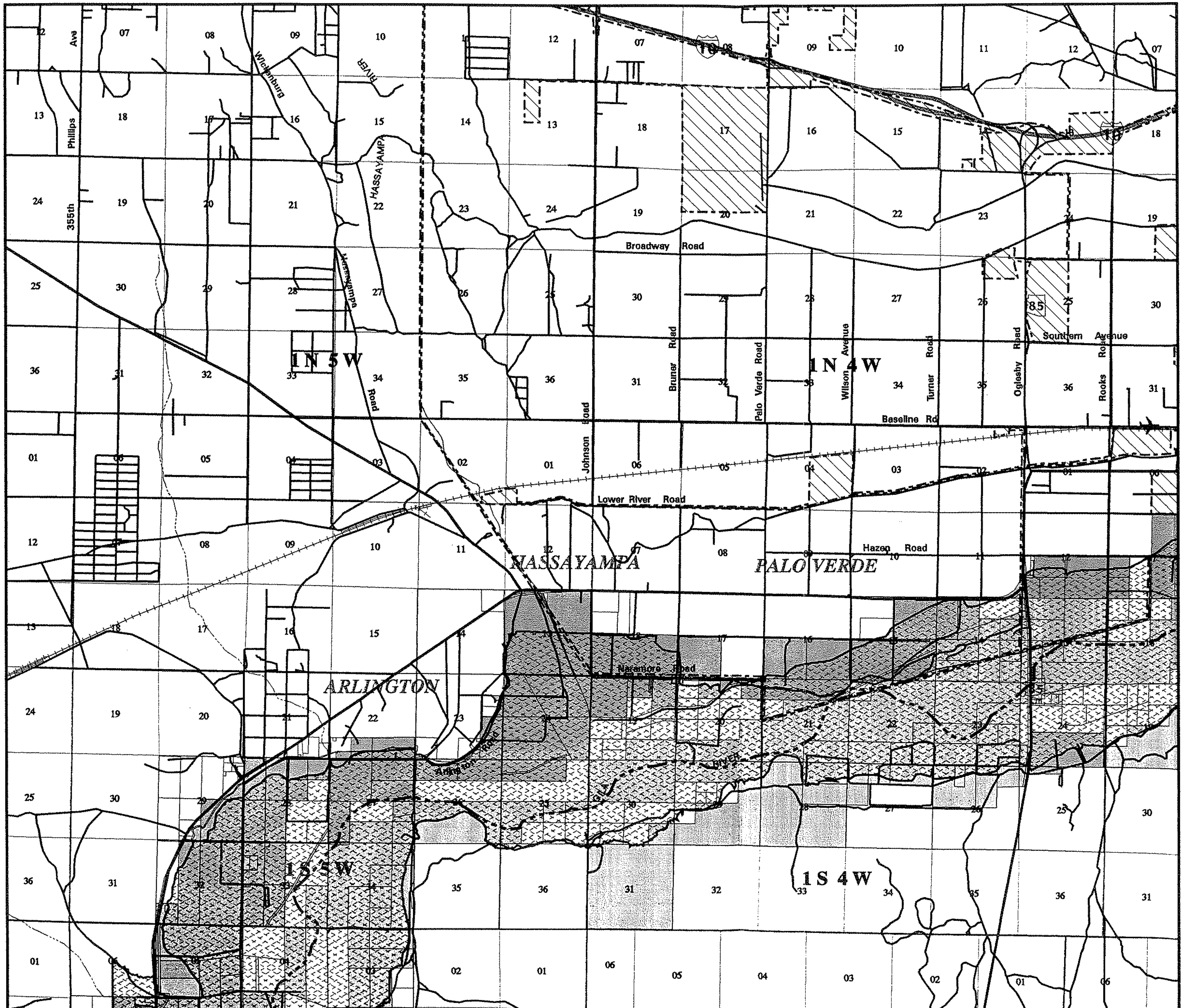

LEGENDS

Land Use

- Vacant Land
- Residential - Single Family
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- City Limits
- Incorporated Cities
- Indian Reservations

Transportation

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- Primary Highways
- Road or Street
- Railroad

Survey System

- Township
- Section

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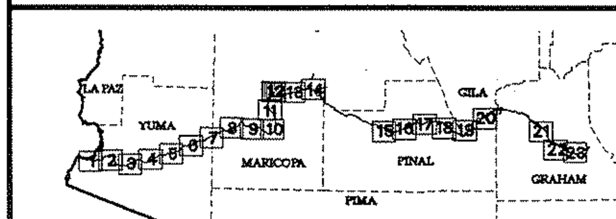
E
S

1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND USE MAP
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Study Area: Town of Safford to the City of Yuma

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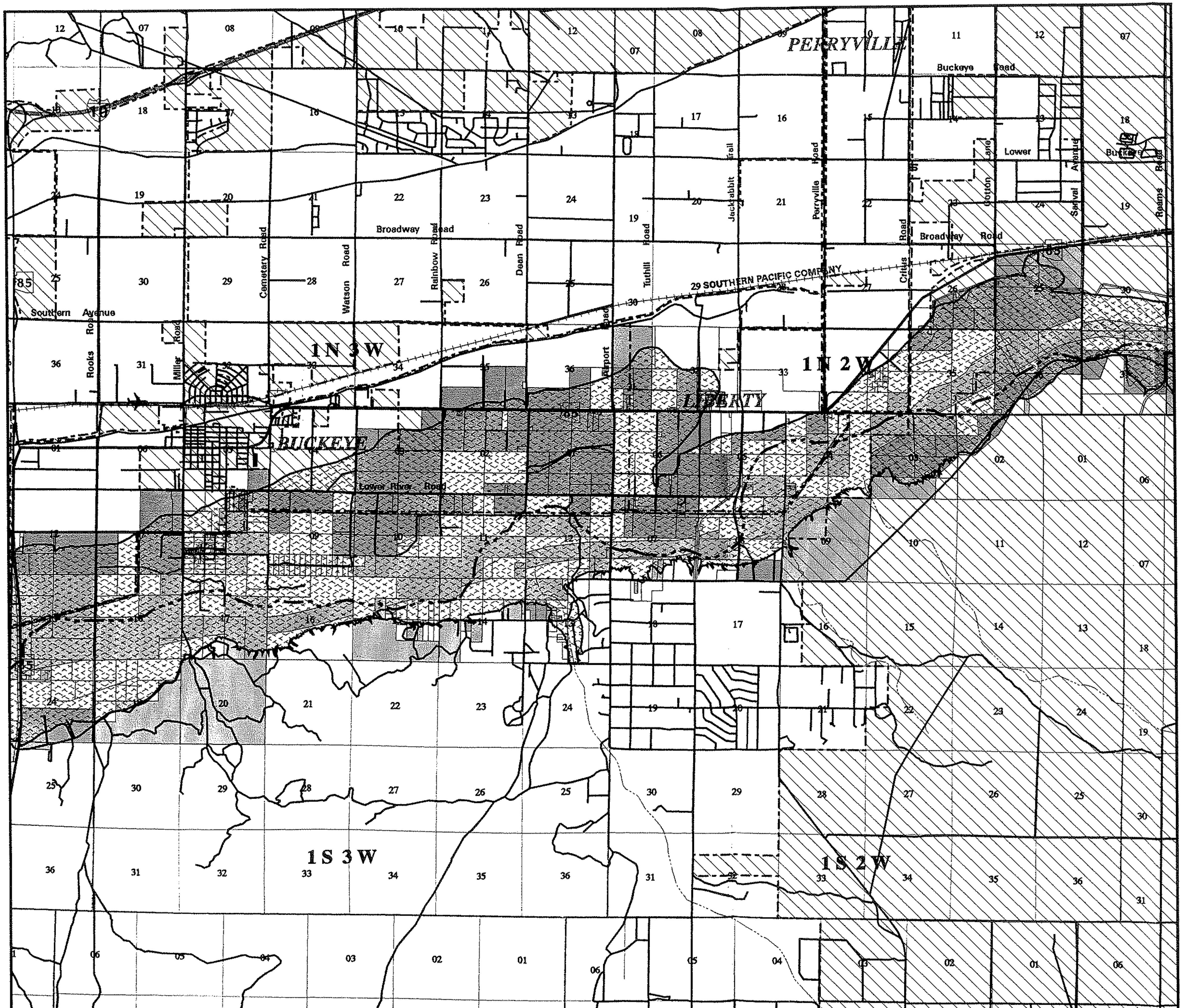

LEGENDS

Land Use

- Vacant Land
- Residential - Single Family
- Residential - Multiple Family
- Hotel - Motel - Resorts
- Condominiums
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- Industrial Property
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- Streams

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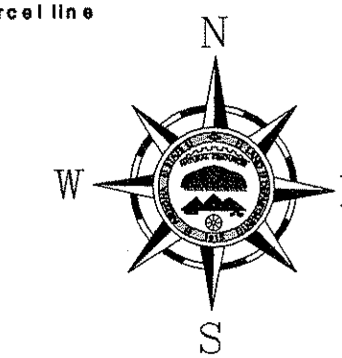
- County
- City Limits
- Incorporated Cities
- Indian Reservations

Transportation

- Interstate Highway
- Primary Highways
- Road or Street
- Railroad

Survey System

- Township
- Section

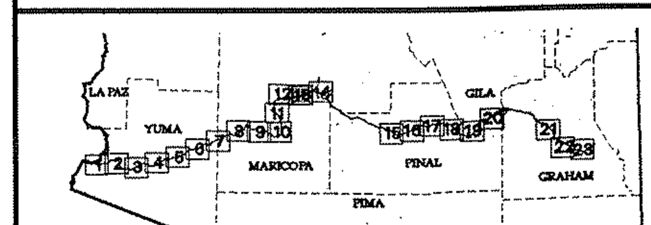


1 0 1 2 MILES

5000 0 5000 10000 FEET

1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
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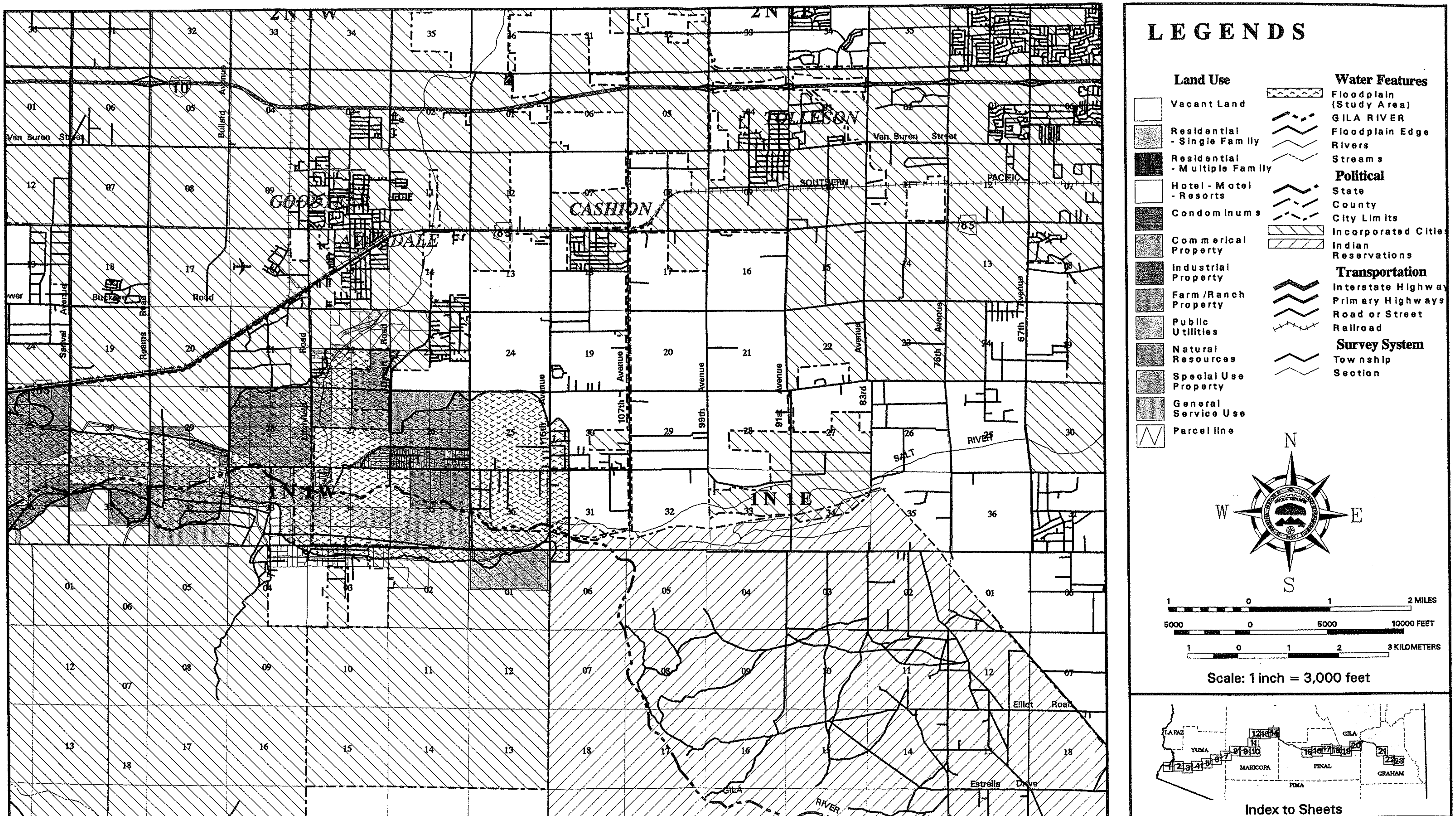
Figure ___________, Sheet 13 of 23 sheets



LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

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Prepared by: Arizona State Land Department

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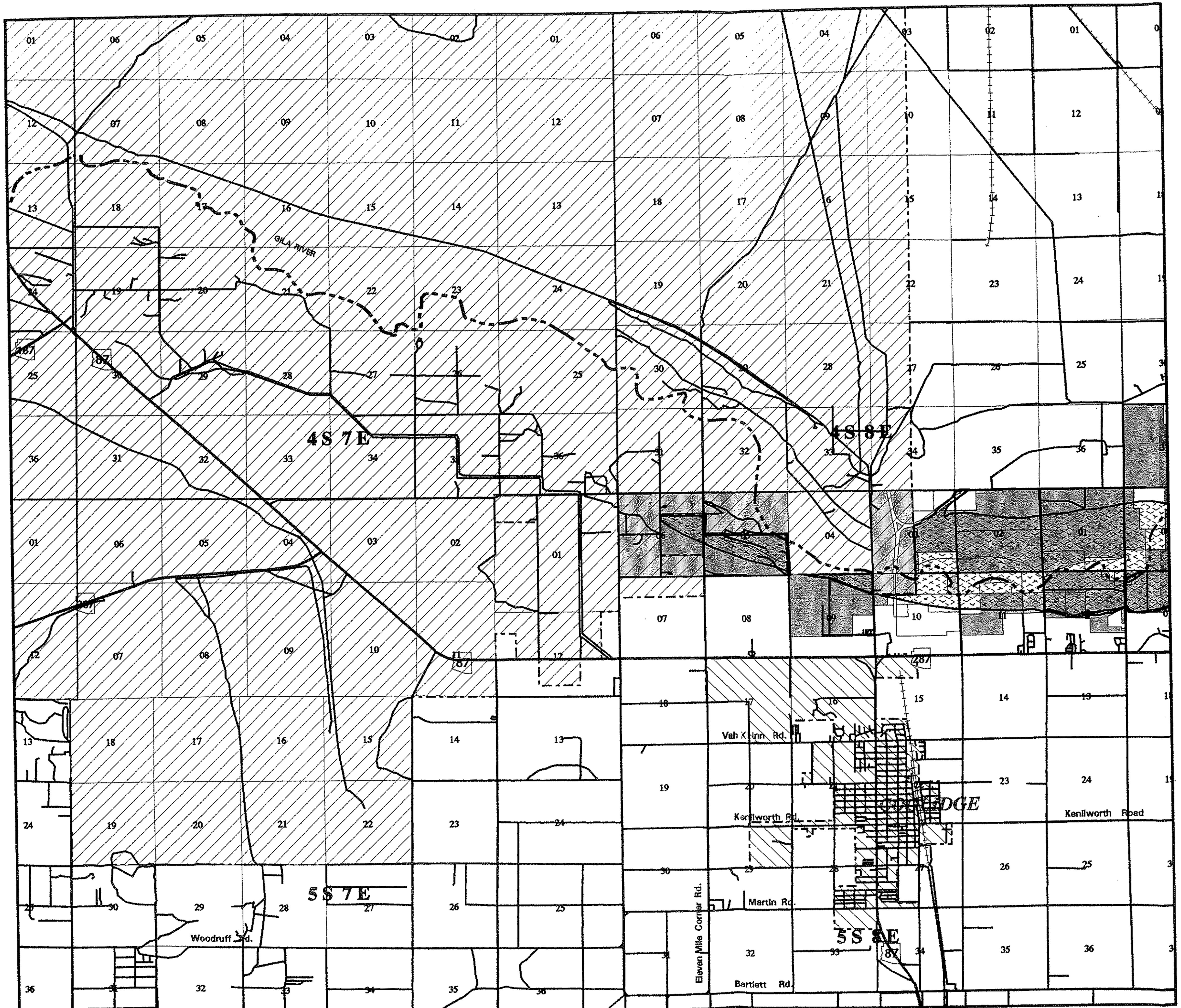

LEGENDS

Land Use

- Vacant Land
- Residential - Single Family
- Residential - Multiple Family
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- Condominiums
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- Industrial Property
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- Primary Highways
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- Railroad

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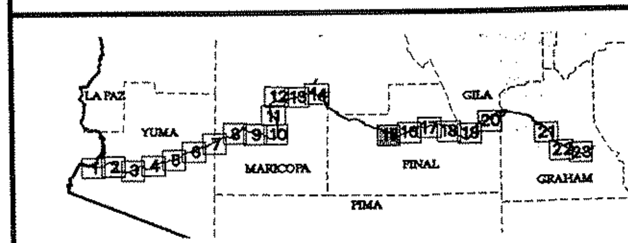
- Township
- Section

N
W E
S

1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
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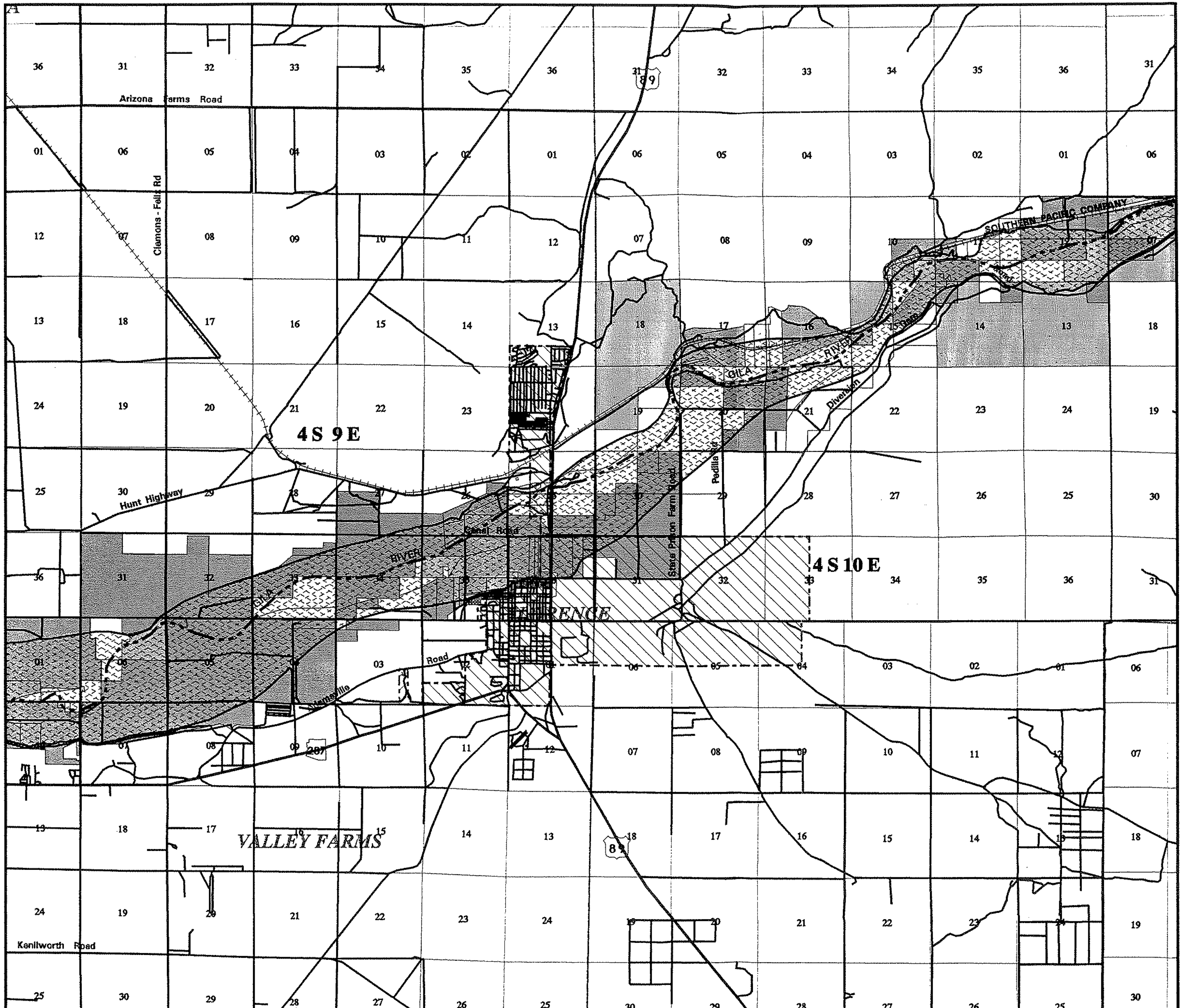

LEGENDS

Land Use

- Vacant Land
- Residential - Single Family
- Residential - Multiple Family
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- Condominiums
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- Industrial Property
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- Streams

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- Railroad

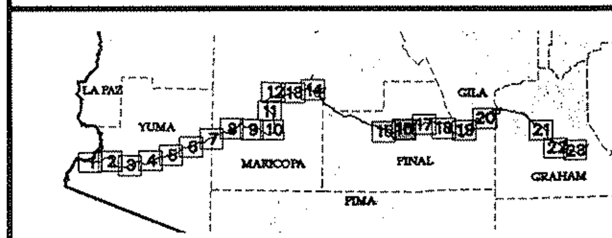
Survey System

- Township
- Section

N
W E
S

1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet



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LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
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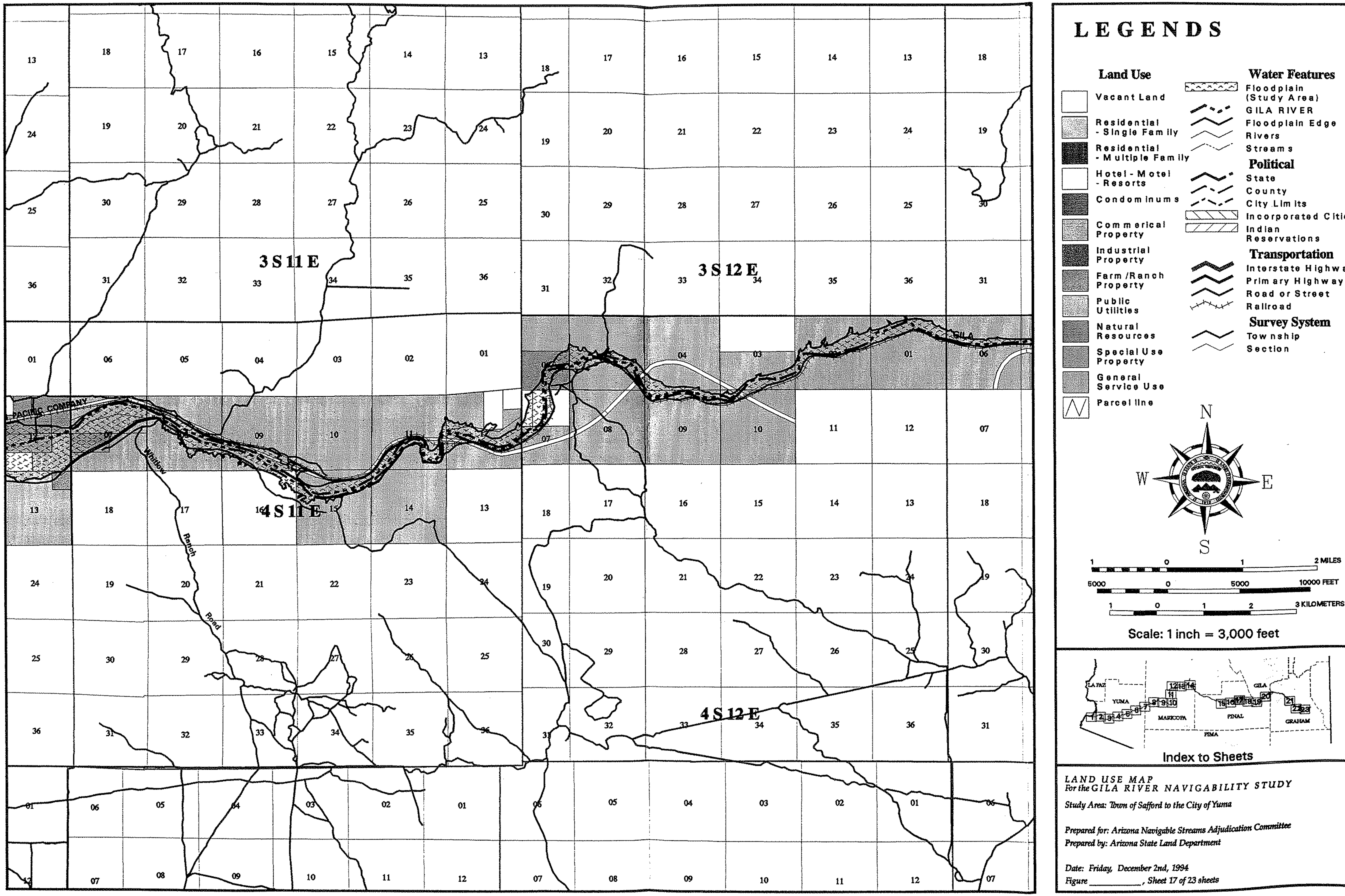
3 S 11 E
3 S 12 E
4 S 11 E
4 S 12 E
PACIFIC COMPANY
GILA
Whitlow Ranch Road
LEGENDS
Land Use
Vacant Land
Residential - Single Family
Residential - Multiple Family
Hotel - Motel - Resorts
Condominiums
Commerical Property
Industrial Property
Farm /Ranch Property
Public Utilities
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Water Features
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N
S
W
E
1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS
Scale: 1 inch = 3,000 feet
LA PAZ
YUMA
MARICOPA
PINAL
PIMA
GILA
GRAHAM
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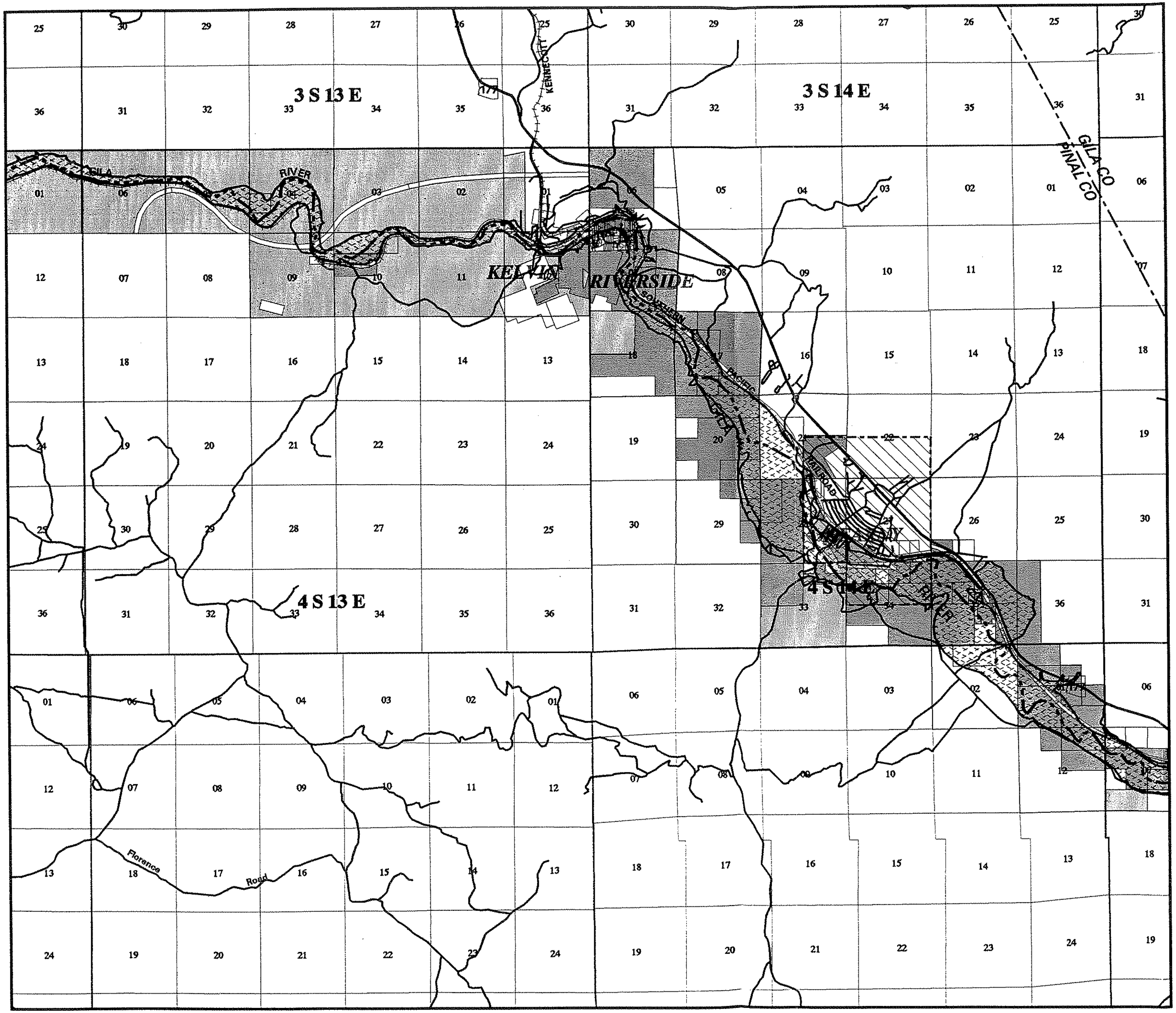
LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY
Study Area: Town of Safford to the City of Yuma
Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department
Date: Friday, December 2nd, 1994
Figure ___________, Sheet 17 of 23 sheets



LEGENDS

Land Use

- Vacant Land
- Residential - Single Family
- Residential - Multiple Family
- Hotel - Motel - Resorts
- Condominiums
- Commerical Property
- Industrial Property
- Farm /Ranch Property
- Public Utilities
- Natural Resources
- Special Use Property
- General Service Use
- Parcel line

Water Features

- Floodplain (Study Area)
- GILA RIVER
- Floodplain Edge
- Rivers
- Streams

Political

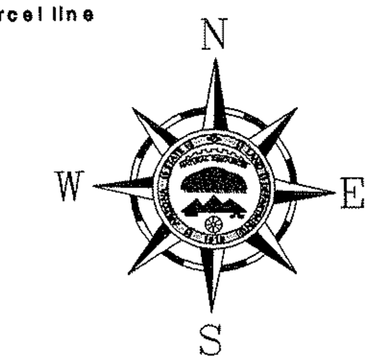
- State
- County
- City Limits
- Incorporated Cities
- Indian Reservations

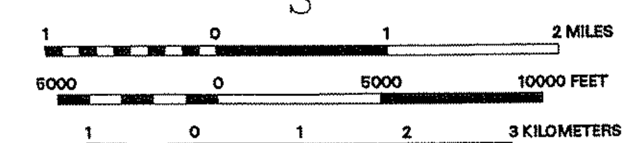
Transportation

- Interstate Highway
- Primary Highways
- Road or Street
- Railroad

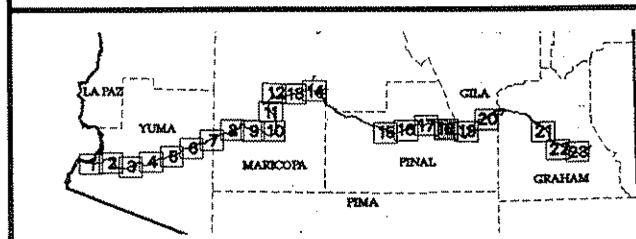
Survey System

- Township
- Section





Scale: 1 inch = 3,000 feet



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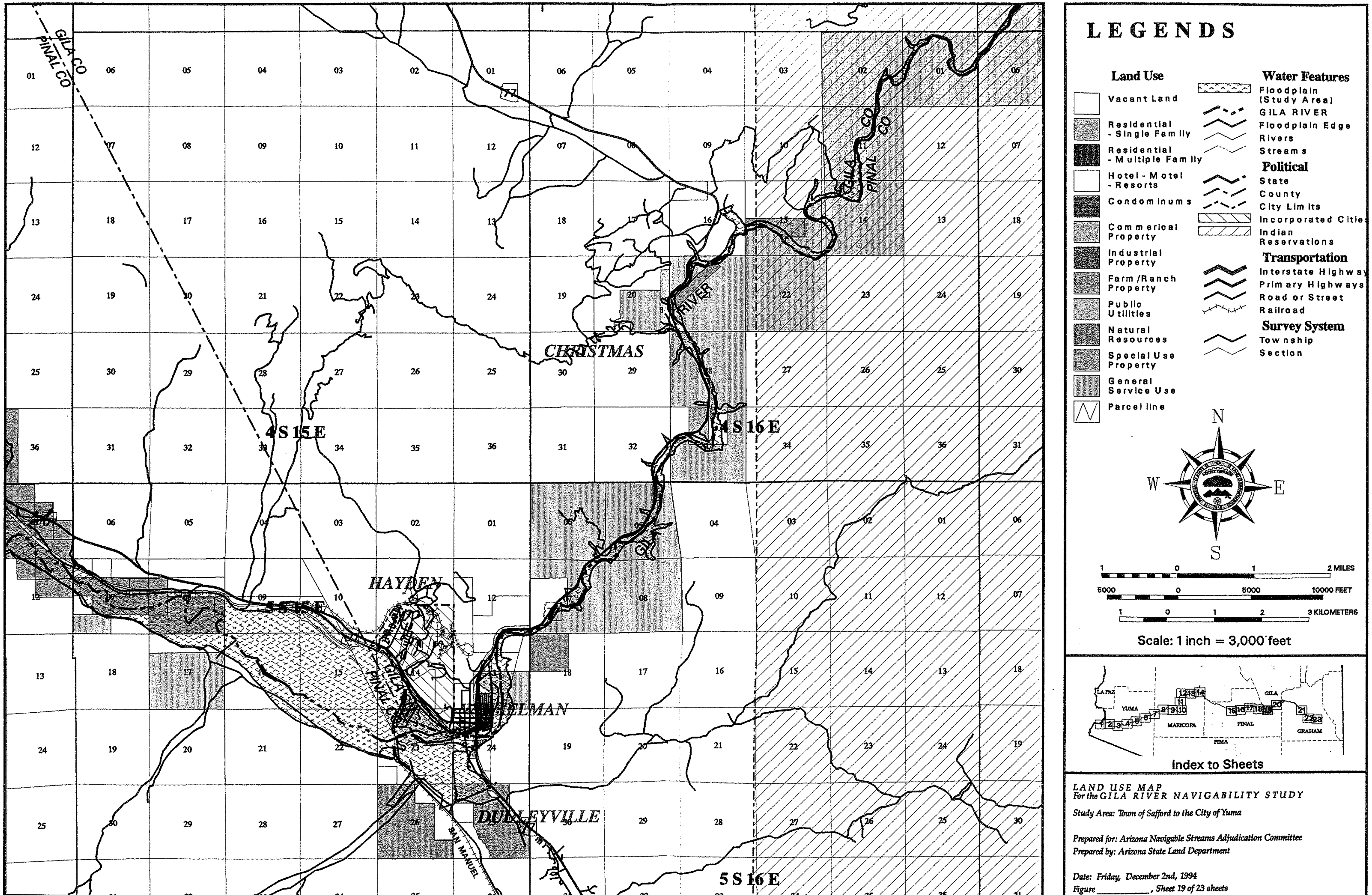
LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
Figure ____________, Sheet 18 of 23 sheets



GILA CO
PINAL CO
4 S 15 E
4 S 16 E
5 S 15 E
5 S 16 E
CHRISTMAS
HAYDEN
WINKELMAN
DUDLEYVILLE
GILA RIVER
SAN MANUEL
77
LEGENDS
Land Use
Vacant Land
Residential - Single Family
Residential - Multiple Family
Hotel - Motel - Resorts
Condominiums
Commerical Property
Industrial Property
Farm/Ranch Property
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Rivers
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County
City Limits
Incorporated Cities
Indian Reservations
Transportation
Interstate Highway
Primary Highways
Road or Street
Railroad
Survey System
Township
Section
N
S
E
W
1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS
Scale: 1 inch = 3,000 feet
Index to Sheets
LA PAZ
YUMA
MARICOPA
PINAL
PIMA
GILA
GRAHAM
LAND USE MAP
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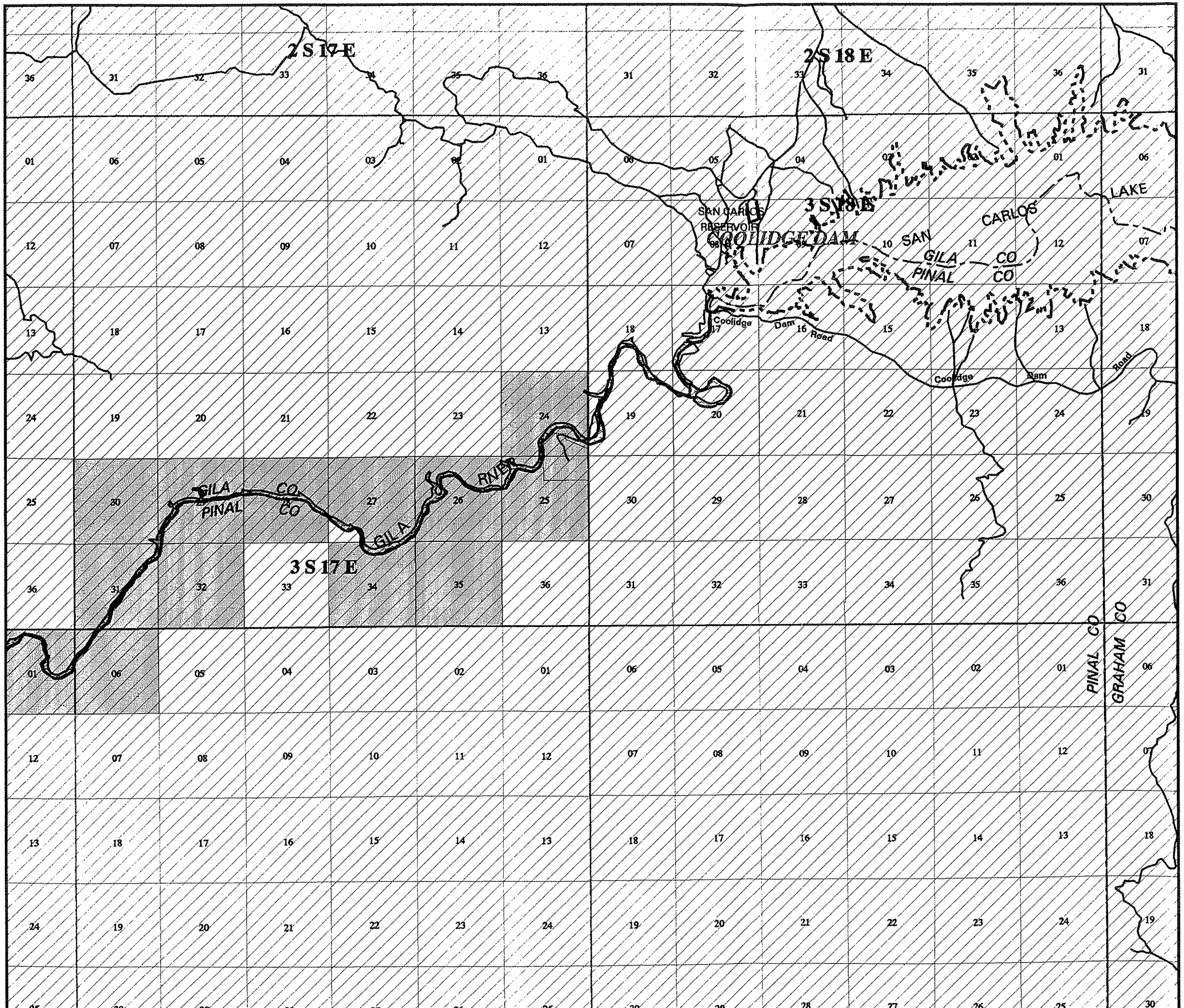
Study Area: Town of Safford to the City of Yuma
Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department
Date: Friday, December 2nd, 1994
Figure ________, Sheet 19 of 23 sheets



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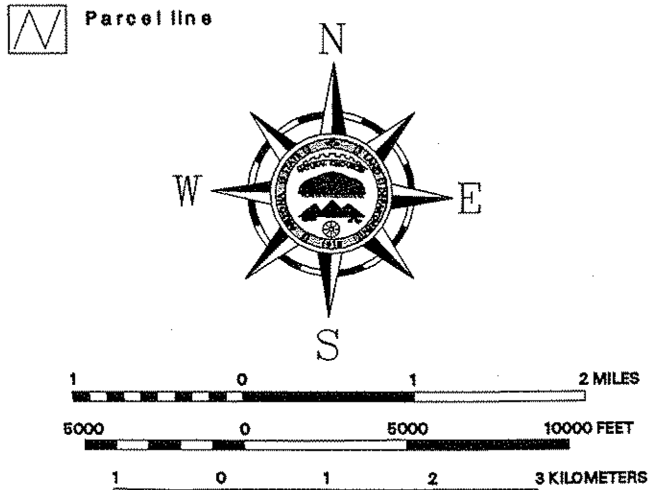

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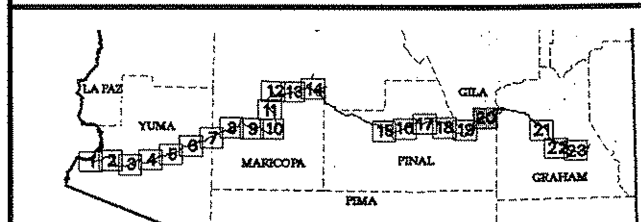

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Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
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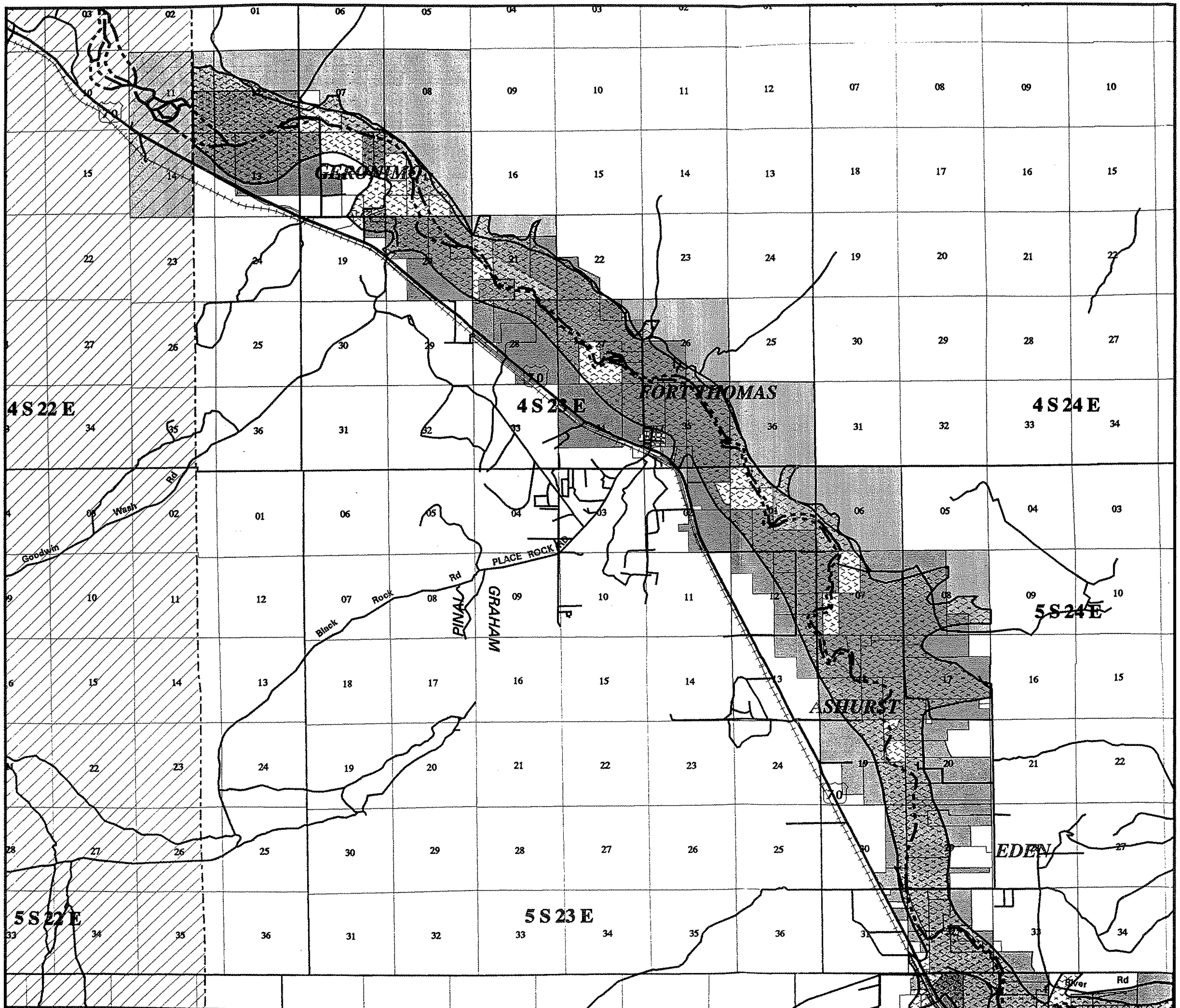
Date: Friday, December 2nd, 1994
Figure __________, Sheet 20 of 23 sheets



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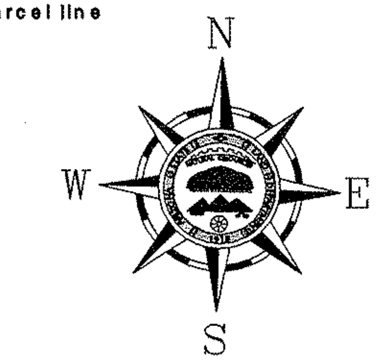

1 0 1 2 MILES
5000 0 5000 10000 FEET
1 0 1 2 3 KILOMETERS

Scale: 1 inch = 3,000 feet

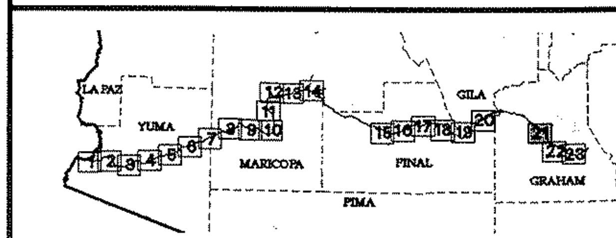

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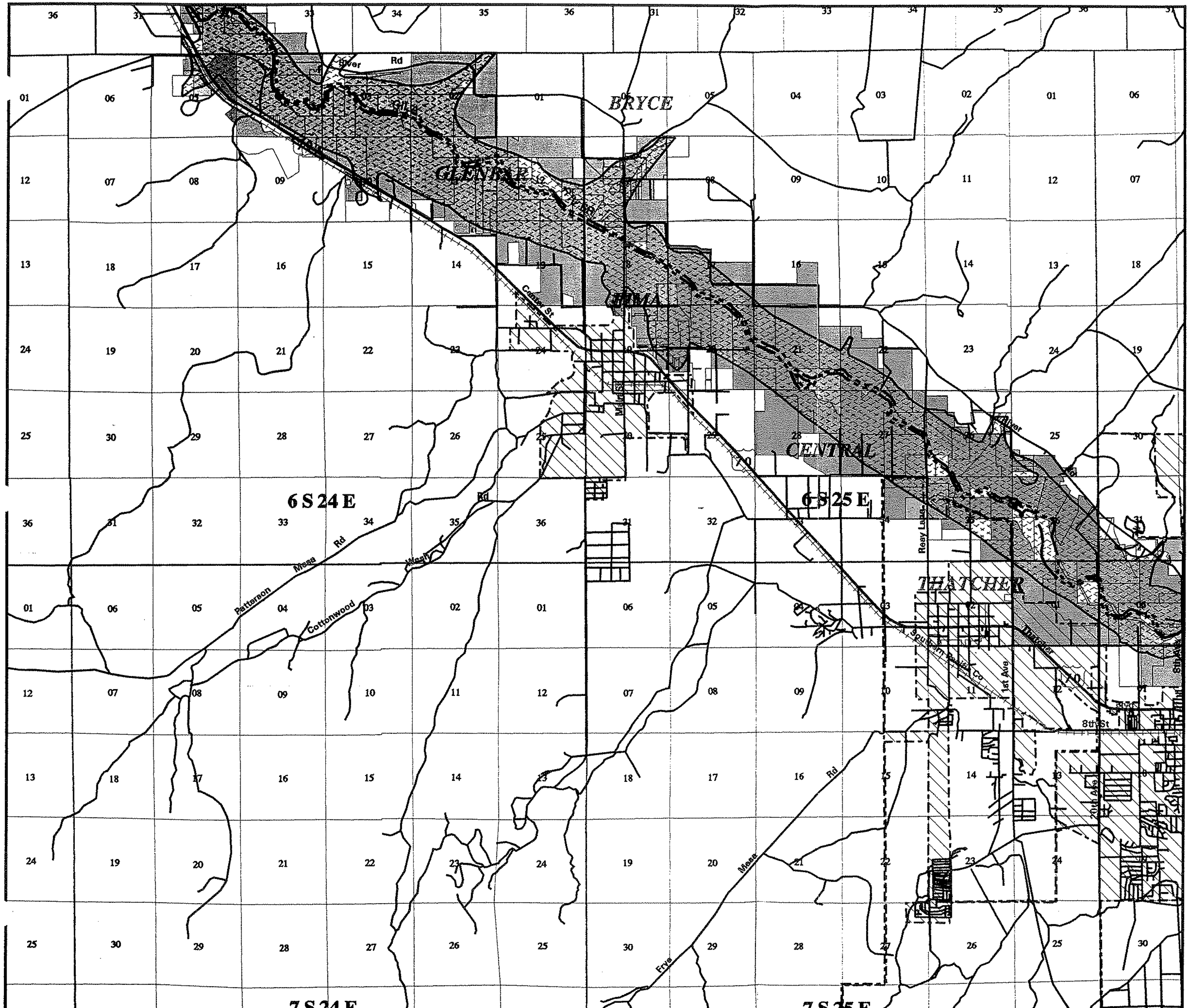
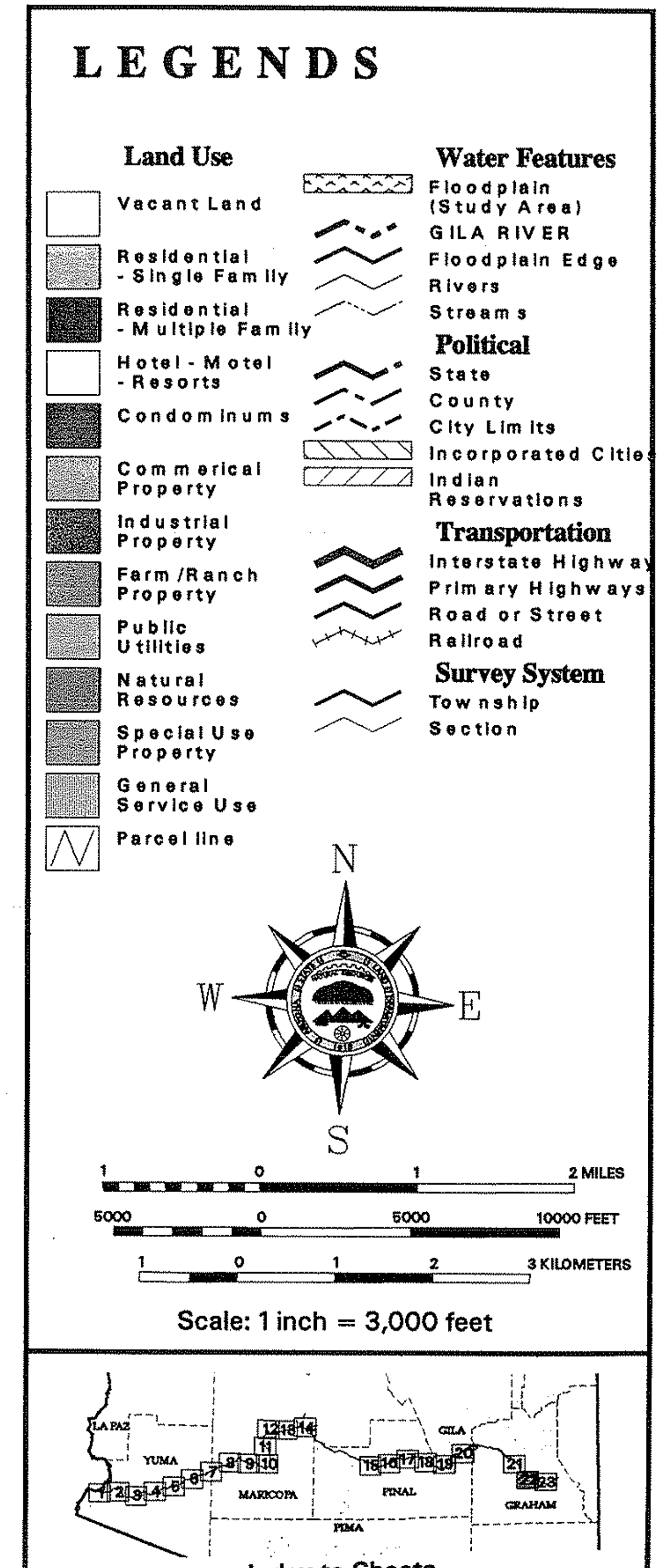
Figure __________, Sheet 21 of 23 sheets





LAND USE MAP
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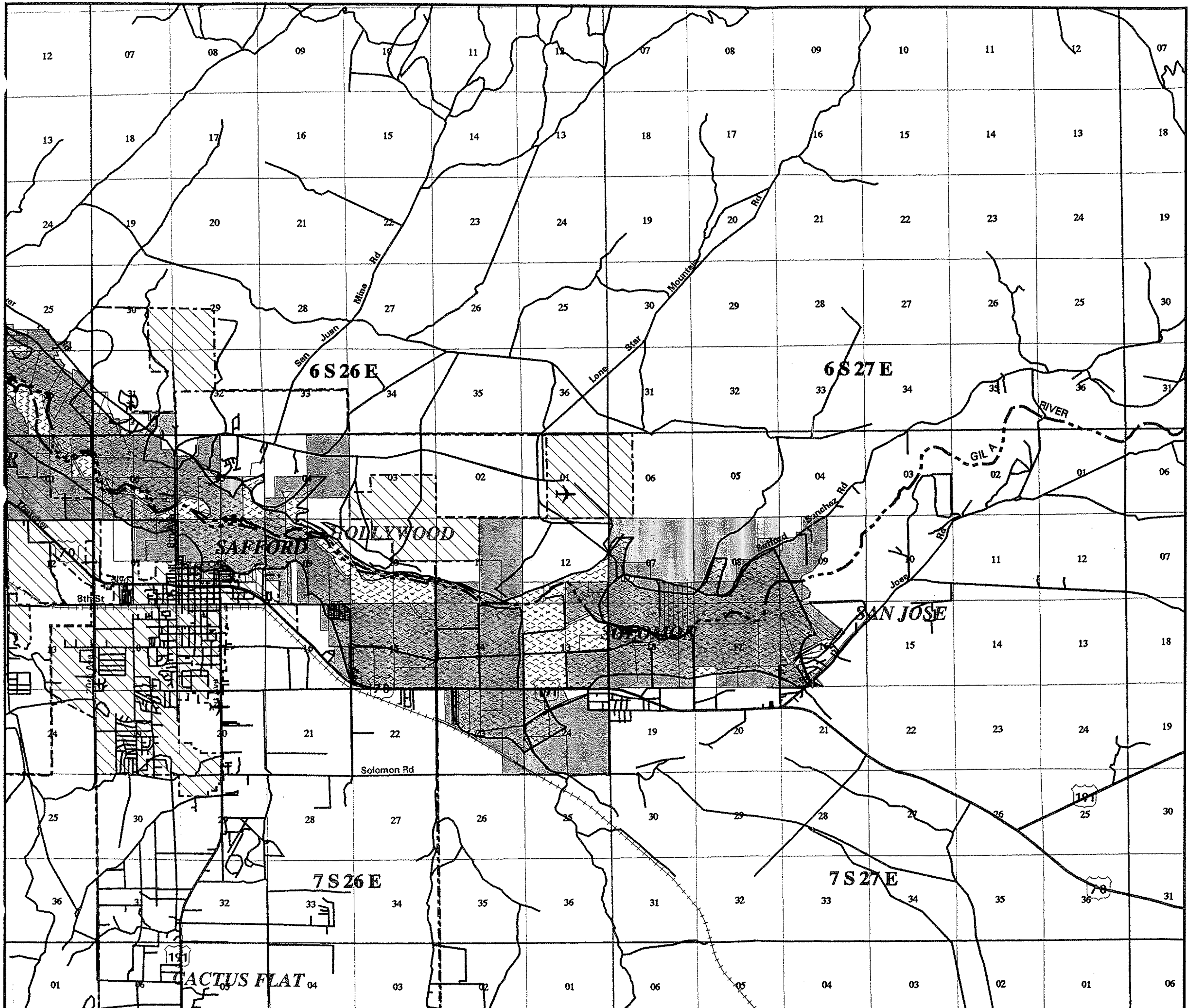
Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department

Date: Friday, December 2nd, 1994
Figure ______, Sheet 22 of 23 sheets



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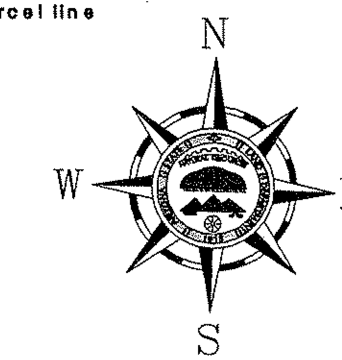
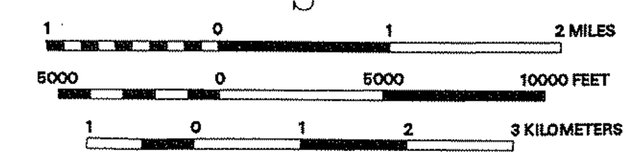
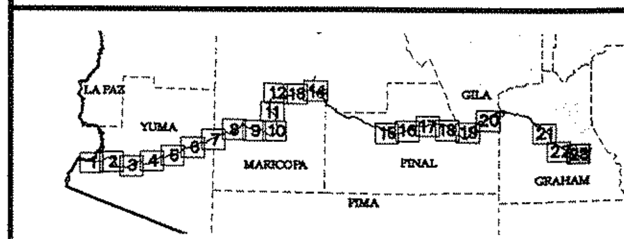




Scale: 1 inch = 3,000 feet



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LAND USE MAP
For the GILA RIVER NAVIGABILITY STUDY

Study Area: Town of Safford to the City of Yuma

Prepared for: Arizona Navigable Streams Adjudication Committee
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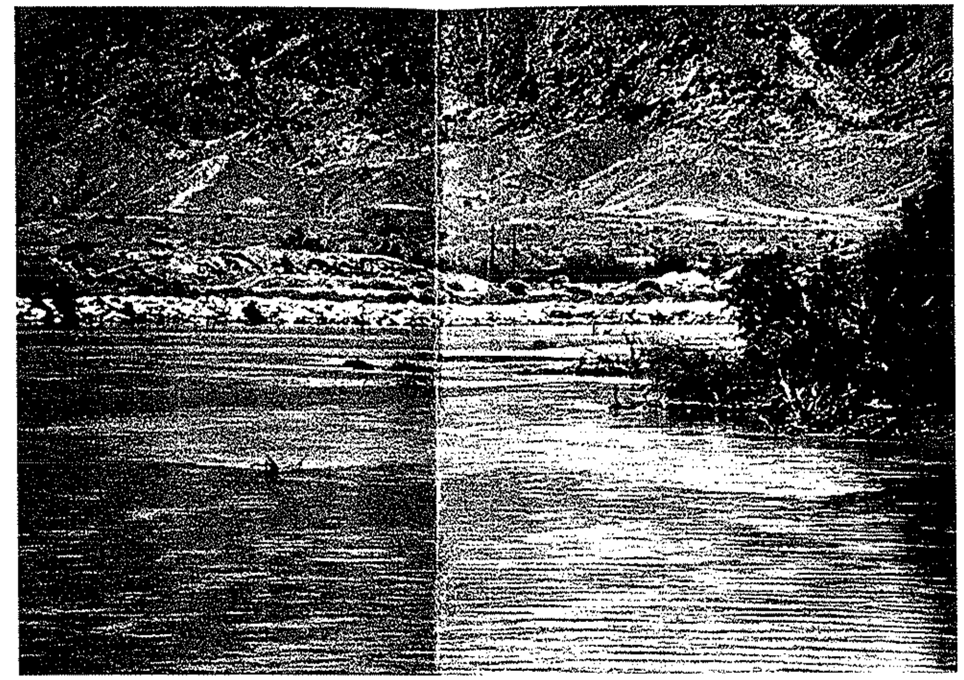
Date: Friday, December 2nd, 1994

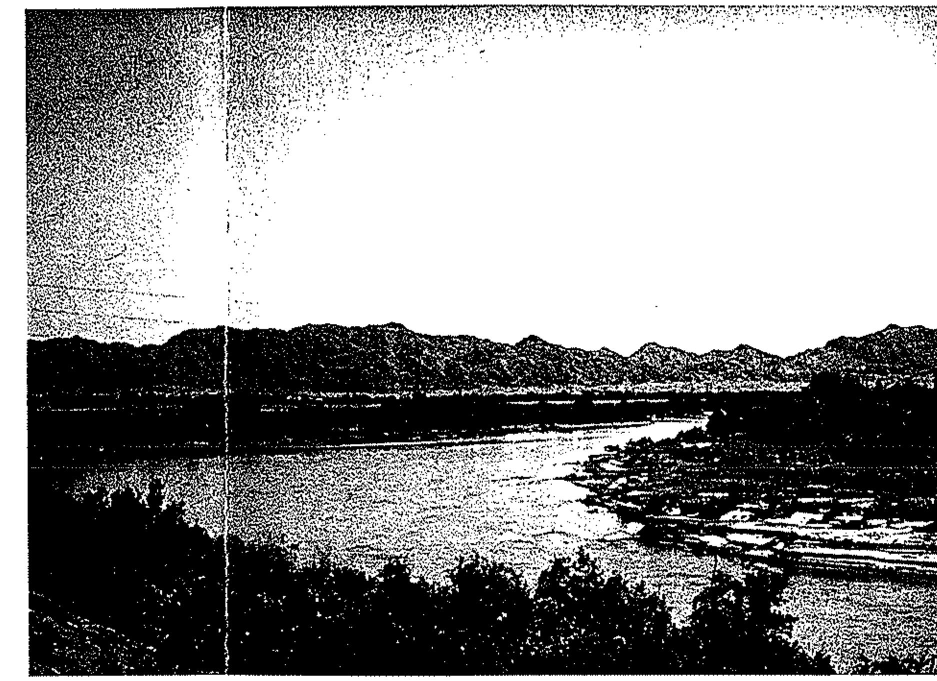
Figure ________, Sheet 23 of 23 sheets

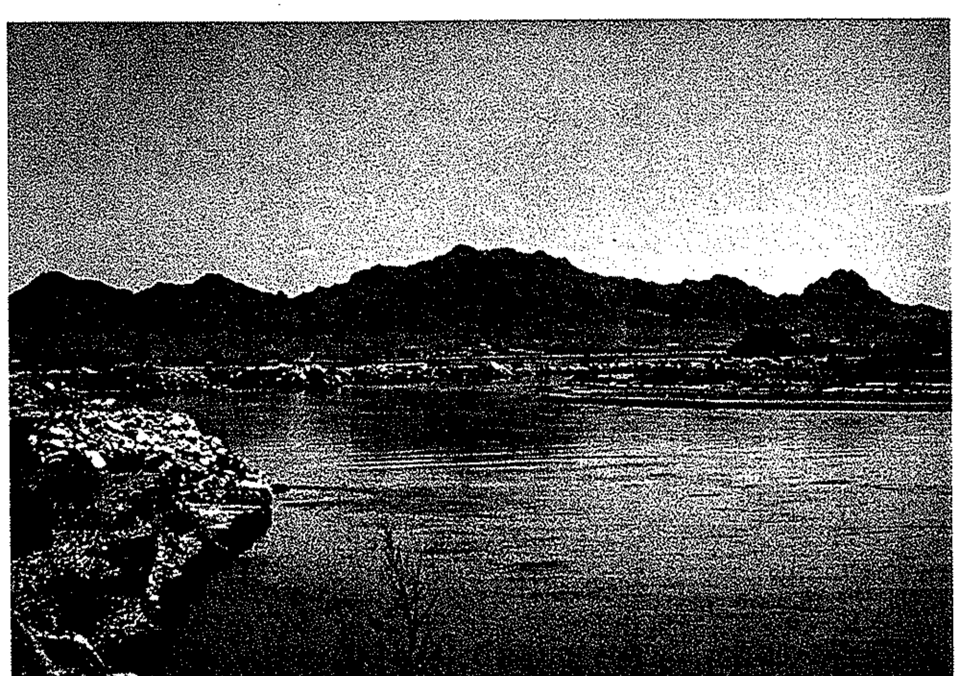
Appendix K

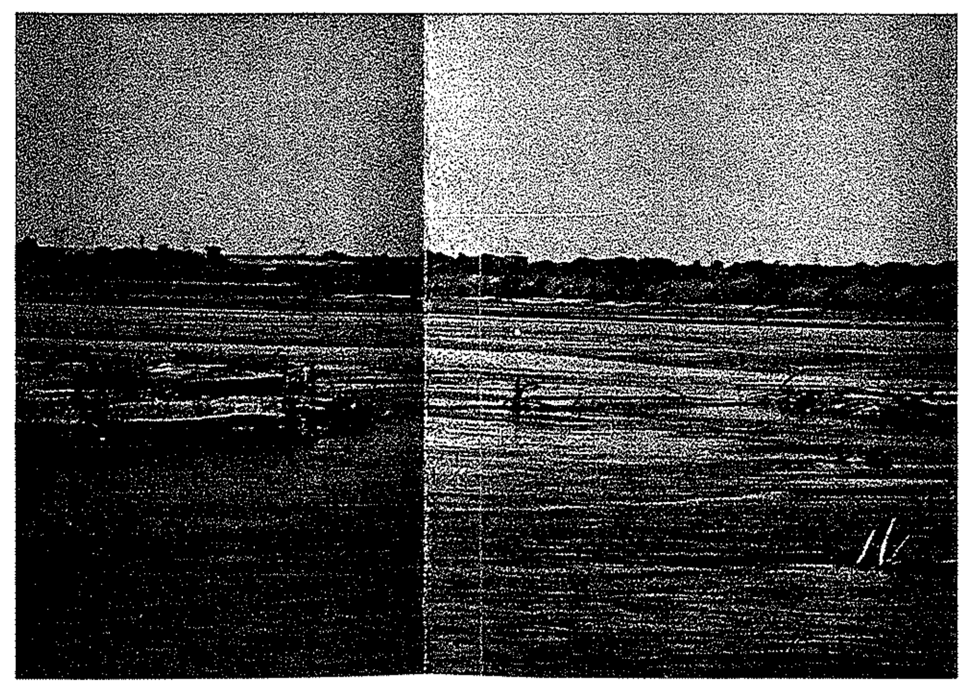
Present-day Gila River Photographs

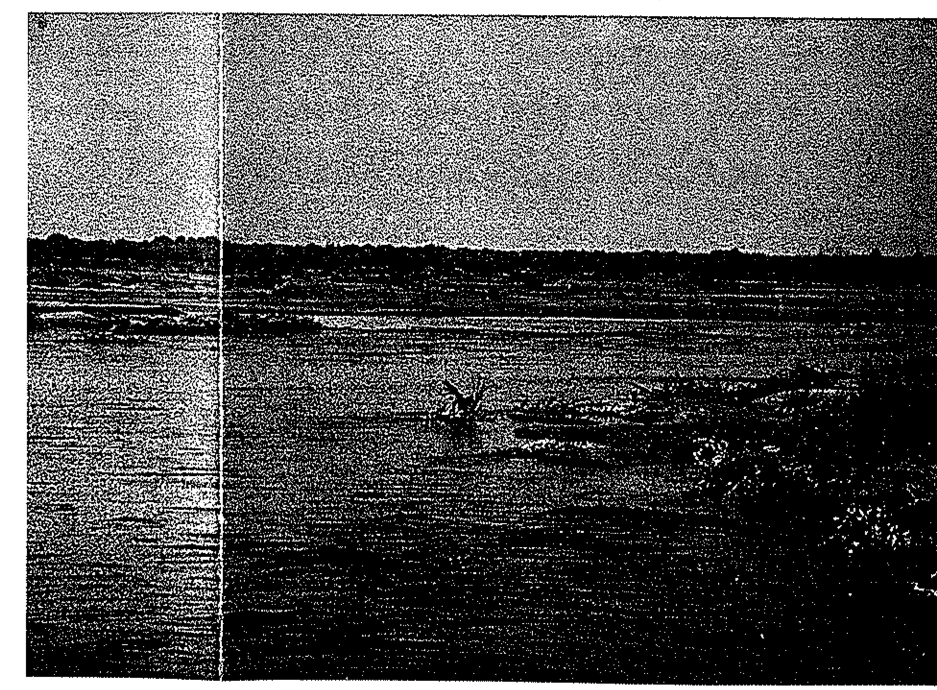

Yuma near confluence


Near Kinter


Near Dome

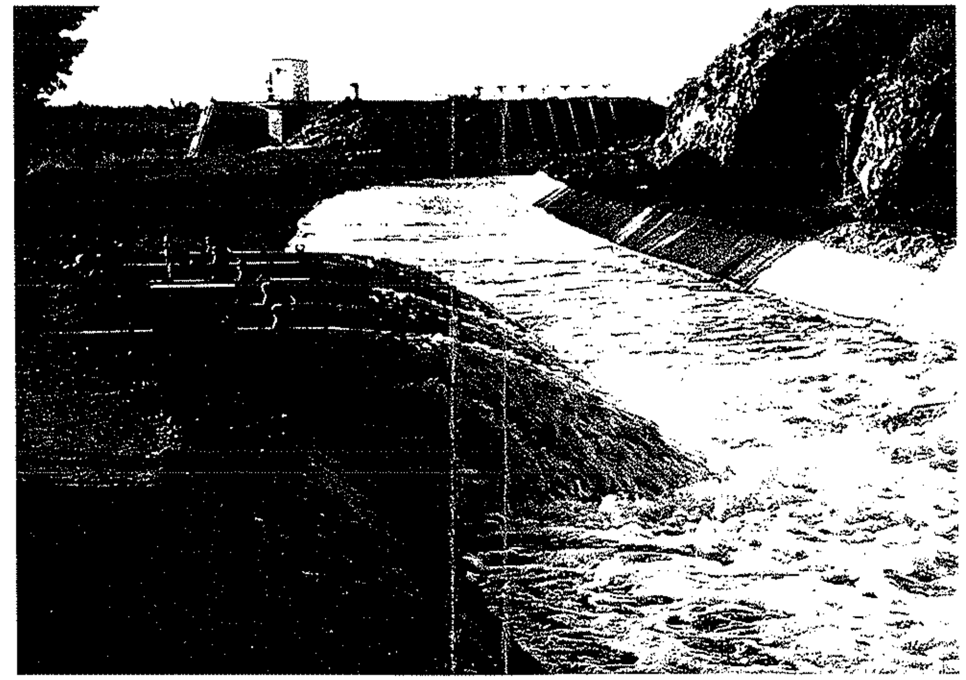

Near Dome


Near Agua Caliente


Near Agua Caliente

VICINITY OF YUMA TO VICINITY OF AGUA CALIENTE

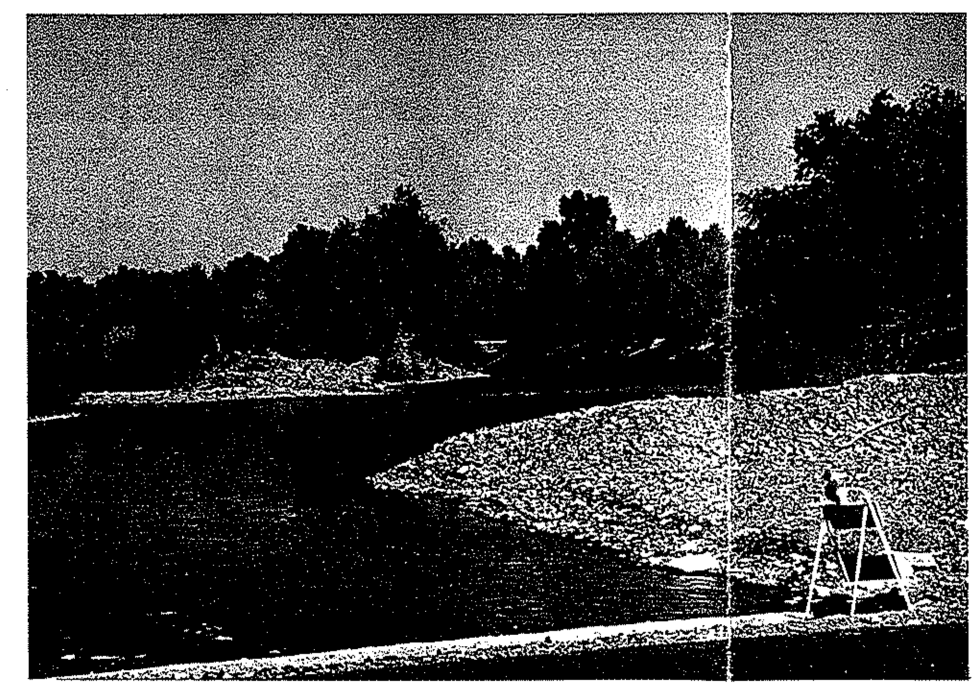
Painted Rock Dam, looking north



Headworks, Consolidated Canal, Gillespie Dam

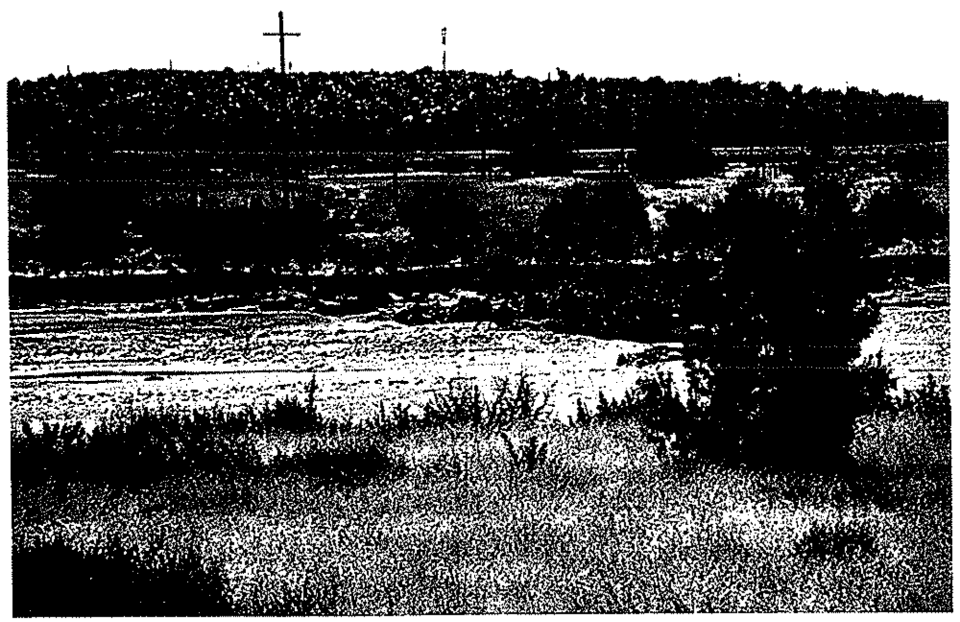
Downstream of Painted Rock

Old Highway 85 Bridge

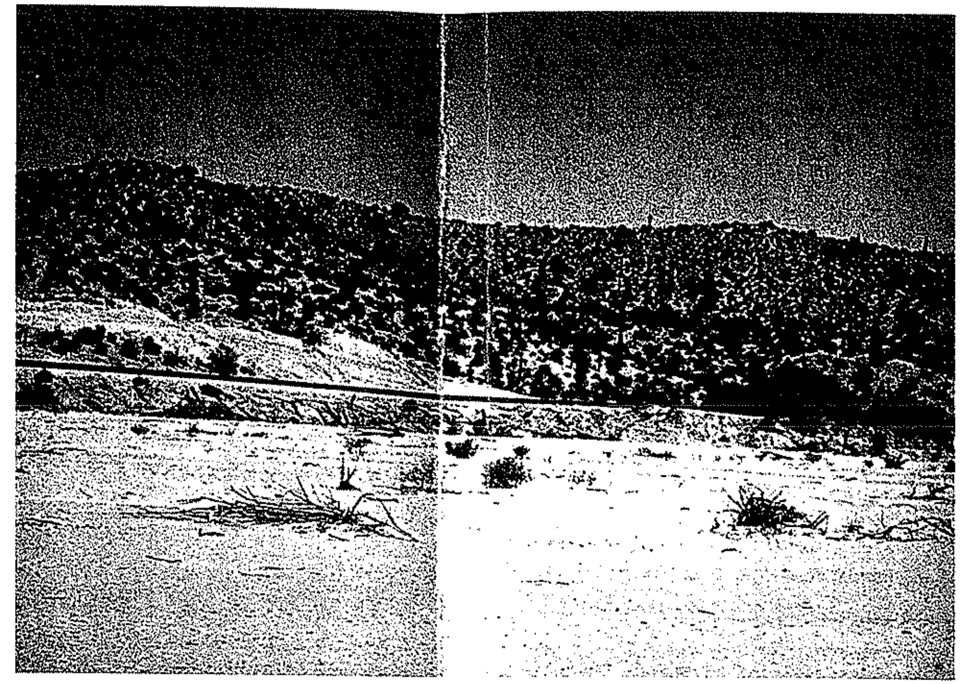


115th Avenue (Phoenix), Salt-Gila confluence

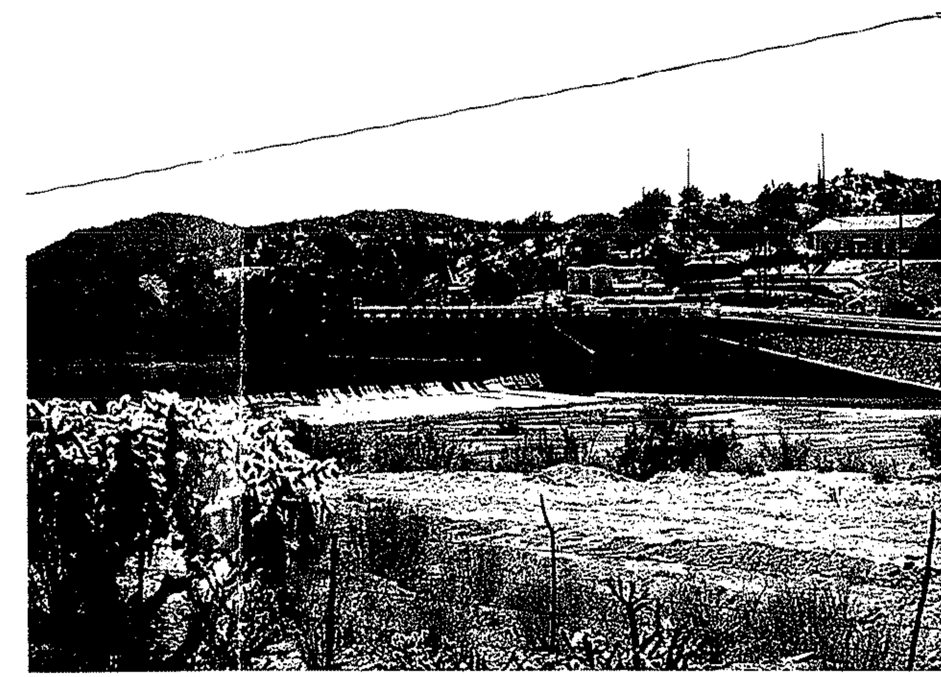
PAINTED ROCK DAM TO VICINITY OF CONFLUENCE WITH SALT RIVER



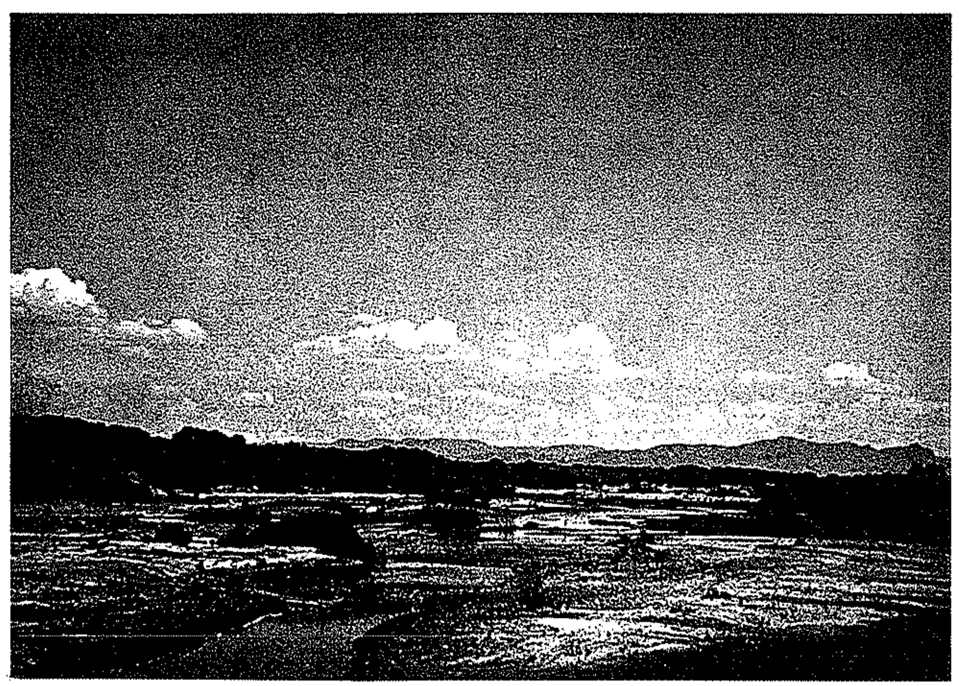
Near Florence



Railroad east of Florence

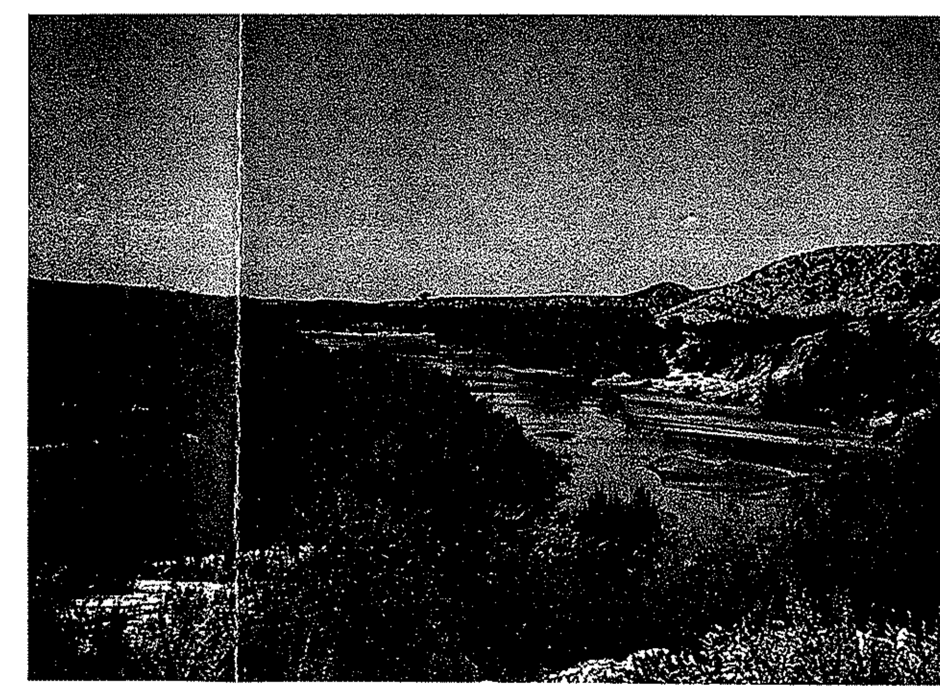


Ashurst-Hayden Dam



Between Fort Thomas and Thatcher

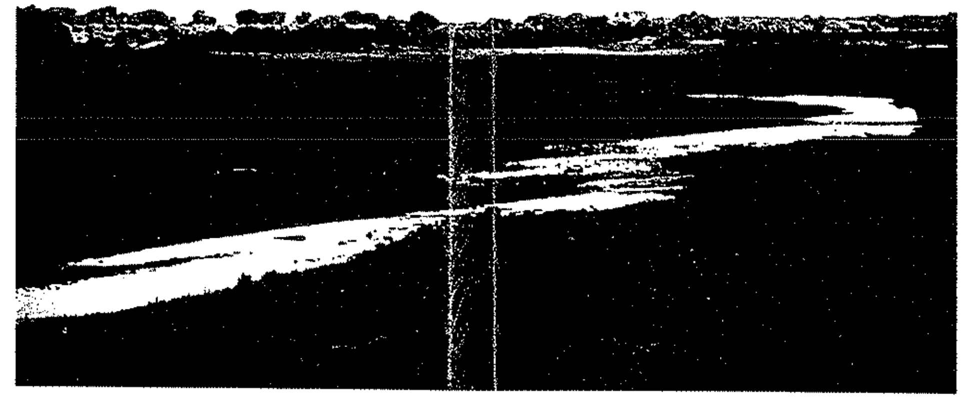
Between Fort Thomas and Thatcher



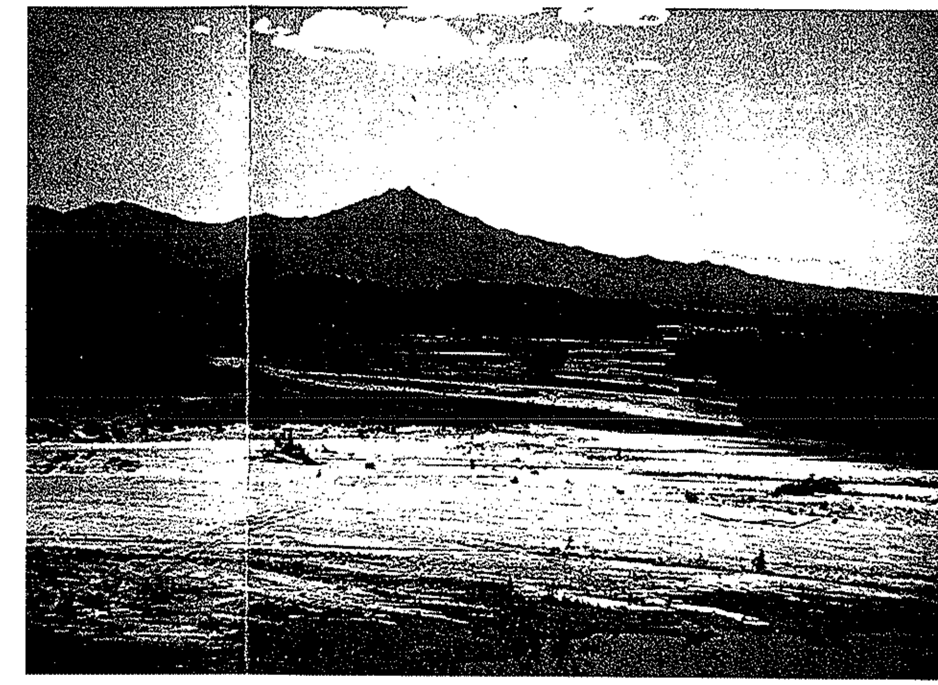
Between Fort Thomas and Thatcher

VICINITY OF FLORENCE TO VICINITY OF THATCHER

Near Safford

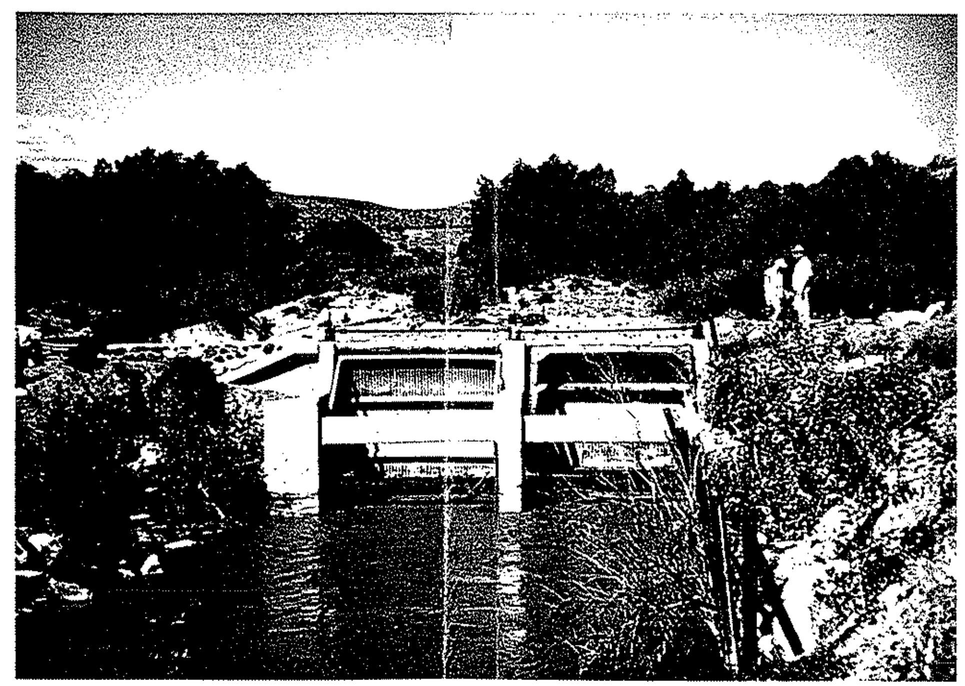


Near Safford

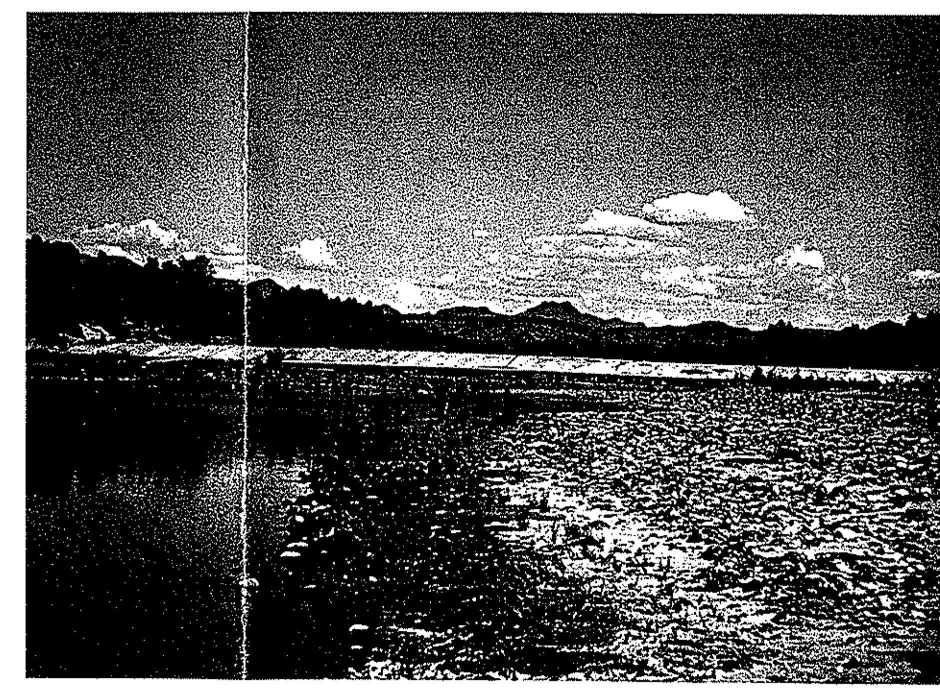


Near Safford

Near Safford



Headgate for San Jose Canal



Upstream of Headgate

VICINITY OF SAFFORD

6

96-003-006

Gila River
01

ORIGINAL

Helm & Kyle, Ltd.

ATTORNEYS AT LAW

RECEIVED 9-3-96

John D. Helm
Theodore L. Kyle
Margaret R. Tinsley
Roberta S. Livesay
Sally Worthington
Michelle L. Margolies

1619 East Guadalupe
Suite One
Tempe, Arizona 85283
(602) 345-9500
Fax (602) 345-6559

September 3, 1996

Christina Waddell
Executive Director
Arizona Navigable Stream Adjudication Commission
1700 W. Washington
Suite 404
Phoenix, Arizona 85007

Re: Gila River

Dear Christina:

Attached are an original and seven copies of Maricopa County's filing on public trust values for the Gila River; one of the copies is to be returned to us.

We would appreciate it if you could date stamp the copy marked with the sticker "Please Date Stamp," and return it to us in the provided envelope.

Thank you for your assistance with this matter.

Sincerely,

Sally Worthington

Sally Worthington

cc: Jim Minter

C:\ansacII\gilfilcv.ltr

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION
PUBLIC TRUST VALUES
FOR THE
GILA RIVER

The following, lists the Maricopa County Department of Transportation roadway facilities within the Gila River as defined by the Federal Emergency Management Agency and as indicated on their Flood Insurance Rate Maps (April 1988 - September 1991), 100 year flood limits. The listed roadways are open to general public use and thereby represent public trust values associated with the Gila River.

The Attached description was based on current Maricopa County Department of Transportation (MCDOT) and Maricopa County Assessor's Records. Describing those areas lying within the Gila River Corridor" indicating those interests obtained by the Maricopa County Department of Transportation.

The interests shown on the attached report are listed with the ;following information: Section, Township and Range, Assessor's Book and Map, Recorder's Book and Page, Maricopa County Department of Transportation interests, Fee interests, and county agencies. This probable course of the Gila River and it's general alignment is based on the Federal Emergency Management Agency and as indicated on their Flood Insurance Rate Maps.

Maricopa County Interests Lying Within
The Gila River Corridor

Those certain Maricopa County lands, easements and rights lying within the Gila River Corridor in,

Township One (1) North, Range One (1) West;
Township One (1) South, Range Two (2) West;
Township One (1) South, Range Three (3) West;
Township One (1) South, Range Four (4) West;
Township One (1) South, Range Five (5) West;
Township Two (2) South, Range Five (5) West;
Township Four (4) South, Range Four (4) West;
Township Five (5) South, Range Four (4) West;
Township Five (5) South, Range Five (5) West;
Township Five (5) South, Range Six (6) West;
Township Five (5) South, Range Ten (10) West, of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, lying within the roadways and documents listed below, together with any rights, title or interests not listed, which may be discovered in the future:

Said aforementioned roadways and documents are made of record at the Maricopa County Recorder and listed as follows;

Book 1 of Road Maps, Page 61;
Book 5 of Road Maps, Page 33;
Book 2 of Road Maps, Page 14;
Book 21 of Road Maps, Page 53;
Book 25 of Road Maps, Page 3;
Book 2 of Road Maps, Page 38;
Book 30 of Road Maps, Page 38;
Book 17 of Road Maps, Page 52;
Book 15 of Road Maps, Page 99;
Book 15 of Road Maps, Page 19;
Book 28 of Road Maps, Page 19;
Book 33 of Road Maps, Page 56;
Book 5 of Road Maps, Page 35;
Book 10 of Road Maps, Page 25;
Book 10 of Road Maps, Page 26;
Book 14 of Road Maps, Page 78;
Book 26 of Road Maps, Page 43;
Book 30 of Road Maps, Page 58;
Book 20 of Road Maps, Page 56;
Book 21 of Road Maps, Page 69;
Book 1 of Road Maps, Page 52;
Book 11 of Road Maps, Page 31;
Book 15 of Road Maps, Page 73;
Book 19 of Road Maps, Page 22;
Book 10 of Road Maps, Page 6;
Book 20 of Road Maps, Page 34, and

The Gila River Corridor

Docket 16021 Page 0785; Docket 03212 Page 0443;
Docket 04759 Page 0337; Docket 16146 Page 0980;
Docket 05488 Page 0207; Docket 05438 Page 0551;
Docket 05446 Page 0144; Docket 15700 Page 0544;
Docket 16208 Page 0587; Docket 09469 Page 0122;
Docket 11630 Page 0634; Docket 11793 Page 0855;
Docket 15165 Page 0603; Docket 11032 Page 0012;
Docket 15165 Page 0584; Docket 11168 Page 0498;
Docket 11168 Page 0500; Docket 11168 Page 0496;
Docket 15165 Page 0607; Docket 10387 Page 1241;
Docket 10607 Page 1339; Docket 15622 Page 0306;
Docket 16226 Page 0503; Docket 11032 Page 0026;
Docket 04694 Page 0400; Docket 10541 Page 0707;
Docket 04671 Page 0352; Docket 04671 Page 0353;
Docket 10994 Page 0011; Docket 09144 Page 0754;
Docket 05568 Page 0139; Docket 07130 Page 0126;
Docket 12938 Page 0900; Docket 05776 Page 0488;
Docket 05775 Page 0537; Docket 05755 Page 0542;
Docket 16345 Page 1036; Docket 16130 Page 1048;
Docket 05871 Page 0002; Docket 03212 Page 0443;
Docket 16021 Page 7850; Docket 03320 Page 0524;
Docket 05305 Page 0441; Docket 11630 Page 0632;
Docket 01252 Page 0296; Docket 03565 Page 0274;
Docket 12057 Page 1164; Docket 01974 Page 0111;
Docket 06327 Page 0059; Docket 03440 Page 0388;
Docket 07945 Page 0317; Docket 06327 Page 0063;
Docket 09360 Page 0744; Docket 09944 Page 0362;
Docket 13475 Page 0462; Docket 07287 Page 0088;
Docket 07732 Page 0013; Docket 09045 Page 0150;
Docket 09208 Page 0752; Docket 09045 Page 0177;
Docket 09235 Page 0234; Docket 09045 Page 0174;
Docket 07747 Page 0767; Docket 04298 Page 0485;
Docket 00168 Page 0438; Docket 00168 Page 0437;
Docket 09208 Page 0750; Docket 14617 Page 0025;
Docket 14975 Page 0263; Docket 14975 Page 0266;
Docket 14583 Page 0556; Docket 14583 Page 0667;
Docket 09045 Page 0152; Docket 14583 Page 0634;
Docket 09045 Page 0154; Docket 14583 Page 0554;
Docket 14805 Page 0495; Docket 14805 Page 0493;
Docket 14805 Page 0494; Docket 02955 Page 0592;
Docket 01674 Page 0131; Docket 01663 Page 0219;
Docket 01674 Page 0133; Docket 14977 Page 0373;
Docket 01680 Page 0523; Docket 01678 Page 0478;
Docket 04955 Page 0011; Docket 08027 Page 0096;
Docket 04437 Page 0074; Docket 08097 Page 0091;
Docket 04428 Page 0402; Docket 08565 Page 0229;
Docket 02372 Page 0143; Docket 02273 Page 0100;
Docket 02341 Page 0037; Docket 07768 Page 0747;
Docket 07747 Page 0762; Docket 07768 Page 0749;
Docket 07824 Page 0527; Docket 07768 Page 0755;

The Gila River Corridor

Docket 07768 Page 0753; Docket 07768 Page 0751;
Docket 07768 Page 0770; Docket 08470 Page 0885;
Docket 11793 Page 0855; Docket 16130 Page 1055;
Docket 05755 Page 0542; Docket 05755 Page 0537;
Docket 05871 Page 0002; Docket 11630 Page 0632;
Docket 05776 Page 0488; Docket 06327 Page 0061;
Recorder No. 83 027814; Recorder No. 83 205206;
Recorder No. 83 205207; Recorder No. 85 038747;
Recorder No. 85 038748; Recorder No. 85 038749;
Recorder No. 85 038750; Recorder No. 85 038751;
Recorder No. 85 132967; Recorder No. 85 325822;
Recorder No. 85 091256; Recorder No. 87 134763;
Recorder No. 88 199672; Recorder No. 88 199673;
Recorder No. 88 212679; Recorder No. 88 513352;
Recorder No. 88 581154; Recorder No. 89 559794;
Recorder No. 88 586006; Recorder No. 90 034738;
Recorder No. 90 441307; Recorder No. 90 460102;
Recorder No. 91 042690; Recorder No. 91 054027;
Recorder No. 91 054028; Recorder No. 91 054029;
Recorder No. 91 125996.

MARICOPA COUNTY INTEREST WITHIN THE GILA RIVER 100 YEAR FLOODWAY CORRIDOR

REFERENCE MAP SHEET NUMBER	SECTION TWN,RNG	ASSESSORS BK/MAP	RECORDERS BK/PAGE	HIGHWAY DEPT. INTEREST	FEE INTEREST	COUNTY AGENCY
1	29 T1N,R1W	500-81		D6996 D4794 D15382	None	None
2	30 T1N,R1W	500-83		D6996	500-83-001H 500-83-001K	FCD FCD
3	31 T1N,R1W	500-86		D6853 C1321	500-86-001S 500-86-001U 500-86-002L	FCD FCD FCD
4	32 T1N,R1W	500-82 & N/A		C1990 D15270 D15382	500-82-0002	MC
5	33 T1N,R1W	500-79		D15270 D851 D5158	500-79-002A 500-79-0005 500-79-0006 500-79-0007	FCD MC MC MC
6	34 T1N,R1W	500-78		D7213 D15314	None	None
8	36 T1N,R1W	500-69 & N/A		C1819 D6247 D15568 D6226 D7048 D7073	500-69-003J 500-69-005E 500-69-005F 500-69-005K 500-69-005L 500-69-008D 500-69-010D 500-69-011P 500-69-011S 500-69-011T 500-69-011V 500-69-072B 500-69-073B 500-69-074B	FCD FCD FCD FCD FCD FCD FCD FCD FCD FCD FCD FCD FCD FCD
10	3 T1S,R2W	400-04		None	400-04-007E	FCD
11	4 T1S,R2W	400-05		None	400-05-005B	FCD
12	5 T1S,R2W	400-06		D14831 D1032 D14011 D1033 D1130 D1120	400-06-011H	FCD
13	7 T1S,R2W	400-08		D17343 D16594 D5865 D14839 D14774 D14775 D14776	400-08-008B 400-08-017C	FCD FCD
14	8 T1S,R2W	400-07 & N/A		D14840 D1052 D14895 C596 D1051	400-07-002E 400-07-002G 400-07-002J 400-07-003C	FCD FCD FCD FCD
16	1 T1S,R3W	400-10		D16915 D17344 D5764 D5750	None	None

MARICOPA COUNTY INTEREST WITHIN THE GILA RIVER 100 YEAR FLOODWAY CORRIDOR

REFERENCE MAP SHEET NUMBER	SECTION TWN,RNG	ASSESSORS BK/MAP	RECORDERS BK/PAGE	HIGHWAY DEPT. INTEREST	FEE INTEREST	COUNTY AGENCY
17	2 T1S,R3W	400-12		D16977 D16904	None	None
18	3 T1S,R3W	400-13		D17331	None	None
19	4 T1S,R3W	400-15		D13075	None	None
22	9 T1S,R3W	400-43 N2		D17426	None	None
23	10 T1S,R3W	400-14		D5180 D17308	None	None
24	11 T1S,R3W	400-11		D16975 D16976 D18399 D16798	None	None
25	12 T1S,R3W	400-02		D17121 D16978 D18133 D5867 D10705 D10675 D10505 D10513	400-02-003G 400-02-003J 400-02-004B 400-02-005B	FCD FCD FCD FCD
27	14 T1S,R3W	400-50		None	400-50-008B 400-50-009B	FCD FCD
28	15 T1S,R3W	400-49		None	400-49-007F	FCD
30	17,18,19 T1S,R3W	400-46		None	400-46-002B 400-46-008B 400-46-015A	FCD FCD FCD
32	13 T1S,R4W	401-03		None	401-03-0001 401-03-002A 401-03-002B 401-03-002C 401-03-0005	MC MC MC MC MC
33	14 T1S,R4W	401-05		None	401-05-0001 401-05-002A 401-05-002B 401-05-002C 401-05-003A 401-05-003B 401-05-003C 401-05-0005 401-05-006A 401-05-006B 401-05-006C 401-05-0007 401-05-0008	MC MC MC MC MC MC MC MC MC MC MC MC MC
34	24 T1S,R4W	401-04		None	401-04-020B 401-04-021A	FCD FCD
35	30 T1S,R4W	401-14		None	401-14-047A	FCD
36	25 T1S,R5W	401-33		None	401-33-010B 401-33-014B	FCD FCD

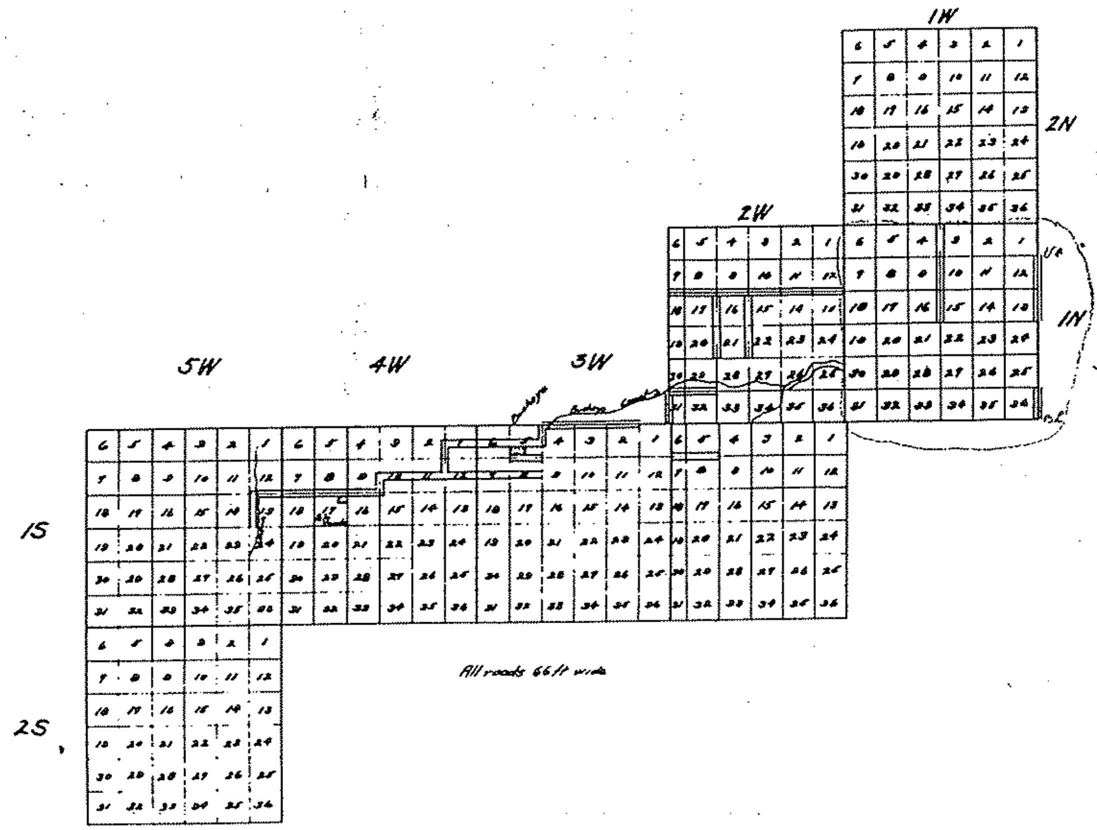
MARICOPA COUNTY INTEREST WITHIN THE GILA RIVER 100 YEAR FLOODWAY CORRIDOR

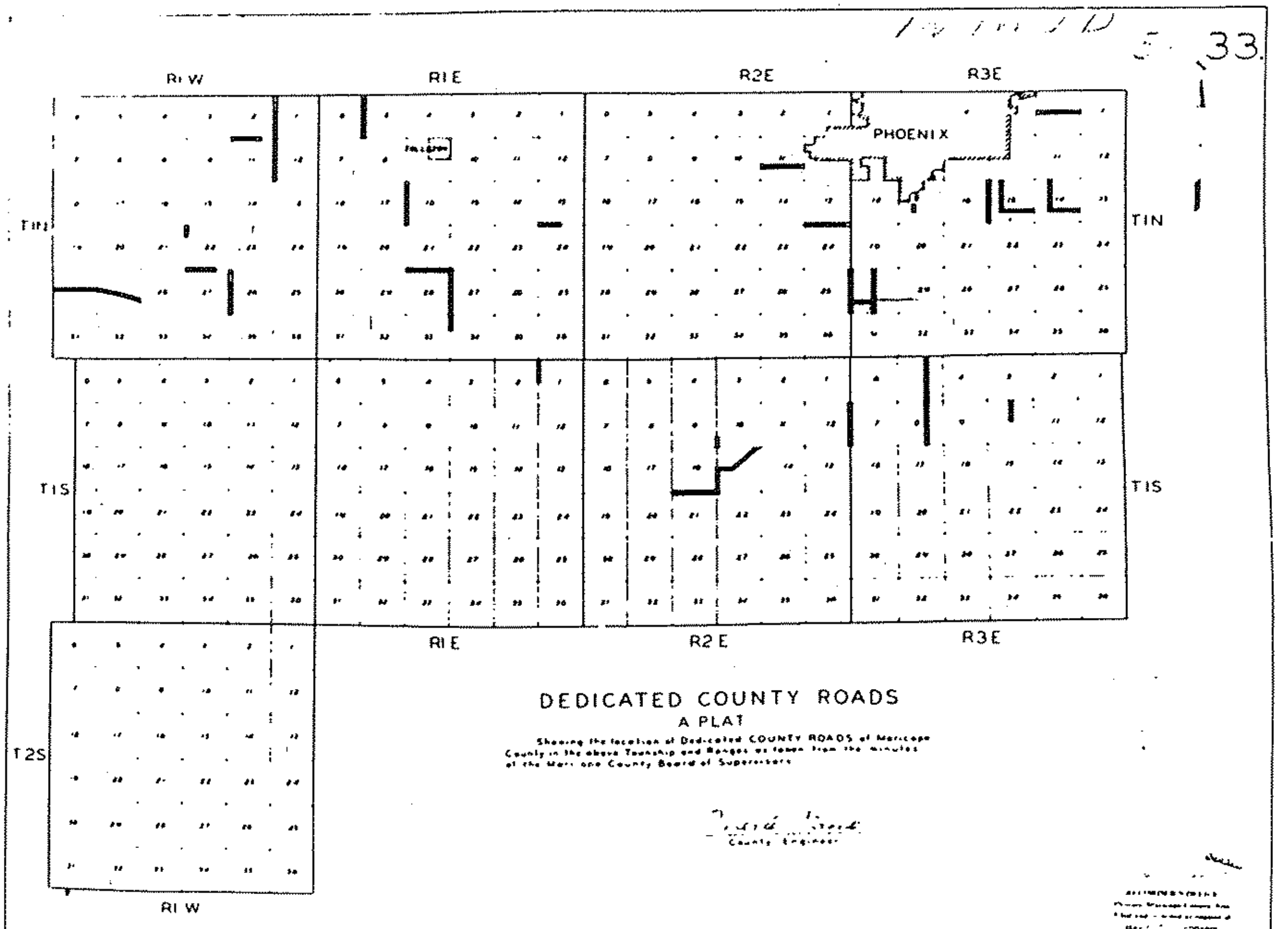
REFERENCE MAP SHEET NUMBER	SECTION TWN,RNG	ASSESSORS BK/MAP	RECORDERS BK/PAGE	HIGHWAY DEPT. INTEREST	FEE INTEREST	COUNTY AGENCY
36	26 T1S,R5W	401-33		D7738 D7736	None	None
36	27 T1S,R5W	401-33		D7739	401-33-018A	FCD
39	33 T1S,R5W	401-34			401-34-006B 401-34-0007	Sch. Dist. #47 Sch. Dist. #47
42	8 T2S,R5W	401-59		D9815	None	None
43	20 T2S,R5W	401-61		D16824	None	None
43	28 T2S,R5W	401-61		D13198 RF 1026 RS 2477	None	None
44	27 T2S,R5W	401-62		RF 1026 RS 2477	None	None
49	9 T4S,R4W	401-72		D8987	None	None
49	16 T4S,R4W	401-72		D8985	None	None
51	29 T4S,R4W	401-73		D15672	None	None
54	19 T5S,R4W	402-05		D9574 D9629	None	None
56	20 T5S,R5W	403-15		RF 553 D9504	None	None
56	1 T5S,R6W	403-15		D814	None	None
56	2 T5S,R6W	403-15		D814 D811	None	None
56	11,12 T5S,R6W	403-15		D818	None	None
69	17,19,22 T5S,R10W	403-29		D9315	None	None
69	20,21 T5S,R10W	403-29		D9318 D9363	None	None
70	28 T5S,R10W	403-30		D9293 D17361	None	None
70	29 T5S,R10W	403-30		D9318	None	None
70	32 T5S,R10W	403-30		D9317 D682	None	None
70	33 T5S,R10W	403-30		D9317 D10204	None	None

GILA RIVER

Maricopa County Road Plats

1N-1W S.D. 1 61





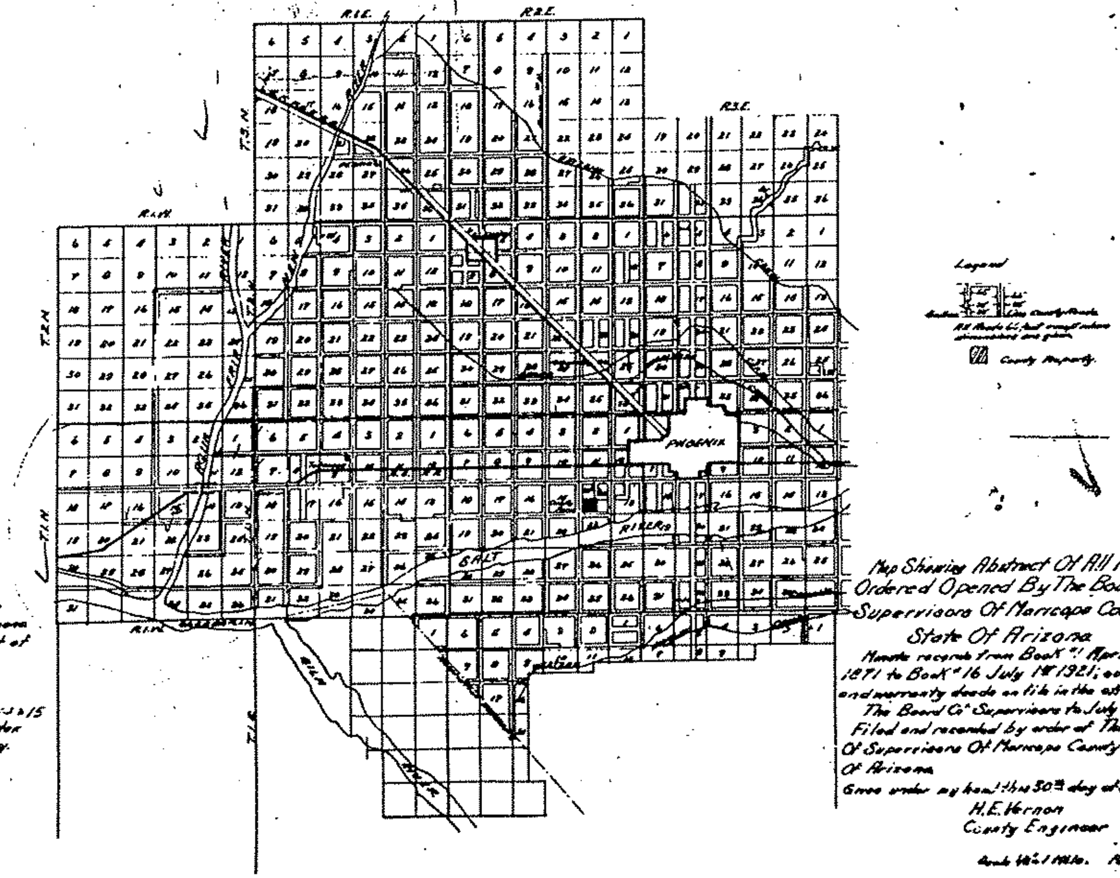
DEDICATED COUNTY ROADS

A PLAT

Showing the location of Dedicated COUNTY ROADS of Maricopa County in the above Township and Ranges as taken from the minutes of the Maricopa County Board of Supervisors

County Engineer

1N-1W-S.D. 2-14



15693 A
Recorders Office
Phoenix Maricopa Co. Arizona
Filed & Recorded at Request of
H. E Vernon
Date July 30th 1921
At 1:06 P.M.
Book 7 Co. Maps 13, 14 & 15
Edith M. Jacobs Recorder
K.P. Mausy Deputy.

Map Showing Abstract Of All Roads Ordered Opened By The Board Of Supervisors Of Maricopa County State Of Arizona

Minute records from Book No. 1 April 5th 1871 to Book No. 16 July 1st 1921; quitclaim and warranty deeds on file in the office of The Board Co. Supervisors to July 1st 1921

Filed and recorded by order of The Board Of Supervisors Of Maricopa County State Of Arizona

Given under my hand this 30th day of July 1921

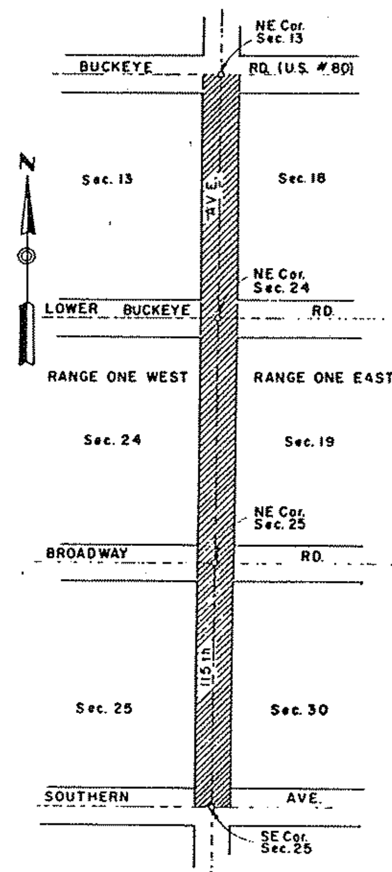
H.E. Vernon
County Engineer

Scale 1/2" = 1 Mile. Page 92

21·53

DESIGNATED COUNTY ROAD

A PLAT



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way beginning at the Southeast corner of Section Twenty-five(25), Township One(1) North, Range One(1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; thence Northerly to a terminus at the Northeast corner of Section Thirteen(13), of said Township and Range.

More commonly known as 115th AVENUE from SOUTHERN AVENUE to BUCKEYE ROAD (U.S. #80).

OFFICIALLY DESIGNATED BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA, on the 7th day of May, 1973.

R C Esterbrooks

R. C. ESTERBROOKS, P.E.
County Engineer

SEC 13,18,19,24,25,30, T1N-R1W & T1N-R1E

ROAD FILE NO 2225

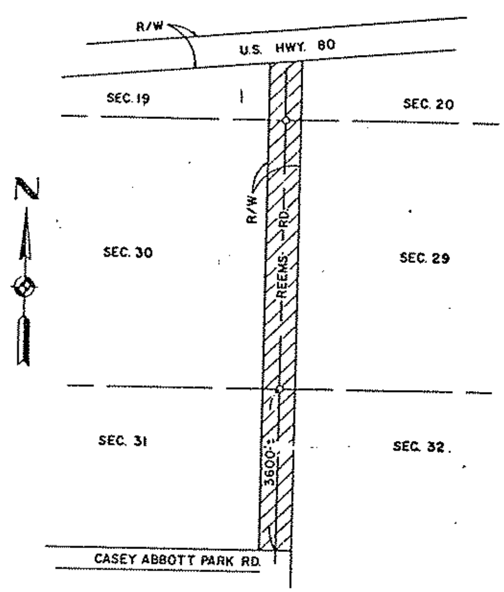
25-3

Sec 19,20,29,30,31 & 32 T1N R1W

DESIGNATED COUNTY ROAD

A PLAT

25-3



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way beginning at the Southerly right-of-way line of U. S. Highway 80 and extending Southerly along the line between Sections Nineteen(19) and Twenty (20), Twenty-nine(29) and Thirty(30), Thirty-one(31) and Thirty-two(32), all lying in Township One(1) North, Range One(1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona to Casey Abbott Park Road approximately 3600 feet South of the corner common to said Sections 29, 30, 31 and 32.

Also known as REEMS ROAD from U. S. HIGHWAY 80 to the CASEY ABBOTT PARK ROAD.

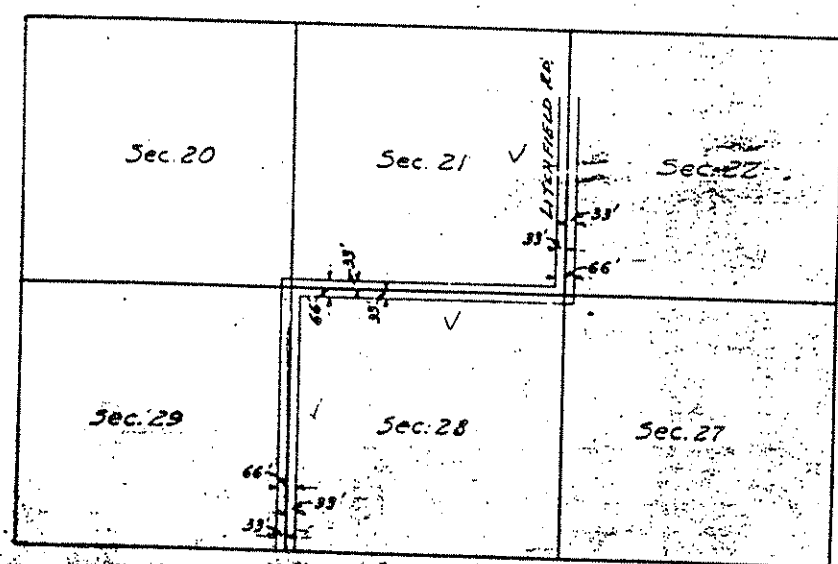
OFFICIALLY DESIGNATED on the 22nd day of February, 1978, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

F. H. LATHROP, P.E.
Deputy County Engineer.

SEC. 19, 20, 29, 30, 31 & 32. T1N, R1W.

ROAD FILE NO. 2589

T 1N. R 1W.



The foregoing plat shows the location of a county road 66 feet in width: 33 feet on each side of the section line. Beginning at the Buckeye Dam in the Southeast Corner of Section 29 – thence North to the Northeast Corner of said Section – thence East to the Northeast Corner of Section 28 – thence North ½ mile to the present road leading South from Avondale.

Given under my hand this 21st day of April, 1924.

J. L. Bone
County Engineer

[illegible] of the County Recorder, Maricopa [illegible]

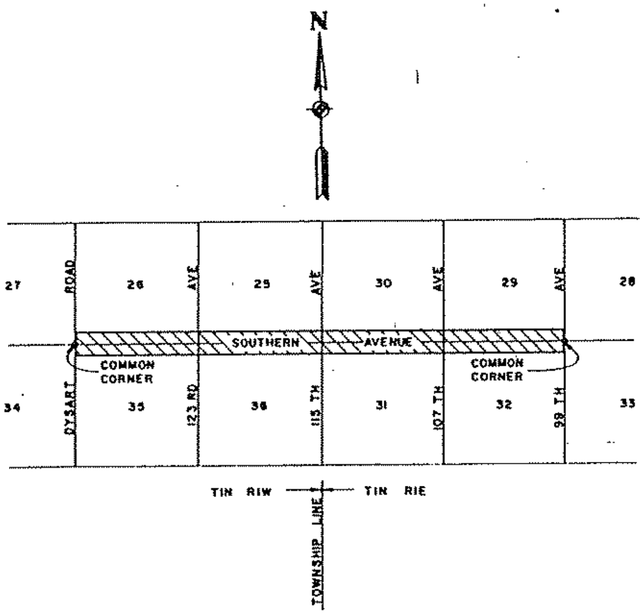
Secs. 28, 29, 30, 31, 32, 33 T1N, R1E
Secs. 25, 26, 27, 34, 35, 36 T1N, R1W

86 040947

DESIGNATED COUNTY ROAD

A PLAT

30-38
1-27-86



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way whose center line is described as follows:

Beginning at the section corner common with Sections Twenty-six (26), Twenty-seven (27), Thirty-four (34) and Thirty-five (35), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; THENCE East along the section line common to Sections Twenty-six (26), Thirty-five (35), Twenty-five (25) and Thirty-six (36), Township One (1) North, Range One (1) West and Sections Thirty (30), Thirty-one (31), Twenty-nine (29), Thirty-two (32), Township One (1) North, Range One (1) East to the terminus at the section corner common with Sections Twenty-eight (28), Twenty-nine (29), Thirty-two (32) and Thirty-three (33) all of said Base and Meridian.

Said roadway also known as Southern Avenue from Dysart Road to 99th Avenue.

OFFICIALLY DESIGNATED on the 4th day of November, 1985, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

A. W. Collins, P.E.
Deputy County Engineer

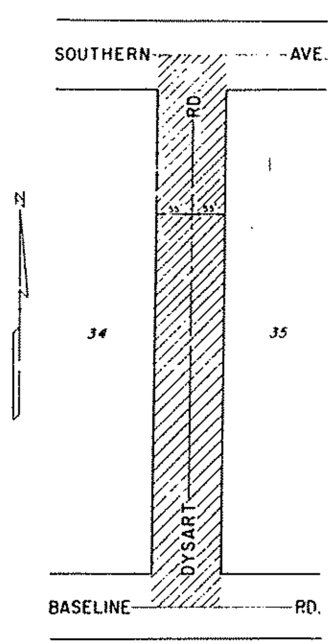
SEC. 25, 26, 27, 34, 35, 36 T1N R1W 28, 29, 30, 31, 32, 33 T1N R1E

ROAD FILE NO. 4063

17-52

DESIGNATED COUNTY ROAD

A PLAT



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway 110 feet in width described as follows: The East Fifty-five(55) feet of Section Thirty-four(34); The West Fifty-five(55) feet of Section Thirty-five(35), all being in Township One(1) North, Range One(1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. KNOWN AS DYSART ROAD FROM BASELINE ROAD NORTH TO SOUTHERN AVENUE.

OFFICIALLY DESIGNATED APRIL 3, 1967, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

SAMUEL F. LANFORD
COUNTY ENGINEER

INDEXED
PAGED
05-MISC
95025
STATE OF ARIZONA
County of Maricopa
County Highway
Book 17
page 52
County Recorder
Deputy Recorder

SEC.34 & 35 T.1N, R.1W

ROAD FILE No.1815

DESIGNATED COUNTY ROAD
A PLAT

15-99

ROAD FILE 1685

SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway Eighty (80) feet in width, being the East Forty (40) feet of Section Thirty-five (35) and the West Forty (40) feet of Section Thirty-six (36) in Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, known as El Mirage Road from Baseline Road North to Southern Avenue.

OFFICIALLY DESIGNATED AS A COUNTY HIGHWAY FEBRUARY 23, 1965, BY THE BOARD OF SUPERVISORS.

SAMUEL F. LANFORD,
COUNTY ENGINEER

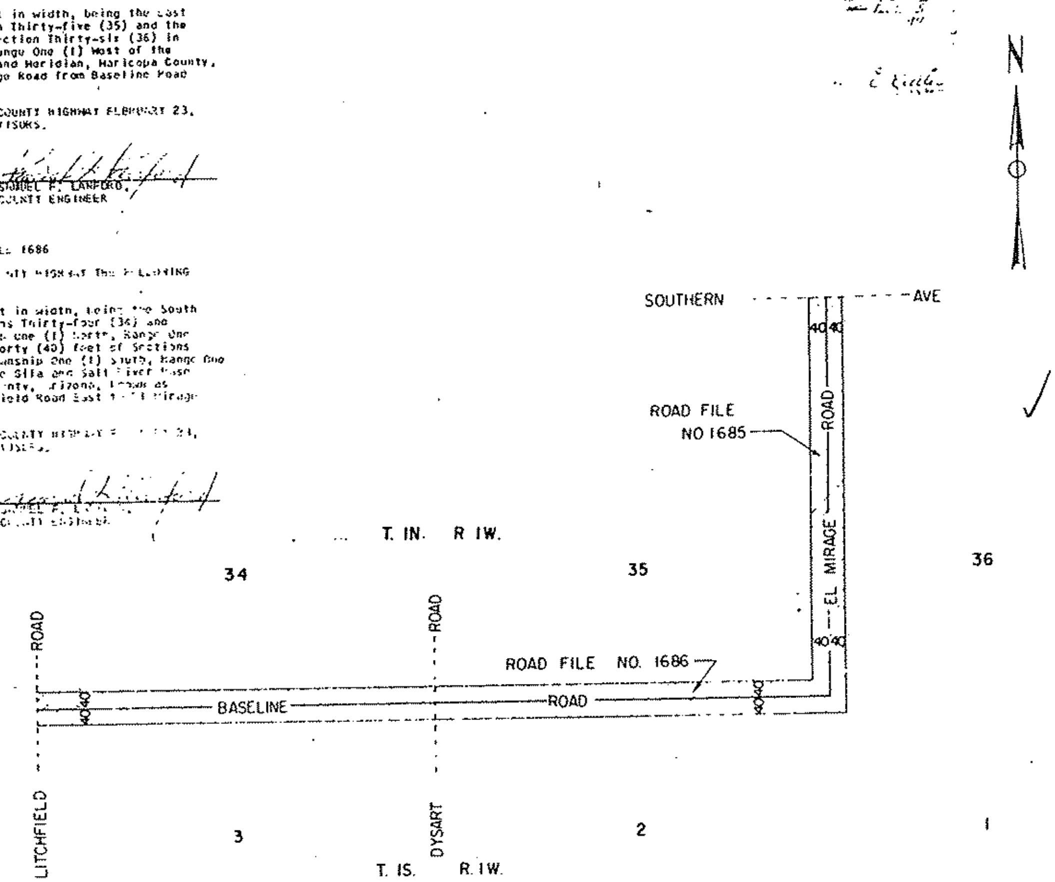
ROAD FILE 1686

SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway Eighty (80) feet in width, being the South Forty (40) feet of Sections Thirty-four (34) and Thirty-five (35), Township One (1) North, Range One (1) West, and the North Forty (40) feet of Sections Two (2) and Three (3), Township One (1) South, Range One (1) West, all being of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, known as Baseline Road from Litchfield Road East to El Mirage Road.

OFFICIALLY DESIGNATED AS A COUNTY HIGHWAY F[illegible] 23, 1965, BY THE BOARD OF SUPERVISORS.

SAMUEL F. L[illegible]
COUNTY ENGINEER



SEC. 34 35 36 T. IN. R IW.
SEC. 1 2 3 T. 1S. R. IW.

ROAD FILE NO. 1685-1686

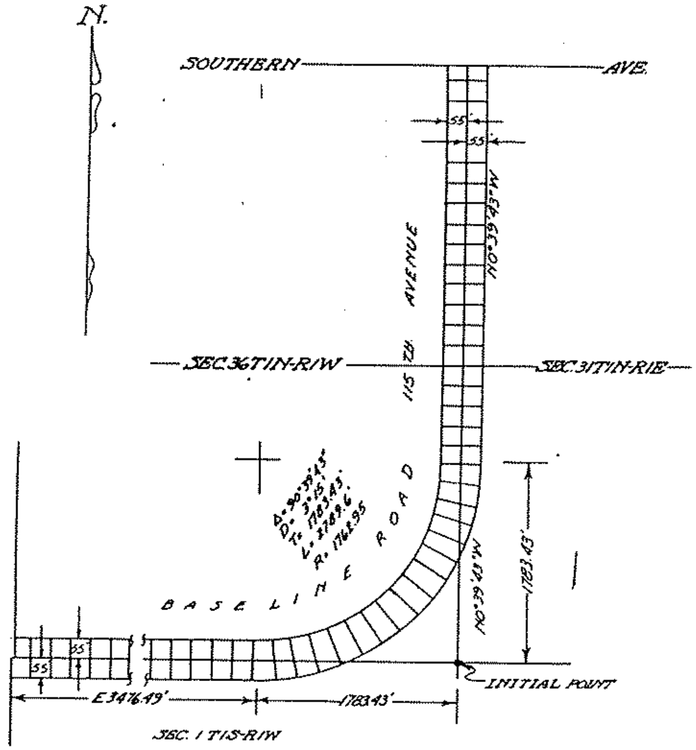
Sec. 36 – 1N 1W

15-19

DESIGNATED COUNTY ROAD
A PLAT

SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway 110 feet wide, being Fifty-five (55) feet on each side of the following described centerline: beginning at the Northwest corner of Section One (1) Township One (1) South, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; thence East along the section line common to said Section 1 and Section Thirty-six (36), Township One (1) North, Range One (1) West; for a distance of 3476.49 feet to the point of curve of a 3° 15' curve concave Northwesterly having a central angle of 90° 39' 43", said P.C. being 1783.43 feet West of the Initial Point; thence Northeasterly along the arc of said curve for a distance of 2789.6 feet to the point of tangent of said curve, said point of tangent being North 0° 39' 43" West 1783.43 feet from said Initial point and on the section line common to said Section 36, T1N, R1W and Section 31, T1N, R1E; thence North 0° 39' 43" West along the Section line common to Sections 31 and 36 to the North line of said Sections 31 and 36, more commonly known as Baseline Road from the Northwest corner of Section 1, to the point of angent on the East line of Section 36 and 115th Avenue from said point of tangent to Southern Avenue.



OFFICIALLY DESIGNATED SEPTEMBER 30, 1963 BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

193346

Samuel F. Lanford
Samuel F. Lanford,
County Engineer

County Highway

OCT 25 1963 3 20

Bk 15

19

E. Sell

By Deputy Recorder

SEC. 1 T1S-R1W, SEC.36T1N-R1W & SEC. 31, T1N-R1E

ROAD FILE No 1596

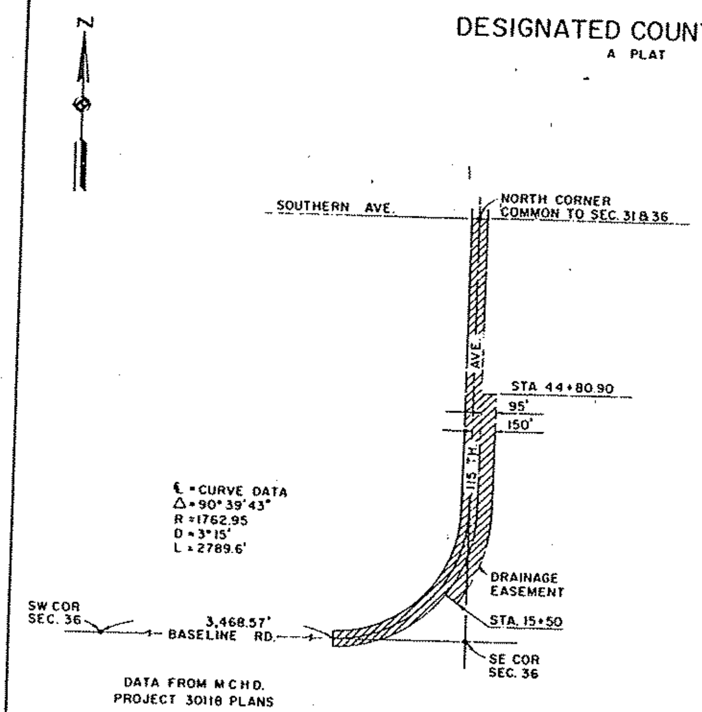
191496

DESIGNATED COUNTY ROAD

A PLAT

28-19

6-21-82



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A parcel of land lying in Section Thirty-six (36), Township One (1) North, Range One (1) West and Section Thirty-one (31), Township One (1) North, Range One (1) East all in the Gila and Salt River Base and Meridian, Maricopa County, Arizona more particularly described as follows:

A roadway of a width consistent with the right-of-way and including a Drainage Easement lying within a strip of land 150 feet wide (measured at right angles and radially) in a Southeasterly and Easterly direction from the following described center line beginning at Engineer's Highway Station 15+50 and extending to Engineer's Highway Station 44+80.90 as shown on the approved plans for Maricopa County Highway Department - Work Order No. 30118 - 115th Avenue at the Gila River:

Beginning at the Southwest corner of said Section 36; thence East (assumed bearing), 3468.57 feet along the South line of said Section 36 to the true point of beginning for this road right-of-way, said point being also the beginning of a 3°15' curve concave Northwesterly having a central angle of 90°39'43" and a radius of 1762.95 feet; thence in an Easterly and Northerly direction along said curve 2789.6 feet to a point on the East line of said Section 36 and the Northerly end of said curve; thence Northerly along the East line of said Section 36 to the North cor... common to said Section 36 and Section 31.

Also known as 115th Avenue from Southern Avenue to Baseline Road Alignment.

OFFICIALLY DESIGNATED on the 7th day of June, 1982, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

F. H. Lathrop, P.E.
Deputy County Engineer

SEC. 36 T1N R1W, SEC. 31 T1N R1E

ROAD FILE NO. 2904

Secs. 35, 36 T1N, R1W -
Secs. 1, 2 T1S - R1W

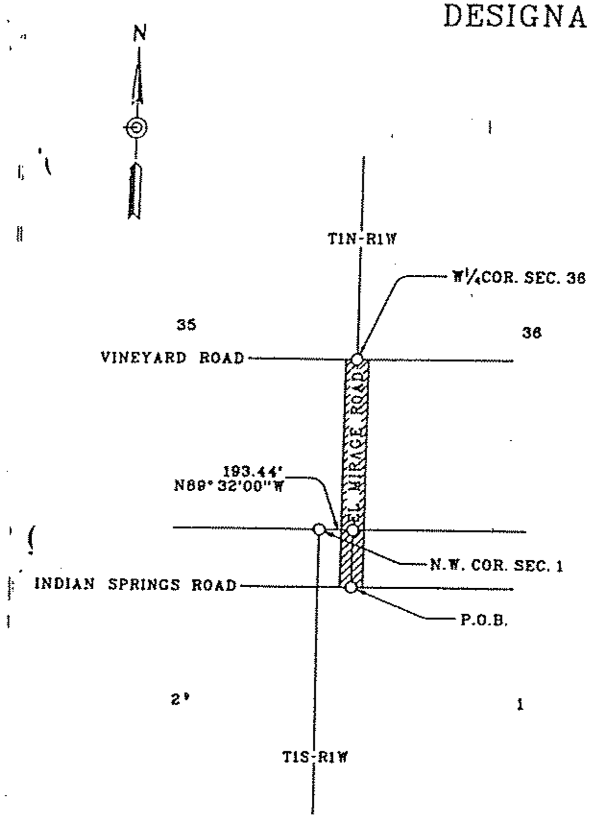
33-56

DESIGNATED COUNTY ROAD

A PLAT

33-56

90 20566



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of width consistent with the right-of-way lying within Sections One (1) and Two (2), Township One (1) South, Range One (1) West, and Sections Thirty-five (35) and Thirty-six (36), Township One (1) North, Range One (1) West, all in the Gila and Salt River Base and Meridian, Maricopa County, Arizona, whose centerline is described as follows:

BEGINNING at a point on the centerline intersection of Indian Springs Road and El Mirage Road, said centerline of El Mirage Road being East and parallel with the West line of said Section 1; THENCE North along said centerline of El Mirage Road to the North line of said Section 1, Township One (1) South, Range One (1) West, from which the Northwest corner of said Section 1, bears North 89°32'00" West, a distance of 193.44 feet (193.36 feet G.L.O.); THENCE, continuing North along the West line of Section 36, Township One (1) North, Range One (1) West to the West one-quarter (W1/4) corner thereof, and the terminus of the herein described centerline.

Said roadway also known as El Mirage Road (123rd Avenue) from Indian Springs Road to Vineyard Road; lying within an unincorporated area, and lying within a portion of the incorporated area of the City of Avondale.

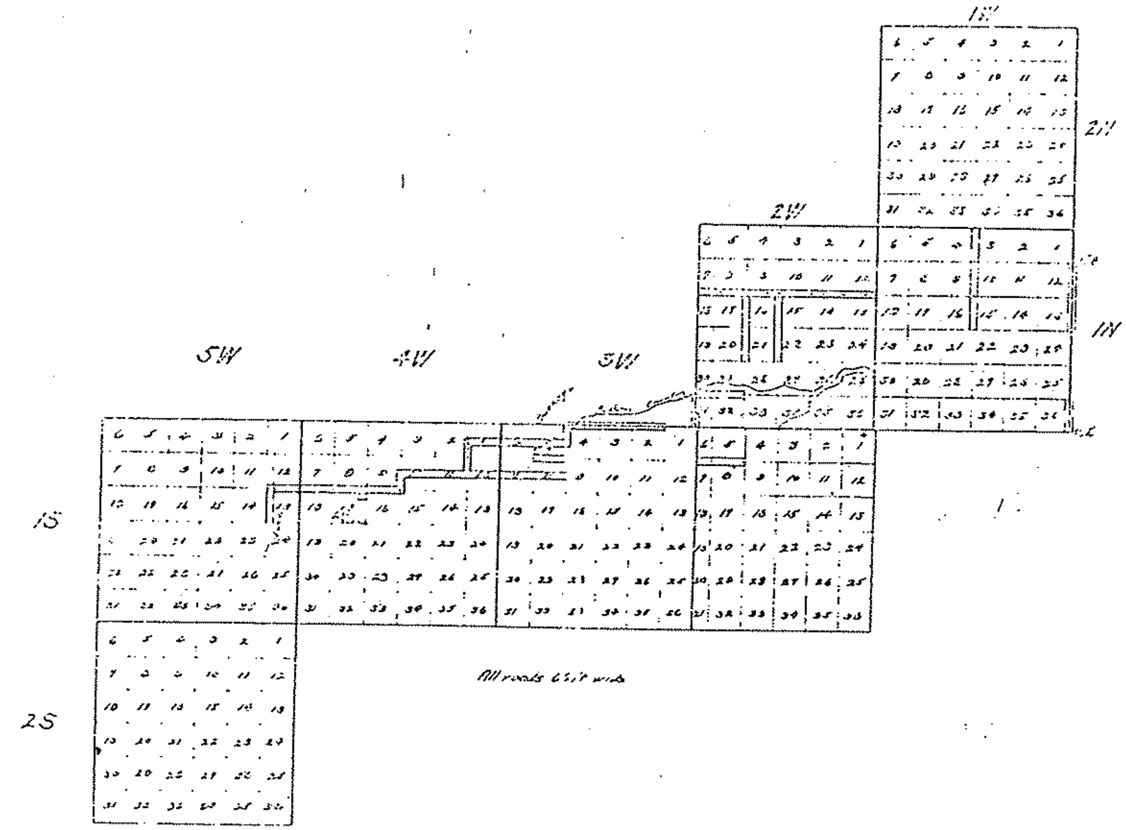
OFFICIALLY DESIGNATED on the 5th day of February, 1990, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

D. C. BLACK, P.E.
COUNTY ENGINEER

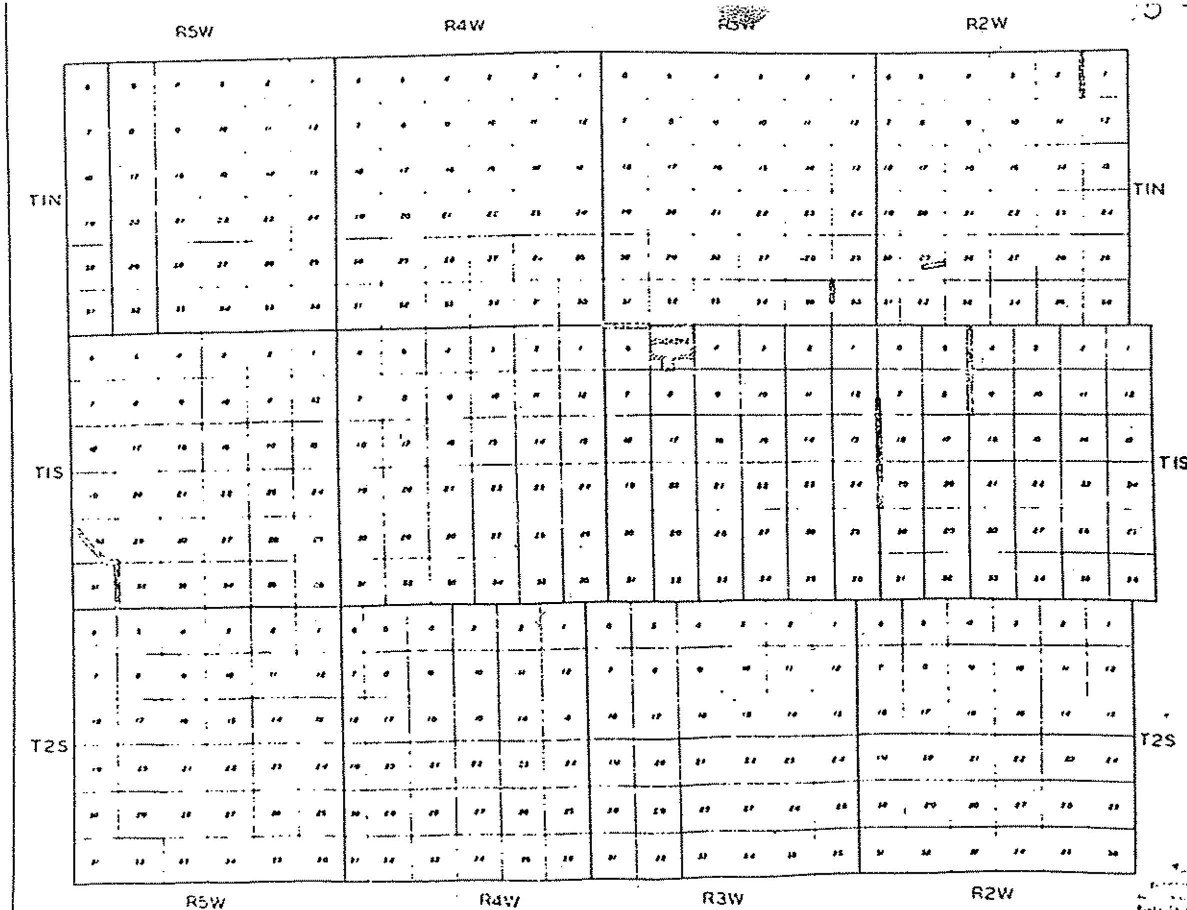
In Book 33
Page 56

SEC. 1,2 T1S-R1W 35,36 T1N-R1W

ROAD FILE NO. 4477



1E
2N
2W
1N
5W
4W
3W
1S
2S
All roads 66 ft wide



DEDICATED COUNTY ROADS

A PLAT

Showing the location of Dedicated COUNTY ROADS of Maricopa County in the above Township and Ranges as taken from the minutes of the Maricopa County Board of Supervisors

County Engineer.

10 - 2 [illegible]

DESIGNATED COUNTY ROAD
A PLAT

[illegible]

A roadway being [illegible] feet in width and being [illegible] feet (except as later noted) on each side of the following described center line: Commencing at the 1/4 corner common to Sections 3 and 2, [illegible], said 1/4 corner being a P.O.T.; thence N 0° [illegible] 29.03 feet to the true point of beginning and Engineers Station 237 + 30.10, the P.C. of a curve to the [illegible] having a radius of [illegible] feet and a central angle of [illegible]; thence along said curve to the [illegible] feet to the P.T., Engineers Station [illegible]; [illegible] feet across a portion of said Section 3 and [illegible] to Engineers Station [illegible], the P.C. [illegible] having a radius of [illegible] feet and a central [illegible]; thence along said curve to the [illegible] feet to Engineers Station [illegible] P.T.; [illegible] Sections [illegible] and [illegible] to Engineers Station [illegible], [illegible] corner of said Section [illegible]; thence by an angle of [illegible], N 0° [illegible] E, [illegible] feet along the Section line common to Sections 20 and 21, and [illegible], T1S, [illegible], to Engineers Station [illegible], the 1/4 corner common to said Sections 16 and 17; thence by an angle of [illegible] left, N 0° [illegible] W, 2,635.10 feet along the Section line common to said Sections 16 and 17 to Engineers Station [illegible], the [illegible] of said Section 17; thence by an angle of [illegible] left, S [illegible] W 2,[illegible] feet [illegible] to Engineers Station [illegible], [illegible] 1/4 corner [illegible] said Sections [illegible]; thence by an angle of [illegible] right, N 2° [illegible] E, 1223.16 feet along the [illegible] center line of said Section 8 to Engineers Station 546 + 73.40, the P.C. of a curve to the left having a radius of 5729.58 feet and a central angle of 14° 45' 00"; thence along said curve to the left, 1430.[illegible] feet to Engineers Station 561 + 51.40 P.T.; thence N 12° [illegible] W 415.60 feet to Engineers Station 565 + 21.[illegible], the P.C. of a curve to the right having a radius of [illegible]015.57 and a central angle of 2[illegible]° 41' 00"; thence along said curve to the right [illegible]2.23 feet to Engineers Station 581 + 03.25 P.T.; thence N 17° 28' 00" E, 2[illegible] feet to Engineers Station 584 + 75.[illegible], the P.C. of a curve to the left having a radius of [illegible]51.75 feet and a central angle of [illegible] 00"; thence along said curve to the left 521.57 feet to Engineers Station 592 + 97.61 P.T.; thence N [illegible] 12' 00" E, 2,[illegible] feet to Engineers Station 621 + 36.[illegible]; thence by an angle of [illegible] 00" right, N 2° 37' 00" E, 1,3[illegible].92 feet to Engineers Station 634 + 37.60, the N 1/4 corner of Section 5, T1S, R.[illegible] G&SRB&M, the end.

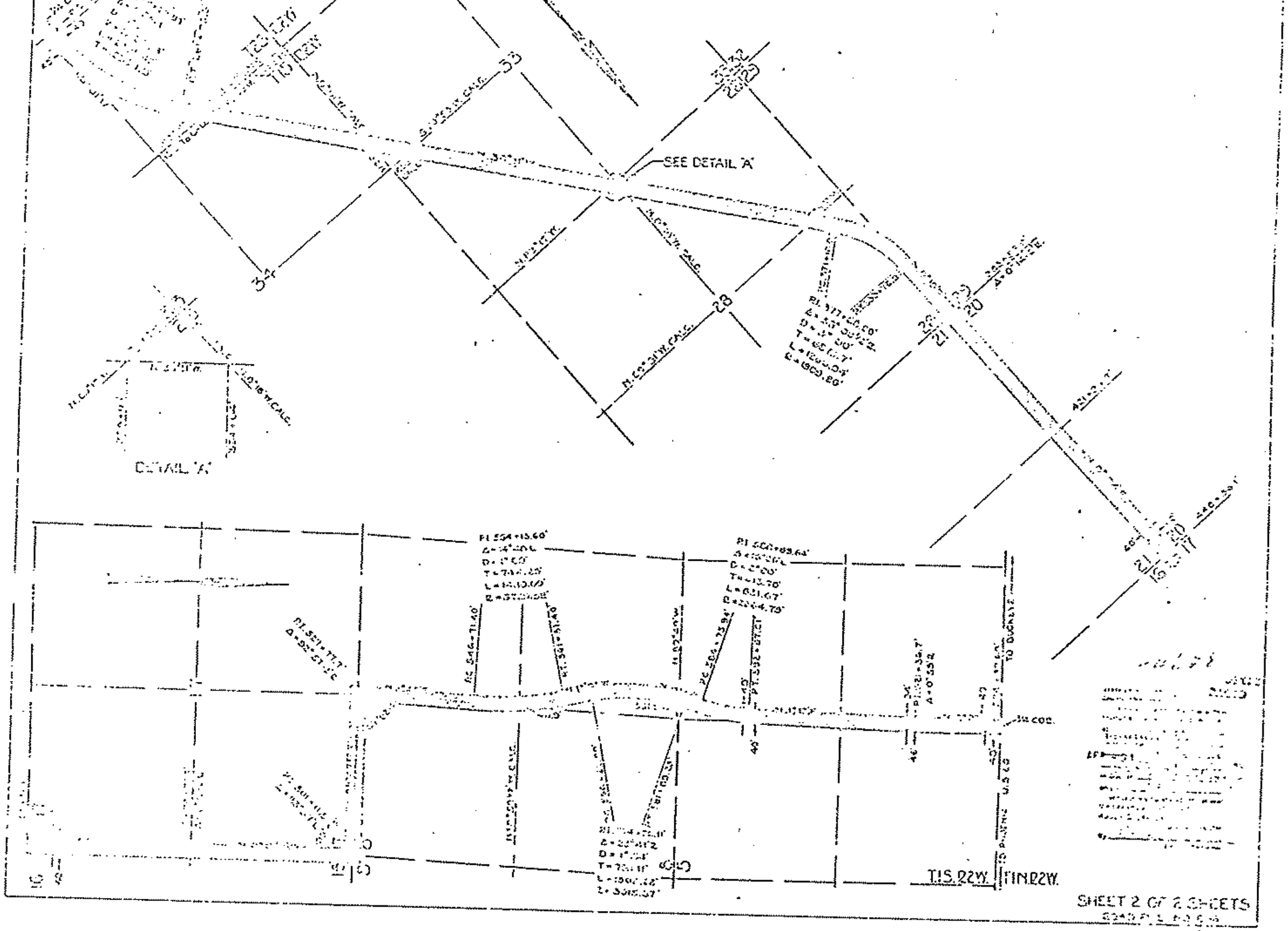
On the left side, the roadway width shall vary uniformly from 43 feet at Engineers Station 592 + 97.61 to 34 feet at Engineers Station 621 + 36.10 to 40 feet at Engineers Station 634 + 37.60. On the right side, the roadway width shall vary uniformly from 43 feet at Engineers Station 592 + 97.61 to 4[illegible] feet at Engineers Station 621 + 36.10 to 40 feet at Engineers Station 634 + 37.60.

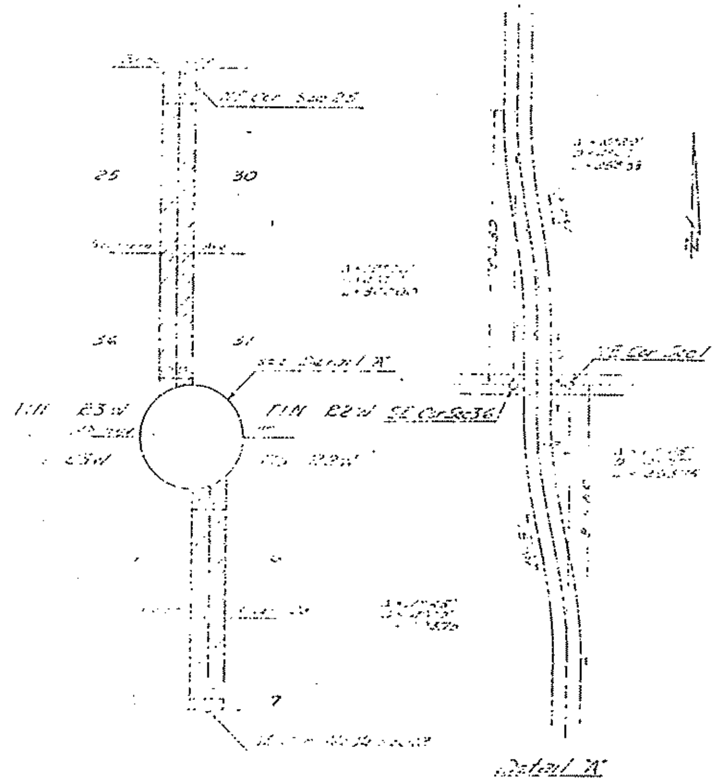
Officially designated July 21, 1959, by the Board of Supervisors of Maricopa County, Arizona.

[illegible]
County Engineer

[illegible]

SHEET 1 OF 2 SHEETS
[illegible]

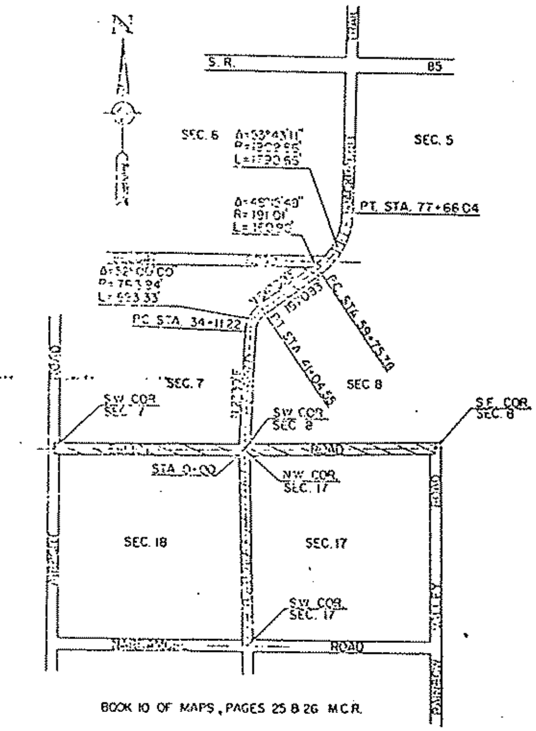

SEE DETAIL 'A'
DETAIL 'A'
33
34
28
29
20
21
T.1S. R.22W.
T.1N. R.22W.
SHEET 2 OF 2 SHEETS


25
30
36
31
T1N R22W
SE Cor Sec 36
7
Detail "A"

25-3
9-17-80

DESIGNATED COUNTY ROAD

A PLAT



BOOK 10 OF MAPS, PAGES 25 & 26 M.C.R.

SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way extending from the Southwest corner of Section Eight (8), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona to the Southwest corner of said Section 8 with said Southwest corner of Section 8 being also designated as Engineers Highway Station 0+00 as shown on the plans for Tuthill Road Bridge Approaches, Maricopa County Highway Department Work Order #6508; thence North 2°39' East (M.C.H. Bearing) along the West line of said Section 5 to Engineers Highway Station 34+11.22 and the beginning of a curve concave southeasterly having a radius of 753.94 feet and a central angle of 52°00'00"; thence along the arc of said curve 693.33 feet in a Northerly and Northeasterly direction to Engineers Highway Station 41+04.55 and the beginning of a tangent; thence North 54°39' East, 1870.53 feet to Engineers Highway Station 59+75.38 and the beginning of a curve concave Northwesterly having a radius of 1999.65 feet and a central angle of 53°43'11"; thence along the arc of said curve 1790.65 feet in a Northeasterly and Northerly direction to the beginning of a tangent that is also the center line of the existing Rainbow Valley Road as shown in Book 10 of Road Maps, Pages 25 and 26 M.C.R. and the Point of Ending for said center line. Also known as Elliot Road from Rainbow Valley Road approximately 3/4 mile south of the Phoenix-Buckeye Highway.

Also a roadway of a width consistent with the right-of-way extending from the Southwest corner of Section Seventeen (17) to the Northwest corner of Section Seventeen (17) and the Southwest corner of Section Eight (8). Also known as Tuthill Road from Narramore to Elliot.

Also a roadway of a width consistent with the right-of-way extending from the Southwest corner of Section Seven (7) to the Southwest corner of Section Eight (8) all being in Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

Also known as Elliot Road from Airport Road to Tuthill Road.

OFFICIALLY DESIGNATED on the 2nd day of September, 1980, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

SEP 22 1980 2 18

R. H. Leitner, P.E.
Deputy County Engineer

SEC 5,6,7,8,17,18 - T.1S, R.2W.

ROAD FILE NO. 2738

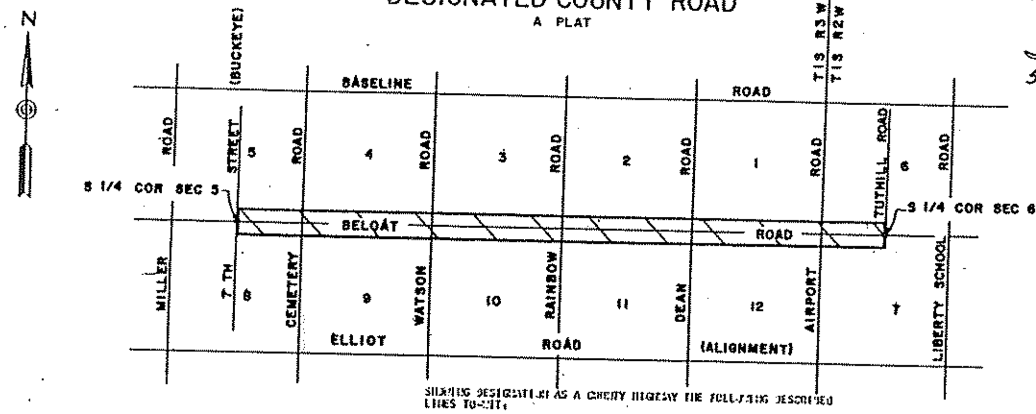
Secs. 1,2,3,4,5,8,9,10,11,12 T1S, R3W

DESIGNATED COUNTY ROAD

A PLAT

-86-245161

30-58
5-19-86



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way described as; BEGINNING at the South one-quarter (S¼) corner of Section Five (5) in Township One (1) South, Range Three (3) West; THENCE East along the South lines of Sections Five (5), Four (4), Three (3), Two (2) and One (1) all in said Township One (1) South, Range Three (3) West, to the Southwest corner of Section Six (6) in Township One (1) South, Range Two (2) West; THENCE continuing East along the South line of said Section 6, to the terminus at the South one-quarter (S¼) corner of said Section 6, all in the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

Said roadway also known as Beloat Road from 7th Street to Tuthill Road.

OFFICIALLY DESIGNATED on the 24th day of February, 1986, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

A. W. Collins
A. W. Collins, P.E.
Deputy County Engineer

County Highway Dept.
MAY 19 1986
30
58

Sec 6, 7, - T1S - R2W

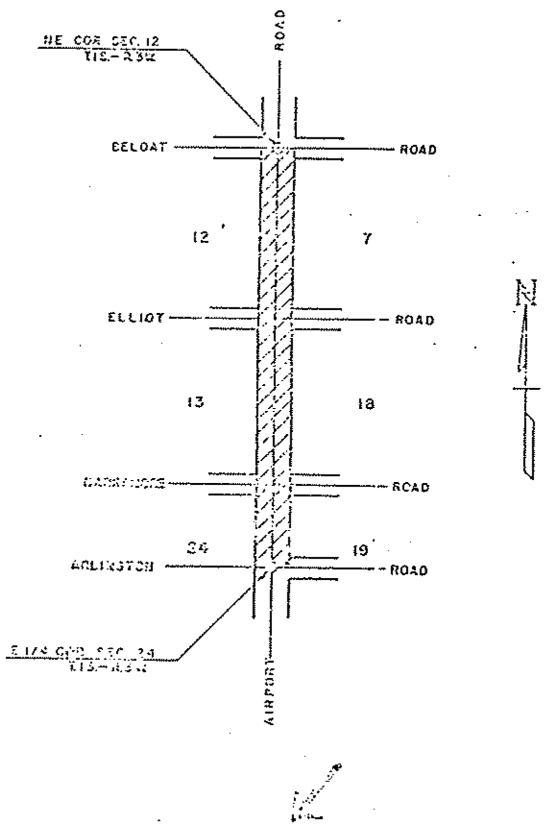
SEC. 6, 7 T1S R2W & SEC 1, 2, 3, 4, 5, 8, 9, 10, 11, 12 T1S R3W

ROAD FILE NO. 4129

20-56

DESIGNATED COUNTY ROAD

A PLAT



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way beginning at the one-quarter corner common to Section Twenty-four (24), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, and Section Nineteen (19), Township One(1) South, Range Two(2) West of said Base and Meridian; thence Northerly to a terminus at the Northeast corner of Section Twelve(12), Township One(1) South, Range Three(3) West of said Base and Meridian.

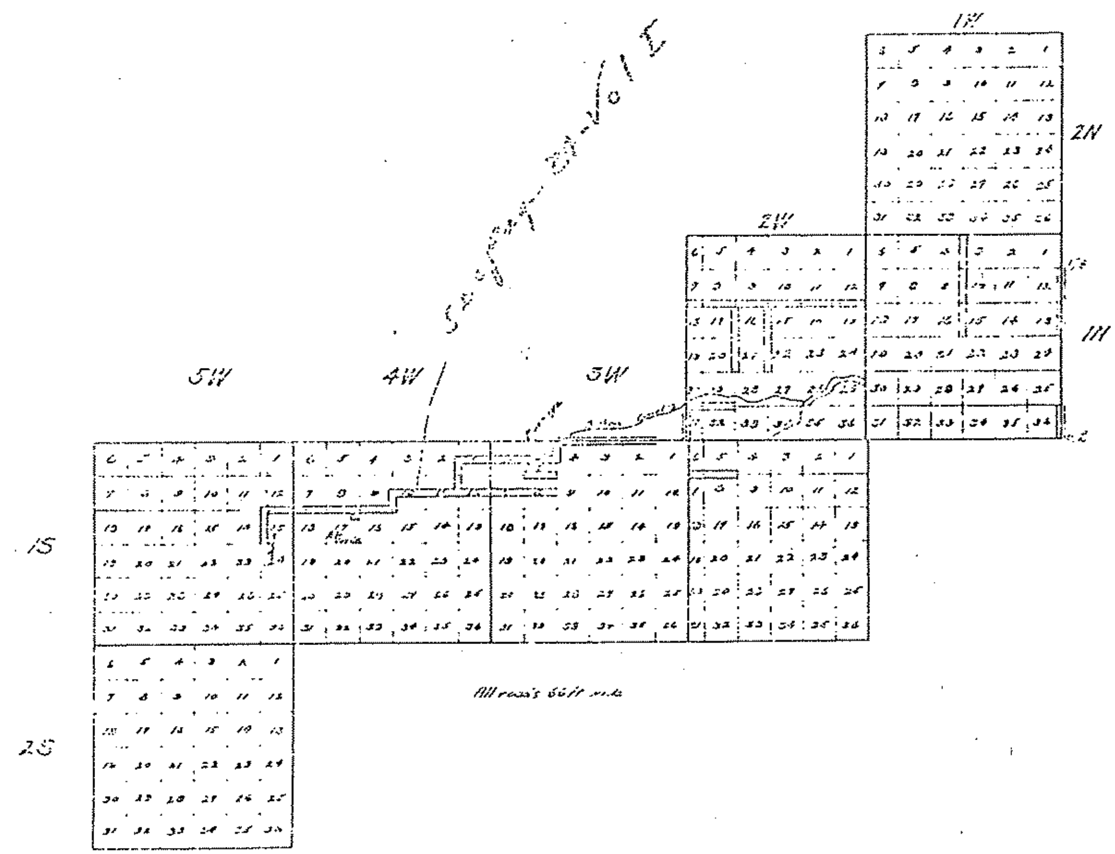
More commonly known as AIRPORT ROAD from ARLINGTON ROAD to BELOAT ROAD.

OFFICIALLY DESIGNATED on the 26th day of October, 1971, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

County Engineer

SECTIONS 7, 18, 19, T.1S.-R.2W. & SECTIONS 12, 13, 24, T.1S.-R.3W.

ROAD FILE NO. 2116


1W
2N
2W
1N
5W
4W
3W
1S
2S
All roads 66 ft wide

5 - 55.

DEDICATED COUNTY ROADS

A PLAT

Showing the location of Dedicated COUNTY ROADS of Maricopa County in the above Township and Ranges as taken from the minutes of the Maricopa County Board of Supervisors

County Engineer.

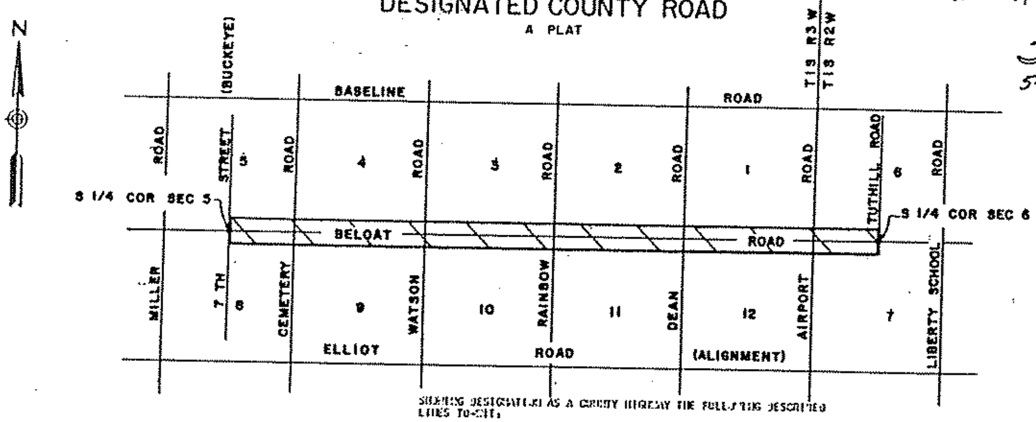
Secs. 1,2,3,4,5,8,9,10,11,12 T 1S, R3W

DESIGNATED COUNTY ROAD

A PLAT

86-245161

30-58
5-19-86



SHOWING DESIGNATED AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way described as; BEGINNING at the South one-quarter (S¼) corner of Section Five (5) in Township One (1) South, Range Three (3) West; THENCE East along the South lines of Sections Five (5), Four (4), Three (3), Two (2) and One (1) all in said Township One (1) South, Range Three (3) West, to the South... corner of Section Six (6) in Township One (1) South, Range Two (2) West; THENCE continuing East along the South line of said Section 6, to the terminus at the South one-quarter (S¼) corner of said Section 6, all in the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

Said roadway also known as Beloat Road from 7th Street to Tuthill Road.

OFFICIALLY DESIGNATED on the 24th day of February, 1986, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

A. W. Collins, P.E.
Deputy County Engineer

County Highway Dept.
MAY 19 1986
30
58

SEC. 6, 7 T1S R2W & SEC 1, 2, 3, 4, 5, 8, 9, 10, 11, 12 T1S R3W

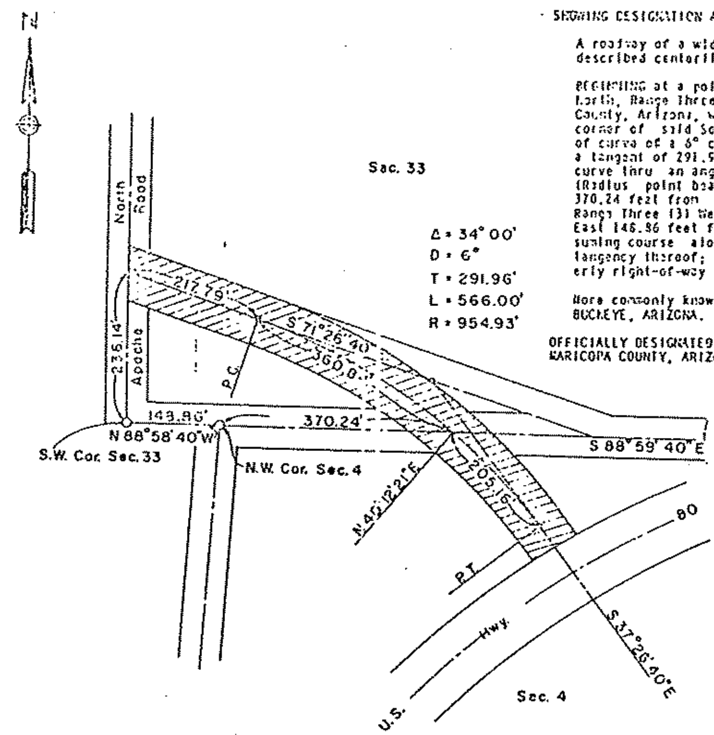
ROAD FILE NO. 4129

Secs - 1,2,3,4,5,8,9,10,11,12 T1S- R3W

DESIGNATED COUNTY ROAD

21-69

A PLAT



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way on each side of the following described centerline:

BEGINNING at a point on the West line of Section Thirty-three (33), Township One (1) North, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, which lies North (assumed bearing) 236.14 feet from the Southwest corner of said Section 33; thence South 71°26'40" East 217.79 feet to the point of curve of a 6° curve concave Southwesterly having a central angle of 34°00', and a tangent of 291.96 feet; thence Southeasterly 360.84 feet along the arc of said curve thru an angle of 21°39'01" to a point on the South line of said Section 33 (Radius point bears South 40°12'21" West), which point lies South 88°59'40" East 370.24 feet from the Northwest corner of Section Four (4), Township One (1) South, Range Three (3) West of said Base and Meridian, which in turn lies South 88°58'40" East 146.96 feet from the said Southwest corner of said Section 33; thence resuming course along said curve 205.16 feet into said Section 4 to the point of tangency thereof; thence South 37°26'40" East approximately 40 feet to the westerly right-of-way line of U.S. Highway No. 80.

More commonly known as a connection between BASELINE ROAD and U.S. #80 near BUCKEYE, ARIZONA.

OFFICIALLY DESIGNATED on the 24th day of September, 1973, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

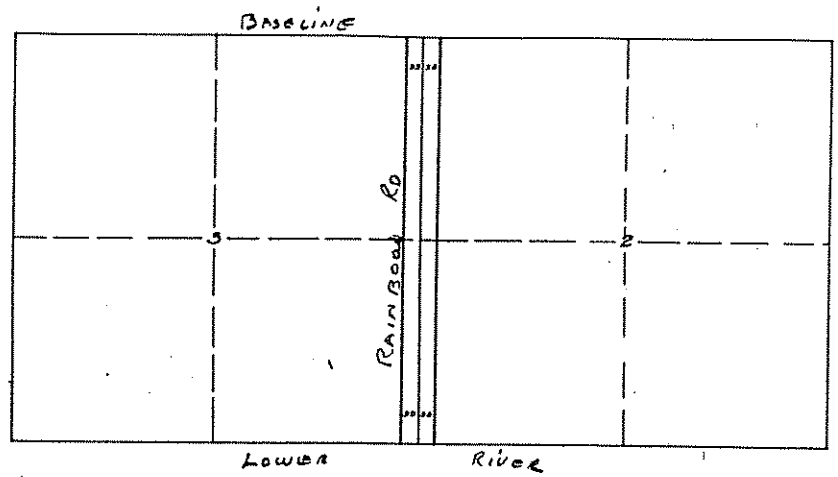
R. C. [illegible], P.E.
County Engineer

OCT 16

SEC. 33, T1N-R3W
SEC. 4, T1S-R3W

ROAD FILE NO. 2244

T.1.S. R.3.W.



State of Arizona
Maricopa County } ss

The foregoing plat shows the location of a county road 66 feet in width and 1 mile in length, running North & South between Sections 2 & 3, of Township 1 South, Range 3 West, G & S.R.B & M, said road to be 33 feet on each side of the Section line.

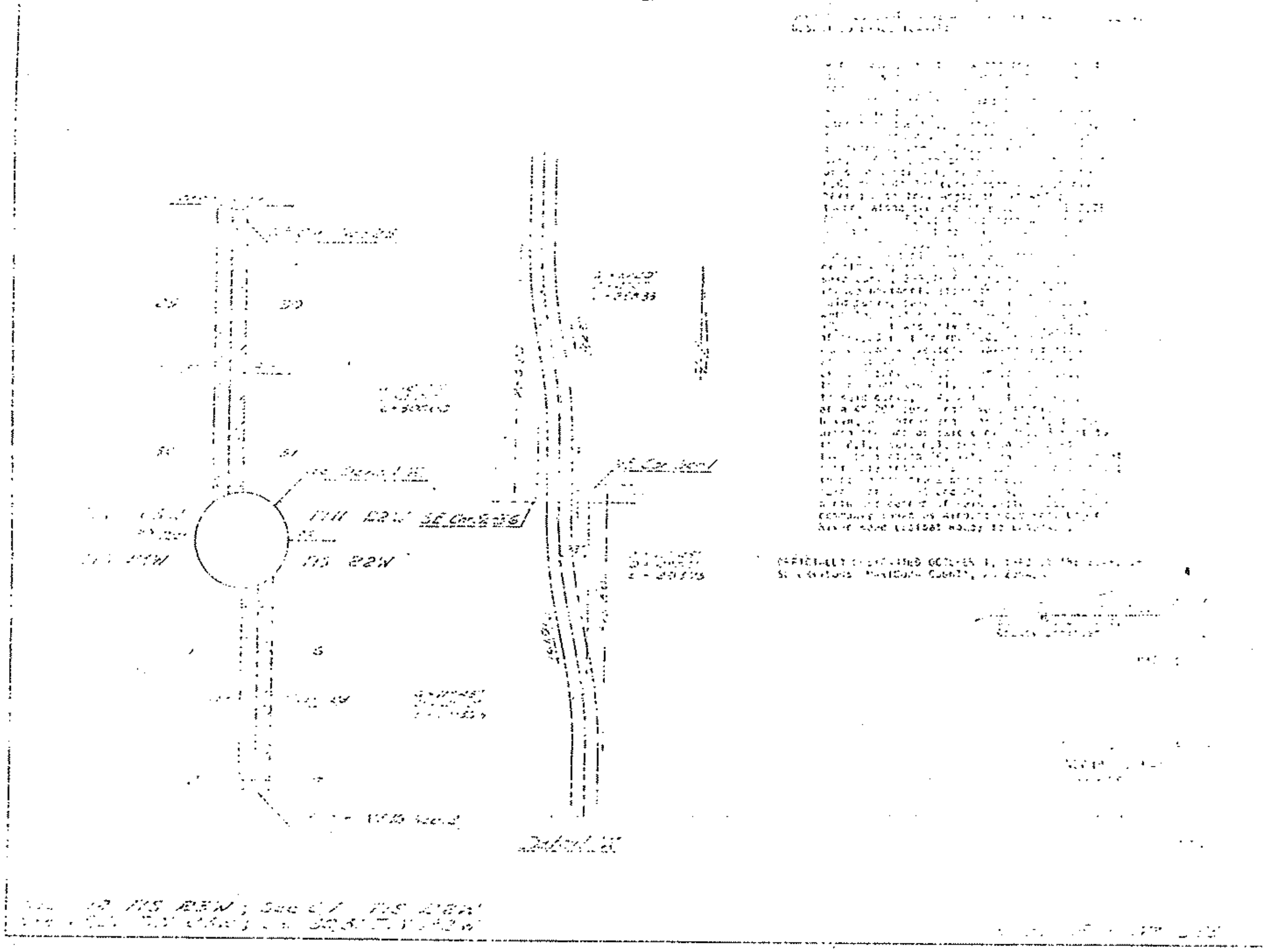
Established by order of the Board of Supervisors on June 19, 1916.

Given under my hand this 19th day of July 1916

H. M. Bergman
County Engineer

95-4

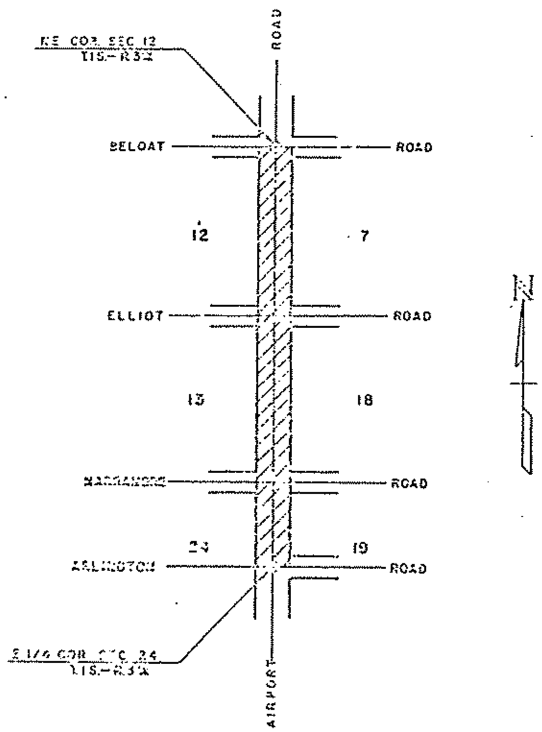
RECORDER'S OFFICE
Maricopa Co., Arizona:
Filed and recorded at request of H. M. Bergman
JUL 20 1916
1 Road Maps
County Recorder
By J. T. Hudson
Deputy



20-50

DESIGNATED COUNTY ROAD

A PLAT



SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way beginning at the one-quarter corner common to Section Twenty-four (24), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, and Section Nineteen (19), Township One(1) South, Range Two(2) West of said Base and Meridian; thence Northerly to a terminus at the North-east corner of Section Twelve(12), Township One(1) South, Range Three(3) West of said Base and Meridian.

More commonly known as AIRPORT ROAD from ARLINGTON ROAD to BELOAT ROAD.

OFFICIALLY DESIGNATED on the 26th day of October, 1971, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

R. C. Esterbrooks, P.E.
County Engineer

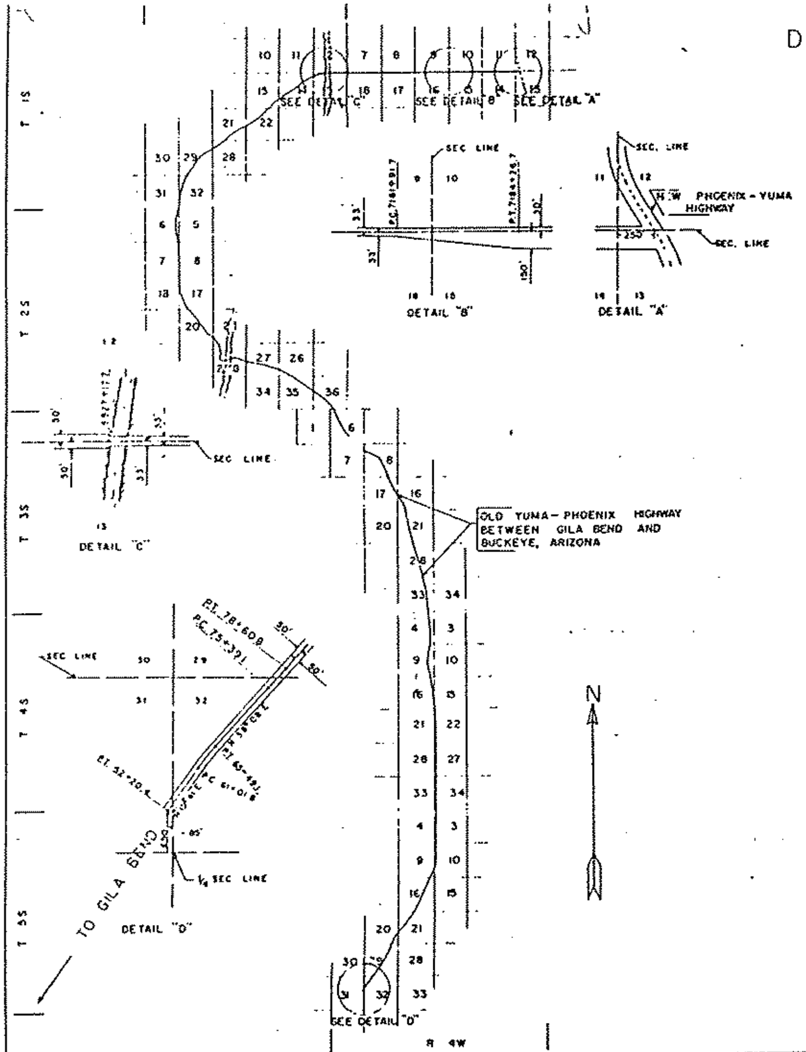
SECTIONS 7, 18, 19, T1S.-R.2W. & SECTIONS 12, 13, 24, T.1S.-R.3W.

ROAD FILE NO. 2116

DESIGNATED COUNTY ROAD

A PLAT

FEB 23 1957



Showing designation as a County Highway the following described lines, to-wit:

The old Yuma-Phoenix Highway, between Gila Bend and Buckeye, Arizona, in accordance with maps and plats on file in the office of the State Highway Engineer and the Maricopa County Engineer's office: Beginning at a point lying within the SE¼ NE¼ of Section 31, Township 5 South, Range 4 West, G&SRB&M, Maricopa County, State of Arizona, at Highway Engineer's Station P.T. 52+20.4, said point being approximately 85 feet westerly of and 650 feet northerly of the east quarter corner of said Section 31; thence with a right-of-way 100 feet in width 50 feet on each side of the centerline of the constructed highway in a general northerly direction traversing the NE¼ of said Section 31 and Sections 32, 29, 20, 21, 16, 9, 10, and 3, Township 5 South, Range 4 West, Sections 34, 27, 22, 15, 16, 9, and 4, Township 4 South, Range 4 West, Sections 33, 28, 21, 16, 17, 8, 7, and 6, Township 3 South, Range 4 West, Sections 36, 35, 26, 27, 28, 21, 20, 17, 18, 7, 8, 5, and 6, Township 2 South, Range 5 West, Sections 31, 32, 29, 28, 21, 22, 15, 14, 13, and to Station 6927+17.7 near the quarter corner common to Sections 12 and 13 in Township 1 South, Range 5 West, said Station being the end of the 100-foot right-of-way and the beginning of a 66-foot right of way, 33 feet on each side of the section line; thence easterly along the section line, between Sections 12 and 13 in Township 1 South, Range 5 West and Sections 7 and 18, 8 and 17, to Station 7161+91.7 the P.C. of a curve being a point on the Section line between Sections 9 and 16, and the end of the 66-foot right-of-way; thence easterly to Station 7184+26.7 the P.T. of a curve from where the right-of-way has gradually increased to 30 feet to the north side of the section line and 150 feet to the south side of the section line; thence easterly along the section line between Sections 10 and 15, 11 and 14, 12 and 13, Township 1 South, Range 4 West, having a right-of-way 180 feet in width, with 30 feet on the north side of the section line and 150 feet on the south side of the section line and extending to the intersection with the new location of the Phoenix-Yuma Highway located approximately 250 feet easterly along the section line from the southwest corner of Section 12, Township 1 South, Range 4 West, said road being the part abandoned by the State of Arizona, June 19, 1956.

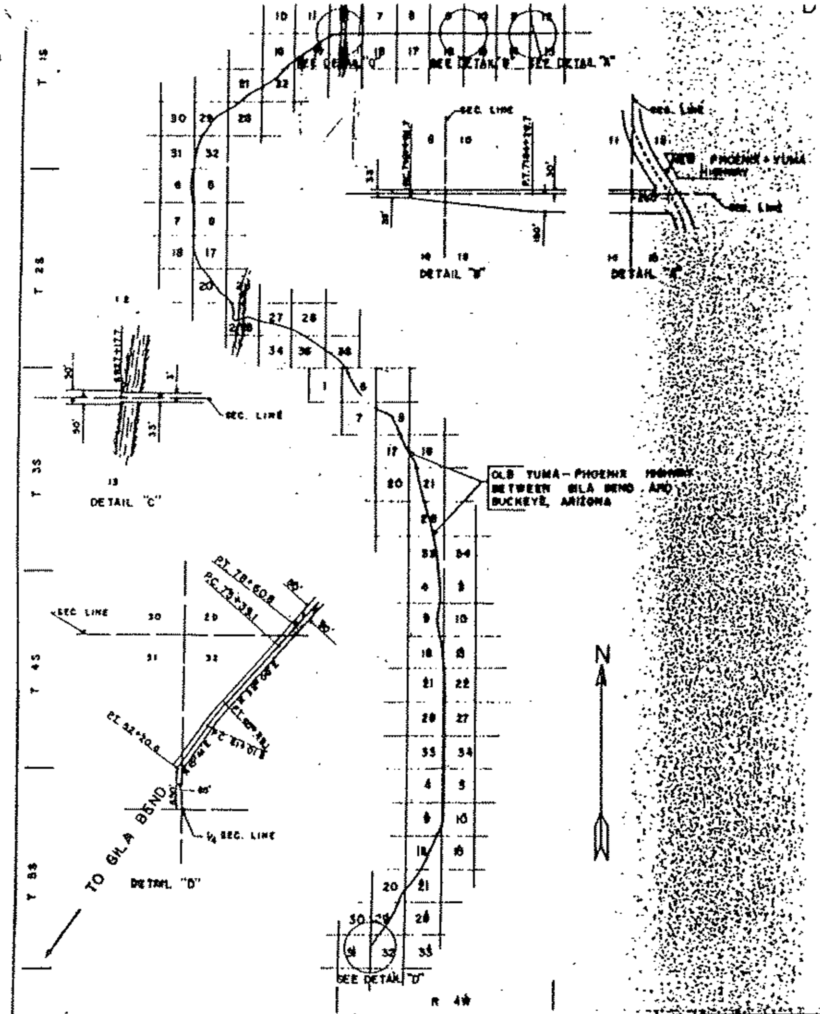
Officially designated October 16th, 1956 by the Board of Supervisors of Maricopa County, Arizona.

County Engineer.

ROAD FILE NO. 1028

DE[illegible]ATED COUNTY ROAD

A PLAT



Showing designation as a County Highway the following described lines, to-wit:

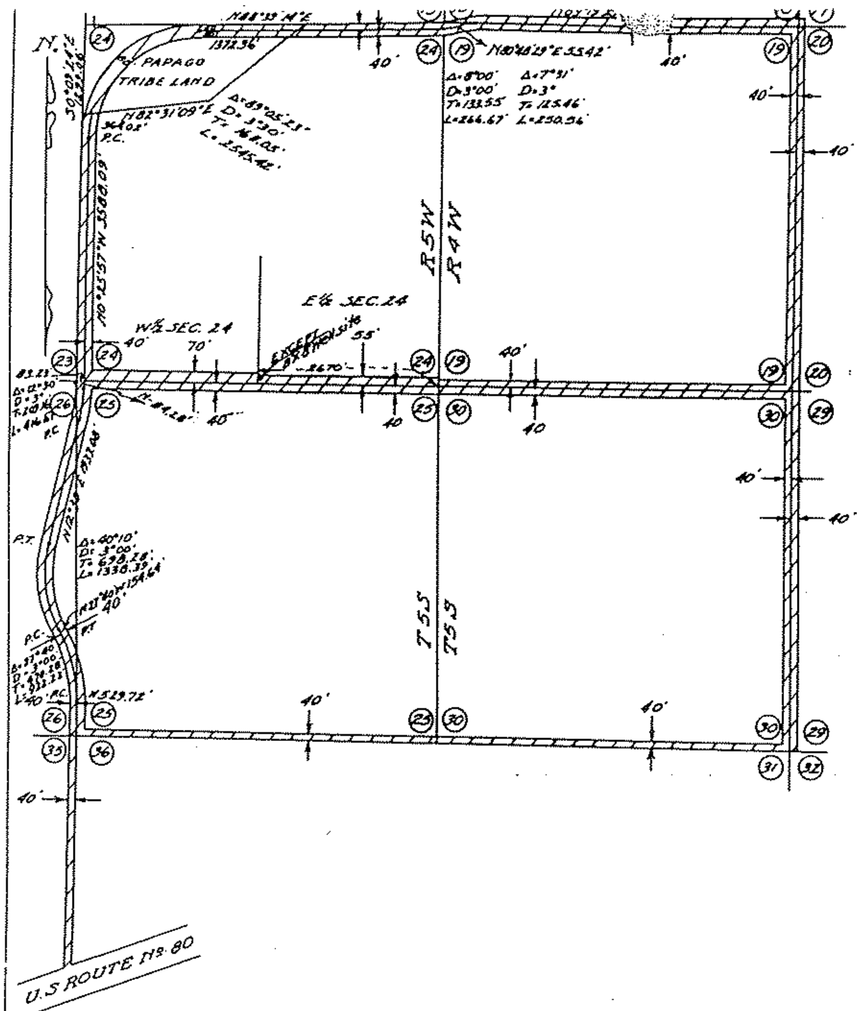
The old Yuma-Phoenix Highway, between Gila Bend and Buckeye, Arizona, in accordance with maps and plats on file in the office of the State Highway Engineer and the Maricopa County Engineer's office: Beginning at a point lying within the SE¼ NE¼ of Section 31, Township 5 South, Range 4 West, G&SRB&M, Maricopa County, State of Arizona, at Highway Engineer's Station P.T. 52+20.4, said point being approximately 85 feet westerly of and 650 feet northerly of the east quarter corner of said Section 31; thence with a right-of-way 100 feet in width 50 feet on each side of the centerline of the constructed highway in a general northerly direction traversing the NE¼ of said Section 31 and Sections 32, 29, 20, 21, 16, 9, 10, and 3, Township 5 South, Range 4 West, Sections 34, 27, 22, 15, 10, 9, and 4, Township 4 South, Range 4 West, Sections 33, 28, 21, 16, 17, 8, 7, and 6, Township 3 South, Range 4 West, Sections 36, 35, 26, 27, 28, 21, 20, 17, 18, 7, 8, 6, and 5, Township 2 South, Range 5 West, Sections 31, 30, 29, 20, 21, 22, 15, 14, 13, and to station [illegible] near the quarter corner common to Sections 12 and 13 in Township 1 South, Range 5 West, said station being the end of the 100-foot right-of-way and the beginning of a 66-foot right of way, 33 feet on each side of the section line; thence easterly along the section line, between Sections 12 and 13 in Township 1 South, Range 5 West and Sections 7 and 18, 8 and 17, to station [illegible] the P.C. of a curve being a point on the section line between Sections 9 and 16, and the end of the 66-foot right-of-way; thence easterly to station [illegible] the P.T. of a curve from where the right-of-way has gradually increased to 30 feet to the north side of the section line and 150 feet to the south side of the section line; thence easterly along the section line between Sections 10 and 15, 11 and 14, 12 and 13, Township 1 South, Range 4 West, having a right-of-way 180 feet in width, with 30 feet on the north side of the section line and 150 feet on the south side of the section line and extending to the intersection with the new location of the Phoenix-Yuma Highway located approximately 250 feet easterly along the section line from the southwest corner of Section 12, Township 1 South, Range 4 West, said road being the part abandoned by the State of Arizona, June 19, 1956.

Officially designated October 18th, 1956 by the Board of Supervisors of Maricopa County, Arizona.

[signature]
County Engineer.

ROAD FILE NO. 1026

DESIGNATED COUNTY ROAD
A PLAT



153505

OFFICIALLY DESIGNATED JULY 13, 1964, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

Samuel F. Lanford

Samuel F. Lanford,
County Engineer

SEC'S. 23, 24, 25, 26 & 35 T5S-R5W
SEC'S 17, 18, 19, 20, 29 & 30 T5S-R4W

SHEET 1 OF 2 SHEETS   ROAD FILE Nº 1645

15-73

DESIGNATED COUNTY ROAD
A PLAT

SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway Forty (40) feet wide measured at right angles from and lying parallel with and adjacent to and on the West side of the following described line: BEGINNING at a point common to Sections Thirty-five (35) and Thirty-six (36), Township Five (5) South, Range Five (5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, and the North line of U.S. Route No. 80; thence North along the section line common to Sections 35 and 36, to the North line of said Sections 35 and 36; thence a roadway Eighty (80) feet wide being Forty (40) feet measured at right angles from and lying parallel with and adjacent to and on each side of the following described centerline: BEGINNING at the section corner common to Section 25, Section 26, Section 35, and Section 36, Township Five (5) South, Range Five (5) West; thence North along the line common to Sections 25 and 26 for a distance of 529.12 feet to the P.C. of a 3° 00' curve to the left, having a central angle of 27° 40' and a tangent distance of 470.28 feet; thence Northwesterly along the arc of said curve 922.22 feet to the P.T. of said curve; thence North 27° 40' West 154.64 feet to the P.C. of a 3° 00' curve to the right, having a central angle of 40° 10' and a tangent distance of 698.28 feet; thence Northwesterly and Northeasterly along the arc of said curve for a distance of 1338.39 feet to the P.T. of said curve; thence North 12° 30' East 1913.08 feet to the P.C. of a 3° 00' curve to the left, having a central angle of 12° 30' and a tangent distance of 209.16 feet; thence Northeasterly along the arc of said curve for a distance of 416.67 feet to the P.T. of said curve; thence North [illegible] feet to a point 83.23 feet East of the Northeast corner of Section 26, Township Five (5) South, Range Five (5) West; from thence the roadway varies in width to include all that part of Section Twenty-four (24), Township Five (5) South, Range Five (5) West which lies between the West line of said Section Twenty-four (24) and a line Forty (40) feet, measured at right angles, lying Easterly of and parallel with the following described centerline: BEGINNING at the point on the South line of said Section Twenty-four (24), 83.23 feet North 88° 43' 31" East from the Southwest corner of said Section Twenty-four (24); thence North 0° 25' 57" West 3588.09 feet to the P.C. of a 3° 30' curve to the right, having a central angle of 39° 05' 23" and a tangent distance of 1011.05 feet; thence Northeasterly along the arc of said curve for a distance of 364.02 feet to a point which is the intersection of said centerline and the Southerly boundary of a tract of land conveyed to the Papago Tribe in Docket 4927, Page 117 of Maricopa County Records, said Southerly boundary of the Papago Tribe land bearing North 82° 31' 09" East from a point on the West line of said Section Twenty-four (24), 1239.06 feet South 0° 09' 24" East from the Northwest corner of said Section Twenty-four (24) and said Southerly boundary line being the Northerly line of the varying width roadway and from whence the roadway is Eighty (80) feet wide being Forty (40) feet, measured at right angles from and lying parallel with the above mentioned centerline continued Northeasterly along the arc of the said 3° 30' curve 2181.4 feet to the P.T. of said curve which P.T. is South Forty (40) feet from the North line of said Section 24; thence North 88° 39' 14" East, parallel with and Forty (40) feet Southerly from the North line of said Section 24, a distance of 1372.36 feet to the intersection of the East line of the PAPAGO INDIAN RESERVATION; thence continuing East to a point Forty (40) feet South of the Northeast corner of said Section 24 and the P.C. of a 3° 00' curve to the left, having a central angle of 8° 00' and a tangent distance of 133.55 feet; thence Northeasterly along the arc of said curve for a distance of 266.67 feet to the P.T. of said curve; thence North 80° 48' 29" East 55.42 feet to the P.C. of a 3° 00' curve to the right, having a central angle of 7° 31' and a tangent distance of 125.46 feet; thence Northeasterly along the arc of said curve 250.56 feet to the North line of Section 19, Township Five (5) South, Range Four (4) West; thence North 88° 19' 29" East along the section line common to Sections 18 and 19, Township Five (5) South, Range Four (4) West to a point Forty (40) feet West of the East line of Sections 18 and 19. ALSO a roadway Forty (40) feet wide being Forty (40) feet, measured at right angles, on the North side of and parallel with the following described line: BEGINNING at a point Forty (40) feet East of the section corner common to Sections Twenty-five (25) and Twenty-six (26), Thirty-five (35) and Thirty-six (36), Township Five (5) South, Range Five (5) West; thence Easterly along the section line common to Sections Twenty-five (25) and Thirty-six (36) to the East line of Range Five (5) West; thence continuing East along the section line common to Section Thirty (30) and Thirty-one (31), Township Five (5) South, Range Four (4) West to a point Forty (40) feet West of the East line of said Section 30. ALSO a roadway Eighty (80) feet wide being Forty (40) feet measured at right angles, on each side of, parallel with and adjacent to, the following described centerline: BEGINNING at the section corner common to Sections 29, 30, 31, and 32, Township Five (5) South, Range Four (4) West; thence North along the section line common to Sections Twenty-nine (29) and Thirty (30) and Sections Nineteen (19) and Twenty (20) to a point Forty (40) feet North of the South line of Sections Seventeen (17) and Eighteen (18). ALSO a roadway [illegible] at a point on the section line common to Sections Twenty-four (24) and Twenty-five (25) and 123.23 feet Easterly from the section corner common to Sections 23, 24, 25, and 26, Township Five (5) South, Range Five (5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, and running thence Easterly along the section line common to Sections 24 and 25 and being 70 feet in width along the South line of the West One-half (W½) of Section 24, and thence [illegible] of 55 feet along the South line of the East One-half (E½) of Section 24, and 40 feet in width along the North line of Section 25, to the East line of Township Five (5) West; thence a roadway 80 feet in width, being 40 feet on each side of, parallel with and adjacent to the section line common to Sections 19 and 30, Township Five (5) South, Range Four (4) West to a point 40 feet West of the East line of said Sections 19 and 30; EXCEPT a wellsite described as follows: BEGINNING at a point 2610 feet West of the Southeast corner of Section 24 to a point on the South section line; thence due North 40 feet to the point of beginning; thence North Eight (8) feet to a point; thence West Eight (8) feet to a point; thence South Eight (8) feet to a point; thence East Eight (8) feet to the point of beginning. (Various roads North and Northwest of Gila Bend, Arizona.)

OFFICIALLY DESIGNATED JULY 13, 1964, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

SAMUEL P. LANFORD,
COUNTY ENGINEER

150865

AUG 7 '64

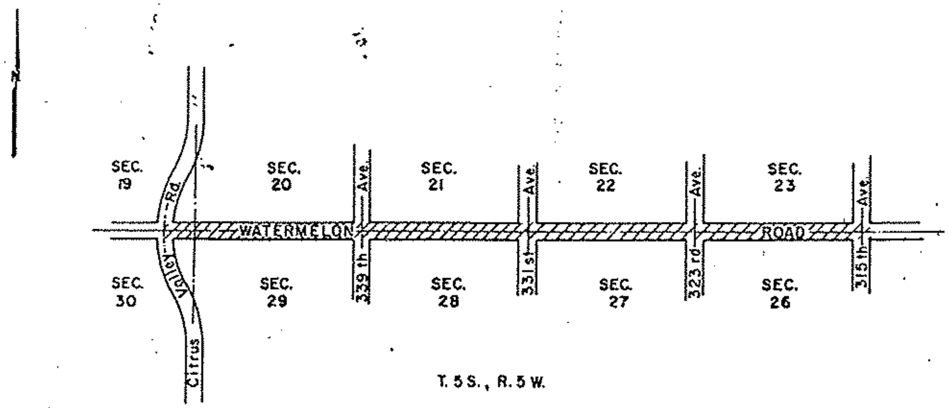
SEC'S 23, 24, 25, 26 & 35 T5S-R5W
SEC'S 17, 18, 19, 20, 29 & 30 T5S-R4W

SHEET 2 OF 2 SHEETS ROAD FILE No. 1645

19-22

DESIGNATED COUNTY ROAD

A PLAT



T. 5 S., R. 5 W.

SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way, beginning at the intersection of the centerline of CITRUS VALLEY ROAD and the Section line common to Sections Nineteen(19) and Thirty(30), Township Five(5) South, Range Five(5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; thence Easterly to a terminus at the Northeast corner of Section Twenty-six (26) of said Township and Range.

More commonly known as WATERMELON ROAD from CITRUS VALLEY ROAD to 315th AVENUE.

OFFICIALLY DESIGNATED on the 30th day of March 1970, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

R. C. Esterbrooks
R. C. ESTERBROOKS, P.E.
COUNTY ENGINEER

INDEXED
PAGED

86257

STATE OF ARIZONA
County of Maricopa

MAR 12 1970
17
22

SEC. 19,20,21,22,23,26,27,28,29 & 30 T. 5 S., R. 5 W.

Road File No. 1900

Sec. 13, 5S, 6W 5S 6W 5D

67768 4S 6W 10-6

INDEXED
PAGED

STATE OF ARIZONA, County of Maricopa } ss.
I hereby certify that the within instrument was filed and recorded at request of Board of Supervisors
JUN 3 1955 4:?? pm
in Book 10 Road Maps
on page 6
Witness my hand and official seal the day and year aforesaid.
ROGER G. LAVEEN
County Recorder
By Ernest R. Morris
Deputy Recorder

DESIGNATED COUNTY ROAD

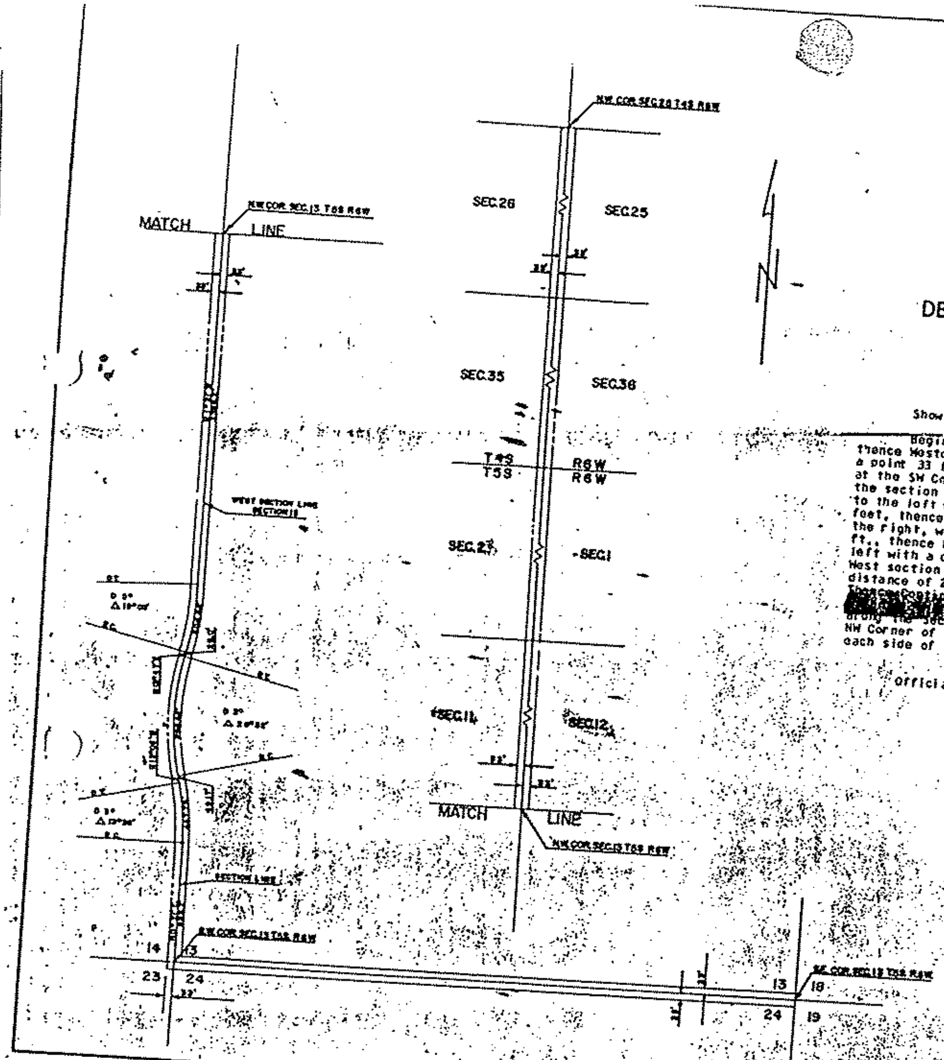
A PLAT

Showing dedicated County road described as follows:

Beginning at the SE corner of [redacted] thence Westerly along the Section line between [redacted] a point 33 ft. West [redacted] at the SW Corner of [redacted] North 0° 21' East along the section line for a distance of 889.2 ft., thence along a 3° curve to the left with a deflection angle of 13° 26', for a distance of 447.78 feet, thence North 13° 05' West 49.17 ft., thence along a 3° curve to the right, with a deflection angle of 26° 52' for a distance of 895.56 ft., thence North 13° 47' East 29.0 ft., thence along a 3° curve to the left with a deflection angle of 15° 08', 504.44 ft., to a point on the West section line of said Section 13, thence North 1° 21' West for a distance of 2566.2 ft. to the North West Corner of said Section 13. [redacted] the Section Line common to Sections [redacted] &SRB&M, thence continuing Northerly [redacted] 35 and 36, 25 and 26, to the NW Corner of Section 25 all in [redacted] G&SRB&M. Said road being 33 ft. each side of the above center [redacted] the benefit and use of the public.

Officially designated August 19, 1954 by the Board of Supervisors.

R. F. Glendening, County Engineer



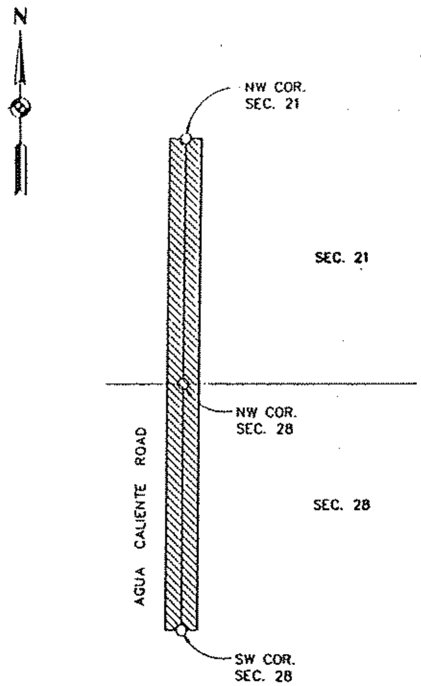
Road 5564 R7:4:1

Sec. 21, 28 T5S, R10W

31-91

DESIGNATED COUNTY ROAD

A PLAT



31-91

9-22-87

SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

Beginning at the Southwest corner of Section Twenty-eight (28), Township Five (5) South, Range Ten (10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; THENCE Northerly along the West line of said Section 28, to the Northwest corner of said Section 28, also being the Southwest corner of Section Twenty-one (21), Township Five (5) South, Range Ten (10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; THENCE continuing Northerly along the West line of said Section 21, to the Northwest corner, thereof and the terminus of the herein described center line.

Said roadway also known as Agua Caliente Road at the Gila River.

OFFICIALLY DESIGNATED on the 15th day of June, 1987, by the BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

A. W. Collins

A. W. COLLINS, P.E.
DEPUTY COUNTY ENGINEER

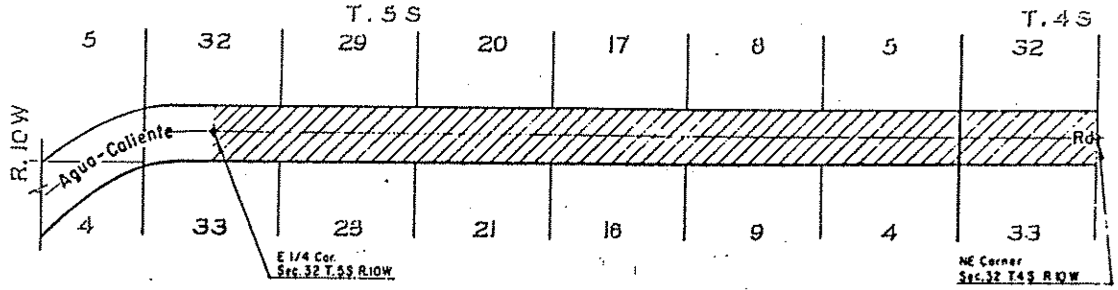
HIGHWAY DEPT.
SEP 22 1987
31
91

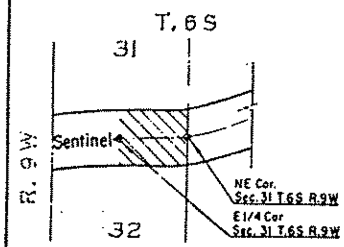
SEC. 21,28 T5S - R10W

ROAD FILE NO.4266

DESIGNATED COUNTY ROAD

A PLAT





SHOWING DESIGNATION AS A COUNTY HIGHWAY THE FOLLOWING DESCRIBED LINES TO-WIT:

A roadway of a width consistent with the right-of-way beginning at the East one-quarter corner of Section Thirty-one(31), Township Six (6) South, Range Nine(9) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; thence Northerly to a terminus at the Northeast corner of said Section 31.

ALSO, beginning at the East one-quarter corner of Section Thirty-two (32), Township Five(5) South, Range Ten(10) West of said Base and Meridian, thence Northerly to a terminus at the Northeast corner of Section Thirty-two (32) Township Four(4) South, Range Ten(10) West of said Base and Meridian.

More commonly known as portions of the SENTINEL-AGUA CALIENTE ROAD and Northerly extension of the same.

OFFICIALLY DESIGNATED on March 22nd, 1971, BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY, ARIZONA.

R. C. ESTERBROOKS, P.E.
County Engineer

1611721

JL 29 71

Book 20

Sec. 31, 32 T.6 S R.9 W
Sec. 4, 5, 9, 8, 16, 17, 20, 21, 28, 29, 32, 33 T.5S R.10 W
Sec. 32, 33 T.4 S R.10 W

ROAD FILE No. 2078

GILA RIVER

Maricopa County Interests
(Deeds and Easements)

MAR · 1965 -8 00 AM

DKT 5488 PAGE 207

06196

STATE OF ARIZONA ss. I hereby certify that the within instrument was filed and recorded

County of Maricopa

Fee No.

IN DOCKET & Page DKT 5488 PAGE 207 and indexed in

UNION TITLE CO.

60449

Witness my hand and official seal.

When recorded, return to:

Maricopa County Board of Supervisors

County Recorder

By Deputy Recorder

Compared
Photostated
Fee:

EASEMENT FOR HIGHWAY PURPOSES

Pol. No. 27571 & 27576

ITEM NO. E-2138

R/W 53-378, Reems Road

Buckeye Water Conservation and Drainage District

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Proofed
WH
1/21
Checked
WH
10/21/64
Approved

The East Forty (40) feet of the South One-half ($S\frac{1}{2}$) of Section Thirty (30) and the West Forty (40) feet of the Southwest One-quarter ($SW\frac{1}{4}$) of Section Twenty-nine (29), all being in Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; lying South of the North right of way of the Buckeye Irrigation Canal.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 11 day of February, 1965

Buckeye Water Conservation and Drainage District

_______________(Seal)

_______________(Seal)

W. W. Weigold (Seal)

Asst. Secy.

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this 11th day of February 1965 by W. W. Weigold,

representing the Buckeye Water Conservation and Drainage District as Assistant Secretary

FORM 93-1C (REV 7-24-63)

Notary Public

My commission expires 1-11-67

When recorded, return to:
Maricopa County Board of
Supervisors

4774

Easement

THIS INDENTURE, Made the ______ day of July 26 ______ 19__
between BUCKEYE IRRIGATION COMPANY
hereinafter designated the Grantor, and Maricopa County, Arizona, hereinafter designated the Grantee.

RECITALS:

The Grantee requires a right of way over and perpetual easement to a parcel of land belonging to the Grantor, upon which the Grantee may construct and maintain thereafter a public highway, and all incidents thereto.

The Grantor does hereby grant to the Grantee a perpetual easement for such purposes subject, however, to the reservation, provisions and conditions hereinafter contained, and said Grantor does hereby approve the location of said highway and consents to the establishment thereof over said land; and does hereby release the said Maricopa County from, and waives all claim for damage or compensation for and on account of the establishment and construction of said highway other than set forth herein.

CONSIDERATION:

In consideration of the premises, covenants, and conditions to be kept and performed by the Grantee and the further consideration of the sum of ------One and no/100------------------------------Dollars ($1.00)
the Grantor does hereby grant a perpetual easement, and does by these presents convey to the use of the Grantee forever, that certain strip, tract, or parcel of land and real estate situated in the County of Maricopa, and State of Arizona, to-wit:

The south 1040 feet of the west 33 feet of Section 28, T1N, R1W, and the south 1040 feet of the east 33 feet of Section 29, T1N, R1W, G&SRB&M, for the use and benefit of the public.

TO HAVE AND TO HOLD the same forever, together with the right to authorize, permit and license the use thereof not inconsistent with its primary use as a highway and temporary rights of way over, upon and across lands of the Grantor that may be required for the purpose of, or in the course of construction and repair of said highway, provided that the Grantee complies with, keeps, and carries out the following stipulations which run with and are attached to all right and interest granted herein.

CONDITIONS:

1. It is understood and agreed that the amount of money mentioned herein is accepted by the Grantor as full compensation for the land taken as right of way and in settlement for all claims for damage, and for injury or damage to the contiguous land from which the right-of-way is severed, now owned by Grantor, and for his assigns and successors in interest thereof, that may hereafter arise or result from the construction, alteration and maintenance of the road bed, its embankment or grade.

2. The County agrees to pay $2,000.00 for the removing or wrecking of an obstruction (dwelling or house) which is partially on above described land, and the Irrigation Co. agrees to give to the County right to wreck and destroy cesspools and septic tanks or any other obstruction (fifteen days after signing of easement) located on the above described land (except an irrigation ditch and flume across the Buckeye Canal. The County further agrees to fence above described easement.)

THAT ALL GRANTS, COVENANTS AND PROVISIONS herein contained shall be binding on and inure to the benefit of the heirs, successors, and assigns of the parties hereto.

IN WITNESS WHEREOF, this instrument has been duly signed and executed by the Grantor the day and year above written.

APPROVED:

Fred Glendening, County Engineer

Chairman, Board of Supervisors

X Buckeye Irrigation Company

X Othel Maranse

FORM 55-9

DKT 3212 PAGE 443

OCT 12 1982 -2 30 16345 1036

I hereby certify that the within named instrument was recorded at request of [illegible] MARICOPA CO. BD. OF SUPERVISORS Docket 16345 Page 1036 - 1043 Records of Maricopa County, Arizona. WITNESS my hand and official seal the day and year aforesaid.

BILL HENRY, County Recorder By D. LIEBLER, Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

Fee No.: D15382 1 of 2 821082

Fee: N-C

Recorded at Request of Board of Supervisors

500-81-2D & 2C
500-82-1
500-80-4A, 4B, 6A, 6B

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

Project No. 68111 - Bullard Ave. Bridge

Item No. V-15

The Buckeye Irrigation Company

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

SEE EXHIBIT A

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

4400-023

(See Reverse Side For Agreement and Signatures)

Exhibit A

Parcel 1:

That part of the Southeast one-quarter of the Southeast one-quarter (SE¼ of SE¼) of Section Twenty-nine (29) and the Southwest one-quarter of the Southwest one-quarter (SW¼ of SW¼) of Section Twenty-eight (28) and the Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼) of Section Thirty-two (32), all being in Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona found to be within a 100-foot wide stip of land lying 50 feet (measured at right angles and radially) on each side of a center line described as:

Beginning at the section corner common to said Sections 28, 29, 32 and 33; thence South (assumed bearing), 2057.12 feet along the line between said Sections 32 and 33 to a point on the center line of the proposed Vineyard Road right-of-way; thence North 80°03'02" West, 442.66 feet along the center line of Vineyard Road to a point on the center line of New Bullard Avenue and the true point of beginning for the right-of-way of New Bullard Avenue; thence North 9°44'11" East, 2267.00 feet to the beginning of a curve concave Westerly, having a radius of 3452.51 feet and a central angle of 9°55'56"; thence in a North-Northeasterly and Northerly direction, 598.50 feet along said curve to the beginning of a tangent that is also a point on the line between said Sections 28 and 29 (the bearing of said line being North 0°11'45" West) and the point of ending of this 100-foot wide strip of road right-of-way.

EXCEPT any portion found to be lying within the 66-foot wide roadway shown in Book 2 of Road Maps on Page 36, M.C.R.

Parcel 2:

A parcel of land lying in the Southeast one-quarter of the Southeast one-quarter (SE¼ of SE¼) of Section Twenty-nine (29) and the Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼) of Section Thirty-two (32) all being in Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona more particularly described as:

Beginning at the Section corner common to Sections 28, 29, 32 and 33, all being in Township One (1) North, Range (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; thence West (assumed bearing), 144.88 feet along the North line of said Section 32 to a point on the West right-of-way line of New Bullard Avenue; thence South 9°44'11" West, 259.00 feet along said West right-of-way line to the Southeasterly corner of this parcel and the true point of beginning; thence North 80°15'49" West, 500.00 feet; thence North 9°44'11" East, 375.00 feet; thence South 80°15'49" East, 500 feet to a point on the Westerly right-of-way line of New Bullard Avenue; thence South 9°44'11" West, 375.00 feet along said Westerly right-of-way line to the true point of beginning.

Parcel 3:

A parcel of land lying in the Southwest one-quarter of the Southwest one-quarter (SW¼ of SW¼) of Section Twenty-eight (28), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona more particularly described as:

Beginning at the Section corner common to Sections 28, 29, 32 and 33 all being in Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; thence East (assumed bearing) 33.00 feet along the line between Sections 28 and 33 to the Southeast corner of an existing right-of-way as described in Book 2 of Road Maps on Page 36, M.C.R. and the true point of beginning for this easement; thence North 0°11'45" West, 275.11 feet along the East line of said right-of-way to the Northwest corner of this parcel; thence North 89°48'15" East, 400.00 feet to the Northeast corner of this easement; thence South 0°05'37" East, 276.48 feet to the Southeast corner of this parcel; thence West, 399.51 feet to the true point of beginning.

Parcel 4:

That part of the North 300 feet of the Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼) of Section Thirty-two (32), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona lying East of the Easterly right-of-way line of New Bullard Avenue (Parcel 1 as described herein).

DKT 5382 PAGE 182

D 6853

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded

County of Maricopa JAN 11 1965 -8 00 AM RECEIVED

IN DOCKET & Page DKT 5382 PAGE 182 and indexed in

M.C.H.D. Witness my hand and official seal.

Fee No. 7401

When recorded, return to:

Maricopa County Board of Supervisors

County Recorder

By Jm Denton Deputy Recorder

Compared
Photostated
Fee: N/C

27572+27573

EASEMENT FOR HIGHWAY PURPOSES

Pol. No.

ITEM NO. E-2141

R/W 53-378, Reems Road

JAMES L. KING AND ESTHER Z. KING, his wife

GRANTORS.

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The East Forty (40) feet of the North One-half of the Northeast One-quarter of Section Thirty-one (31), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona;

Also the East Forty (40) feet of Lots Six (6), Seven (7) and Fourteen (14) of said Section 31, Township One (1) North, Range One (1) West.

APPROVED Date: December 30, 1964
STATE LAND COMMISSIONER

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 29 day of October 1964

_______________ (Seal) James L. King (Seal)

_______________ (Seal) Esther Z. King (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA }

This instrument was acknowledged before me this 29 day of October 1964 by

JAMES L. KING AND ESTHER Z. KING, his wife

FORM 35-1C (REV 7-24-63)

Clara Campfield
Notary Public

My commission expires Feb 3, 1967

C 1321

MARICOPA COUNTY

GREAT SEAL OF THE STATE OF ARIZONA 1912

HIGHWAY DEPARTMENT

4701 EAST WASHINGTON STREET
PHOENIX, ARIZONA

May 6, 1968

Board of Supervisors
Maricopa County
Phoenix, Arizona

Re: Application for Non-rental Right-of-Way over State Land

Honorable Board:

Attached is One(1) original and Two(2) copies of Application for Non-rental right-of-way over State land together with alignment maps showing definite location as follows:

> The East Forty(40) feet and the North Forty(40) feet of Lot 9; The North Forty(40) feet and the West Sixty-five(65) feet of Lot 10; The West Sixty-five(65) feet of Lot 11; The East Forty (40) feet of Lot 12; The North Thirty(30) feet and the West Forty(40) feet of Lot 13; The North Thirty(30) feet of Lot 14, all located in Section Thirty-one(31), Township One(1) North, Range One(1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

I recommend that the Board of Supervisors pass a resolution authorizing and directing the Chairman of the Board to execute this application in behalf of Maricopa County, and forward to the State Land Department at your earliest convenience.

Very truly yours,

Fred Glendening
County Engineer

Earl Sickler:ibm
Attach: 3 appl's.
3 maps

5305 PAGE 441

STATE LAND DEPARTMENT
422 Arizona State Office Building
Phoenix, Arizona

21990 1of2

NOV 16 1964

R/W No. 3690

RIGHT OF WAY

THIS INDENTURE made and entered into this 28th day of October, 19 64, by and between the State of Arizona, hereinafter called the Grantor, and

Maricopa County Board of Supervisors

of Phoenix, State of Arizona, hereinafter called the Grantee,

WITNESSETH, that pursuant to the authority vested in the State Land Commissioner, the Grantee is hereby granted a Right of Way on, over and across the State lands hereinafter described under the Provisions of Article 10, Section 37-461, Arizona Revised Statutes.

The granting of said Right of Way is predicated upon an application duly filed by the Grantee ~~and approved by the Governor of the State of Arizona~~, together with an alignment map showing the definite location and establishing the width and acreage of said Right of Way, both of which are made and become a part of this permit.

It is understood and agreed by Grantee that the State land covered by said Right of Way will be used for no purpose other than the location, construction, operation and maintenance of a highway on, over and across these State lands running ____ miles and/or containing 3.64 acres, more or less, and extending a width of 20 feet on each side of the center line.

TO HAVE AND TO HOLD the same as used for a County highway, but subject to the conditions and reservations herein set forth.

IT IS UNDERSTOOD AND AGREED that:

5305 PAGE 442

1. The Grantee shall not sublet or assign the Right of Way herein granted, or any part thereof, without the written consent of Grantor first obtained, nor shall Grantee grant any franchise, permit or other Right of Way on the lands described herein, or any part thereof.
2. The Grantor reserves the right to grant easements and Rights of Way for public utilities and other purposes over and across State lands described herein, subject to the approval of the Grantee.
3. The Grantor also reserves the right, as provided by law, to grant to the United States Rights of Way and easements over, across or upon the lands embraced in this permit for canals, reservoirs, dams, power or irrigation plants or works, railroads, tramways, transmission lines or other purposes for irrigation works in connection with any Federal Government reclamation project.
4. The Grantee will not permit any loss, nor commit or cause any waste in, to or upon said land; nor cut or remove nor allow to be cut or removed any timber or standing trees that may be upon said land, save and except only such as may be necessary for the improvements of said land, (and then only with the written consent of the State Land Commissioner) or for fuel for the domestic use of said Grantee; provided that nothing herein contained shall be construed to permit the cutting of saw timber for any purpose.
5. The Grantor excepts and reserves out of the grant hereby made all oil, gases, coal, ores, limestone, minerals, fossils, and fertilizer of every name and description that may be found in or upon the land described herein, or any part thereof; and the lands herein described are subject to the execution by Grantor of drilling permits and leases for the purpose of prospecting for, and the extraction of oil, gases, coal, ores, limestone, minerals, fossils and fertilizers as provided by law.

The Lessee agrees to indemnify, hold and save Lessor harmless against all loss, damage, liability, expense, costs and charges incident to or resulting in any way from any injuries to person or damage to property caused by or resulting from the use, condition or occupation of the land.

5305 PAGE 442

C1990 Cor -

LEASE SUPPLEMENT

MARICOPA COUNTY
HIGHWAY DEPT RW AGENT
4701 E WASHINGTON
PHOENIX ARIZ 85034

	LEASE OR REFERENCE NO.
9	3690

ACCOUNT NO FUND	SUB	DESCRIPTION	SEC	TWP		RANGE		ACREAGE
30		THRU W 40FT NWSW & NW	32	1	N	1	W	364 364

STATE OF ARIZONA, County of Maricopa; ss.
I do hereby certify that the within instrument was filed and recorded at request of .... Page 441, 442, 443
Docket 5303
11 17 8 53 Records of Maricopa County, Arizona.
WITNESS my hand and official seal the day and year first above written.
CLIFFORD H. WARD, County Recorder,
218653 By .... Deputy. M/C

51-12 01-DEED

APPROVED
LESSEE MARICOPA COUNTY ENGINEER DATE 11-5-64 STATE LAND COMMISSIONER DATE NOV 1 0 1964
DEPUTY STATE LAND COMMISSIONER

MAY 1 1982 -1 15

16021 785

147594

I do hereby certify that the within named instrument was recorded at request of MARICOPA CO BD. OF SUPERVISORS Fee No. D15270

Docket 16021 Page 785-788 D15270

________, Records of Maricopa County, Arizona.
WITNESS my hand and official seal the day and year aforesaid.

EASEMENT (ES)

N-C

Fee:

BILL HENRY

County Recorder By ________ Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

500-82-1 and 500-79-5, 7, 9 & 10

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

83 205207

Project No. 68111 - Bullard Avenue Bridge @ Gila River

Item No. V-16

Maricopa County (Parks and Recreation Department)

Maricopa County, a political subdivision of the State of Arizona GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

See Exhibit A

This instrument rerecorded to correct legal.
See Exhibit "A"

MARICOPA COUNTY RECORDER ARIZONA

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY, ARIZONA

MAY 27 83 -4 11

BILL HENRY, COUNTY RECORDER

FEE N-C PGS 4

/4

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023

(See Reverse Side For Agreement and Signatures)

68111 - Bullard Avenue Bridge @ Gila River
V-16
500-82-1 and 500-79-5, 7, 9 & 10
Page 1 of 2

~~182214 787~~

D 15270 2 of 3

83 205207

Exhibit A

Parcels of land lying in Sections Thirty-two (32) and Thirty-three (33), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona with all parcels being referred for tie purposes to the corner common to Sections Twenty-eight (28), Twenty-nine (29), Thirty-two (32) and Thirty-three (33) of said Township and Range and being more particularly described as:

Parcel 1

That part of the Southeast one-quarter of the Northeast one-quarter (SE¼ of NE¼) of said Section 32 and BLM Lots 1, 2, 3, 4 & 9 of said Section 33 found to be within a 100-foot wide strip of land lying 50 feet (measured at right angles and radially) on each side of a center line described as:

Beginning at the section corner common to said Sections 28, 29, 32 and 33; thence South (assumed bearing), 2057.12 feet along the line between said Sections 32 and 33 to a point on the center line of the proposed Vineyard Road right-of-way; thence North 80°03'02" West, 442.66 feet along the center line of Vineyard Road to a point on the center line of New Bullard Avenue and the true point of beginning for the right-of-way of New Bullard Avenue; thence North 9°44'11" East, 2267.00 feet to the beginning of a curve concave Westerly, having a radius of 3452.51 feet and a central angle of 9°55'56"; thence in a North-Northeasterly and Northerly direction, 598.50 feet along said curve to the beginning of a tangent that is also a point on the line between said Sections 28 and 29 (the bearing of said line being North 0°11'45" West) and the point of ending of this 100-foot wide strip of road right-of-way.

Parcel 2

That part of the Southeast one-quarter of the Northeast one-quarter (SE¼ of NE¼) of said Section 32 and BLM Lots 1, 2, 3, 4 & 9 of said Section 33 found to be within a 90-foot wide strip of land lying 50 feet (measured at right angles and radially) on the North, Northeast and East and 40 feet on the South, Southwest and West of a center line described as:

Beginning at the section corner common to said Sections 28, 29, 32 and 33; thence South (assumed bearing), 2057.12 feet along the line between said Sections 32 and 33 to a point on the center line of the proposed Vineyard Road right-of-way; thence North 80°03'02" West, 442.66 feet along the center line of Vineyard Road to a point on the center line of New Bullard Avenue and the true point of beginning for the right-of-way of Vineyard Road and 143rd Avenue from New Bullard Avenue to Baseline Road; thence South 80°03'02" East, ~~1657.09~~ 2099.75 feet to the beginning of a curve concave Southwesterly having a radius of 400.00 feet and a central angle of 88°31'40"; thence in an Easterly, Southeasterly and Southerly direction, 618.04 feet along said curve to the beginning of a tangent; thence South 8°28'38" West, 391.26 feet to the beginning of a curve concave Easterly having a radius of 1637.02 feet and a central angle of 37°30'00"; thence in a Southerly and Southeasterly direction, ~~1070.43~~ 1071.43 feet along said curve to the beginning of a tangent; thence South 29°01'22" East, 901.08 feet to the beginning of a curve concave Westerly having a radius of 477.47 feet and a central angle of 28°56'40"; thence in a Southeasterly and Southerly direction, 241.20 feet along said curve to the beginning of a tangent; thence South 0°04'42" East, 4.10 feet to the North quarter corner of Section Four (4)(C.C.), Township One (1) South, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona and the terminus of this description.

ALSO a strip of land 10.00 feet in width having as its Northerly line the Southerly line of the West 1300 feet of said 90.00 foot wide strip of land.

AND ALSO a strip of land 10.00 feet in width having as its Northerly, Northeasterly and Easterly line the Southerly, Southwesterly and Westerly line of the Southerly 2609.07 feet of said 90.00 foot strip of land.

This instrument is being re-recorded for the express purpose of correcting two distances in the third paragraph up from the bottom of this page as follows: (1) The distance 1657.09 to read 2099.75 and (2) the distance 1070.43 to read 1071.43.

Exhibit A

Parcel 3

That part of the North one-half (N½) of said Section 32 found to be within a 83.00 foot wide strip lying 50 feet (measured at right angles and radially) on the Northerly and 33 feet on the Southerly side of a center line described as:

Beginning at the section corner common to said Sections 28, 29, 32 and 33; thence South (assumed bearing) 2057.12 feet along the line between said Sections 32 and 33 to a point on the center line of the proposed Vineyard Road right-of-way; thence North 80°03'02" West, 442.66 feet along the center line of Vineyard Road to a point on the center line of New Bullard Avenue and the true point of beginning for the right-of-way of Vineyard Road from New Bullard Avenue to Reems Road; thence North 83°07'33" West, 2176.41 feet to the beginning of a curve concave Northerly having a radius of 2000.00 feet and a central angle of 3°23'49"; in Westerly and Westerly-Northwesterly direction, 118.59 feet along said curve to the beginning of a tangent; thence North 79°43'44" West, 1397.05 feet to the beginning of a curve concave Southerly having a radius of 1000.00 feet and a central angle of 15°02'11"; thence in a Westerly-Southwesterly and Westerly direction 262.43 feet to the beginning of a tangent; thence South 85°14'05" West, 898.93 feet to a point on the West line of said Section 32 (said point being also the terminus for this description) and with the West quarter corner of said Section 32 bearing South 0°10'25" West, 1111.88 feet from said point.

ALSO a strip of land 10.00 feet in width having as its Northerly line the Southerly line of the East 1700.00 feet of said 83-foot wide strip of land.

Parcel 4

A parcel of land lying in the Southeast one-quarter of the Northeast one-quarter (SE¼ of NE¼), Section Thirty-two (32) and in Lot 2, Section Thirty-three (33) all in Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona described as:

Beginning at the intersection point of the East right-of-way line of said New Bullard Avenue and the North right-of-way line of said Vineyard Road; thence North 9°44'11" East (assumed bearing), 375.19 feet along the Easterly right-of-way line of New Bullard Avenue; thence South 62°42'42" East, 923.36 feet; thence South 9°56'58" West, 100.00 feet to a point on the Northerly right-of-way line of said Vineyard Road; thence North 80°03'02" West, 880.00 feet along said Northerly right-of-way line to the point of beginning.

Parcel 5

A parcel of land lying in the Southeast one-quarter of the Northeast one-quarter (SE¼ of NE¼) of said Section 32 described as:

Beginning at the intersection point of the Westerly right-of-way line of New Bullard Avenue and the Northerly right-of-way line of Vineyard Road; thence North 83°07'33" West, 750.00 feet along the Northerly right-of-way line of Vineyard Road; thence North 6°52'27" East, 100 feet; thence North 77°03'39" East, 817.22 feet to a point on the Westerly right-of-way line of New Bullard Avenue; thence South 9°44'11" West, 377.49 feet to the point of beginning.

Parcel 6

A parcel of land lying in the Northwest one-quarter of the Northwest one-quarter (NW¼ of NW¼) of Section Thirty-three (33), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona described as:

Beginning at the Northwest corner of said Section 33; thence South (assumed bearing), 300 feet along the West line of said Section 33; thence East, 433.00 feet, parallel with the North line of said Section 33; thence North 0°05'37" West, 300.00 feet to the North line of said Section 33; thence West, 432.51 feet to the point of beginning.

1252 PAGE 296

STATE OF ARIZONA, County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded DEC 1953 in DOCKET 1252 page 296 and indexed in deeds. at the request of Arizona Title Guar.& Tr.Co.

Fee No 99789

When recorded, mail to
Maricopa County, Office of the
Board of Supervisors,
Court House,
Phoenix, Arizona.

Witness my hand and official seal.
ROGER G. LAVEEN, County Recorder
By
Deputy Recorder

Compared
Photostated
Fee

Order No. C-131551/JTR

Warranty Deed

For the consideration of Ten and 00/100 Dollars, and other valuable considerations, I, or we, DON MUNRO AND GENE N. MUNRO, ALSO KNOWN AS IMOGENE N. MUNRO, husband and wife,

do hereby convey to THE COUNTY OF MARICOPA, State of Arizona, a Body Politic,

the following described real property situate in Maricopa County, Arizona:

PARCEL NO. 1: Lots 3, 4, 9 and 10, or the Southwest quarter of Section 33, Township 1 North, Range 1 West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

PARCEL NO. 2: The North half of the Northwest quarter, and the Northwest quarter of the Northeast quarter, and Lots 1 and 2, or the South half of the Northwest quarter, all in Section 33, Township 1 North, Range 1 West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

SUBJECT TO: Covenants, taxes, encumbrances, liens, conditions, restrictions, reservations, rights, rights of way and easements of record.

And I or we do warrant the title against all persons whomsoever, subject to the matters above set forth

Dated this 15th day of September, 1953.

Imogene N. Munro

STATE OF ARIZONA, County of Maricopa } ss. This instrument was acknowledged before me this 14th day of December, 1953, by DON MUNRO

Notary Public

My Commission Expires April 21, 1957
My commission will expire

STATE OF ARIZONA, County of Maricopa } ss. This instrument was acknowledged before me this 11th day of December, 1953, by GENE N. MUNRO, ALSO KNOWN AS IMOGENE N. MUNRO

Notary Public

My Commission Expires April 21, 1957
My commission will expire

DOCUMENTARY

5-2?1
2 of 3

AMENDMENT TO INSTRUCTIONS

TO ARIZONA TITLE GUARANTEE & TRUST COMPANY

Date October 14, 1953

Escrow No. C-131551

The previous instructions in above numbered ESCROW are hereby modified in the following particulars only:

All parties concerned with this escrow hereby approve the following amended legal description covering Parcel # 3 herein:

"PARCEL NO. 3: Lots 1, 2, 3, and 4, or the South half of the South half, and the South half of the North half, and the North half of the South half of Section 32, Township 1 North, Range 1 West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona."

All other terms and conditions remain the same!

Don Munro
Seller

Imogene N. Munro
Seller

COUNTY OF MARICOPA
Buyer

BY: [signature]
Buyer

BY:

To be evidenced by WARRANTY DEED	Interest to be adjusted to: None
on your regular form in use at this date. Upon recordation of instruments, title insurance policy is to isure title of OWNER	Rents to be adjusted to: None Annual collection fee None
PAYMENT: Upon the filing for record of the documents as provided herein, pay the proceeds of the cash payment and any future payments which may be paid ot Escrow Agent under any agreement for sale executed or transferred in connection herewith to DON MUNRO AND IMOGENE N. MUNRO	IF PERSONAL PROPERTY is to be transferred as a part of this transaction, a Bill of Sale will be handed to Escrow Agent for delivery to Buyer. None Escrow Agent is to assume no liability as to the sufficiency of said Bill of Sale or as to said personal property.

AMENDMENT TO INSTRUCTIONS

TO ARIZONA TITLE GUARANTEE & TRUST COMPANY

Date October 1[illegible], 1953

Escrow No. [illegible]-1[illegible]1

The previous instructions in above numbered ESCROW are hereby modified in the following particulars only:

It is hereby understood and agreed by all parties hereto that the Seller has paid all of 1953 taxes on Parcels #1 and #2, in the sum of $127.7[illegible]. Said amount is to be prorated for the year 1953 as of November 1st, 1953.

All other terms and conditions remain the same.

Imogene N. Munro
~~Seller~~

Don Munro
~~Seller~~

COUNTY OF MARICOPA
Buyer

BY: [signature]
Buyer

BY: ____________

To be evidenced by WARRANTY DEED	Interest to be adjusted to: None
on your regular form in use at this date. Upon recordation of instruments, title insurance policy is to isure title of OWNER	Rents to be adjusted to: None
	Annual collection fee None
PAYMENT: Upon the filing for record of the documents as provided herein, pay the proceeds of the cash payment and any future payments which may be paid ot Escrow Agent under any agreement for sale executed or transferred in connection herewith to DON MUNRO AND IMOGENE N. MUNRO	IF PERSONAL PROPERTY is to be transferred as a part of this transaction, a Bill of Sale will be handed to Escrow Agent for delivery to Buyer. None. Escrow Agent is to assume no liability as to the sufficiency of said Bill of Sale or as to said personal property.

D5155

When recorded, return to: Dkt 3565 pg 74

Maricopa County Board of Supervisors ☒
Maricopa County Engineer ☐

EASEMENT

R W [illegible]

Buckeye Irrigation District

Grantors

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, together with such bridges, culverts, ramps, and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The South Sixty-five (65) feet of the Southwest one-quarter of the Southeast one-quarter of Section Thirty-three (33), Township One (1) North, Range One (1) East; of the Gila and Salt River Base Line & Meridian.

STATE OF ARIZONA } ss.
County of Maricopa
I hereby certify that the within instrument was filed and recorded at request of Maricopa County Highway
Dkt 3565 Page 74
[illegible]
County Recorder

14661

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; that it is free from all encumbrances; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purpose herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used it will be read as singular, and when necessary, and wherever words indicating gender are employed, they will apply to either masculine, feminine or neuter as the context requires.

Dated this 3rd day of January, 19 61

(Seal)	Buckeye Irrigation Company (Seal)
W. W. Weigold (Seal) Secretary	B. E. Schweikart (Seal) President
(Seal)	(Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 3 day of January, 19 61, by

Subscribed and sworn to before me this 3rd day of January 1961 by B. E. Schweikart, President and W. W. Weigold, Secretary of the Buckeye Irrigation Company.

[signature]
Notary Public

My commission expires 1-11-63

FORM 95-16 (REV 4-59)

1965 OCT 8 8 21

DKT 5755 PAGE 54[illegible]

[illegible]TE OF ARIZONA } ss I hereby certify that the within i[illegible] [illegible]ment was filed and recorded

County of Maricopa

IN DOCKET & Page DKT 5755 PAGE 542 and indexed in

MARICOPA CO. BD. OF SUPERVISORS

Witness my hand and official seal.

CLIFFORD H. WARD

County Recorder

By [illegible]

Deputy Recorder

[illegible]

Fee No.

191357

[illegible] DEED

Compared
Photostated
Fee:

When recorded, return to:

Maricopa County Board of Supervisors

NO CHARGE

EASEMENT FOR HIGHWAY PURPOSES

Pol. No. 28,334

ITEM NO. E-2071

R/W 53,374, Baseline Rd.

MARTIN L. COLVIN and CALLIE M. COLVIN, husband and wife; EDGAR F. WHITE and MARY LOU WHITE, husband and wife; and JAMES MARVIN FRIDENMAKER and LORENA MAE FRIDENMAKER, husband and wife. GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The South Forty (40) feet of Lots Three (3), Four (4) and Five (5) of Section Thirty-four (34), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

WH
1-25-65
WH
1-25-65
Approved
WH
1-25-65

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 6th day of February 1965

Edgar F. White

Mary Lou White (Seal)

James Marvin Fridenmaker

Lorena Mae Fridenmaker (Seal)

[illegible] (Seal)

Callie M. Colvin (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 6th day of February, 1965 by Martin L. Colvin and Callie M. Colvin, EDGAR F. WHITE and MARY LOU WHITE and JAMES MARVIN FRIDENMAKER and LORENA MAE FRIDENMAKER.

Richard S. Gilmore
Notary Public

FORM 95.16 (REV 7-24-63)

Notary Public
Tony Lauer
My commission Expires
May 8, 1966

My commission expires May 22, 1966

104

I do hereby certify that the within named instrument was recorded at request of Fee No.
Docket 16130 Page 1055-1059 MARICOPA CO. BD. OF SUPERVISORS
JUL 2 - 1982 -1
______, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.
BILL HENRY By ______
County Recorder Deputy Recorder
When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

207567
Fee: EASEMENT (ES)
N-C
D15314 1of2

16130 1055

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

Project No. 72072 - SALT/GILA CLEARING

Item No. (Assessor Parcel) 500-78-1C

JOE CONWAY and FLORANE A. CONWAY, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

(SEE LEGAL DESCRIPTION and DRAWING ATTACHED)

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

NOW THEREFORE, in consideration of the same and further consideration hereinafter set forth, it is agreed, that this instrument contains the entire agreement between the parties hereto there being no further consideration paid than herein specified.

THE COUNTY OF MARICOPA AGREES:

To use the above described land for the general welfare and benefit of the public.

THE GRANTORS AGREE:

1. To grant an easement for the above described land to the County of Maricopa for the general welfare and benefit of the public.

2. That acceptance of this dedication in no way obligates Maricopa County to construct or maintain a roadway within the right-of-way granted by this document.

Dated this 9th day of June, 1982

Joe Conway
Grantor (JOE CONWAY)

Florane A. Conway
Grantor (FLORANE A. CONWAY)

Grantor

Grantor

STATE OF ARIZONA }
COUNTY OF MARICOPA } ss.

Subscribed and sworn to before me this 9th day of June, 1982

My commission expires My Commission Expires Jan. 12, 1984

Emily Marek
Notary Public SEAL:

Recommended for approval: Eric B. Hoffman
Right of Way Agent

(Deputy County Engineer)

ACCEPTED:
MARICOPA COUNTY BOARD OF SUPERVISORS

by ______
Chairman of the Board

ATTEST:

Cheree Bonnington
Clerk of Board of Supervisors

SALT-GILA RIVER CHANNEL

CONWAY

500-78-1C

That portion of the South half of the Nortwest quarter (S½NW¼) of Section Thirty-four, Township One (1) North, Range One (1) West, Gila and Salt River Base and Meridian, Maricopa County, Arizona, described as follows: The Easterly 33' as measured at right angles to the West line of a strip of land 66' wide whose West line is identical with the centerline of the existing Buckeye Feeder Canal and Wasteway as described in Book 343 of Deeds, Page 50 (MCR) and which centerline and its Southerly extension is described as follows: Beginning on the North line of said South half of the Northwest quarter (S½NW¼) at a point South 89°54' East 815' from the Northwest corner of said South half of the Northwest quarter (S½NW¼); thence South 32°39' West 550' to the end point of said centerline; thence along the Southerly extension of said centerline run due South to termination on the South line of said South half of the Northwest quarter (S½NW¼).

5/20/82; Exhibit A

STATE LAND D[illegible]RTMENT
422 Arizona State [illegible]ce Building
Phoenix, Arizona

C/819 1 of 2

NO CHARGE
Recorded at Request of
Board of Supervisors.

R/W No. 3362

RIGHT OF WAY

THIS INDENTURE made and entered into this 16th day of August, 19 63, by and between the State of Arizona, hereinafter called the Grantor, and

MARICOPA COUNTY BOARD OF SUPERVISORS

of Phoenix, State of Arizona, hereinafter called the Grantee,

WITNESSETH, that pursuant to the authority vested in the State Land Commissioner, the Grantee is hereby granted a Right of Way on, over and across the State lands hereinafter described under the Provisions of Article 10, Section 37-461, Arizona Revised Statutes.

The granting of said Right of Way is predicated upon an application duly filed by the Grantee and approved by the Governor of the State of Arizona, together with an alignment map showing the definite location and establishing the width and acreage of said Right of Way, both of which are made and become a part of this permit.

It is understood and agreed by Grantee that the State land covered by said Right of Way will be used for no purpose other than the location, construction, operation and maintenance of a highway on, over and across these State lands running ______ miles and/or containing 10.00 acres, more or less, and extending a width of Varying feet on each side of the center line.

TO HAVE AND TO HOLD the same as used for a County highway, but subject to the conditions and reservations herein set forth.

IT IS UNDERSTOOD AND AGREED that:

1. The Grantee shall not sublet or assign the Right of Way herein granted, or any part thereof, without the written consent of Grantor first obtained, nor shall Grantee grant any franchise, permit or other Right of Way on the lands described herein, or any part thereof.

2. The Grantor reserves the right to grant easements and Rights of Way for public utilities and other purposes over and across State lands described herein, subject to the approval of the Grantee.

3. The Grantor also reserves the right, as provided by law, to grant to the United States Rights of Way and easements over, across or upon the lands embraced in this permit for canals, reservoirs, dams, power or irrigation plants or works, railroads, tramways, transmission lines or other purposes for irrigation works in connection with any Federal Government reclamation project.

4. The Grantee will not permit any loss, nor commit or cause any waste in, to or upon said land; nor cut or remove nor allow to be cut or removed any timber or standing trees that may be upon said land, save and except only such as may be necessary for the improvements of ~~said land, (and then only~~ with the written consent of the State Land Commissioner) or for fuel for the domestic use of said Grantee; provided that nothing herein contained shall be construed to permit the cutting of saw timber for any purpose.

5. The Grantor excepts and reserves out of the grant hereby made all oil, gases, coal, ores, limestone, minerals, fossils, and fertilizer of every name and description that may be found in or upon the land described herein, or any part thereof; and the lands herein described are subject to the execution by Grantor of drilling permits and leases for the purpose of prospecting for, and the extraction of oil, gases, coal, ores, limestone, minerals, fossils and fertilizers as provided by law.

DKT 4722 PAGE 400

STATE LAND DEPARTMENT

C1819 2 of 2

PHOENIX, ARIZONA

LEASE SUPPLEMENT

	DESCRIPTION	SEC	TWP	RANGE	ACREAGE

APPROVED Samuel F. Lunford 8-29-63 Deputy Louis C. Duncan

SIGNATURE OF LESSEE — DATE — STATE LAND COMMISSIONER — DATE

MARICOPA COUNTY ENGINEER

9/6/63

STATE LAND DEPAR
422 Arizona State Office
Phoenix, Arizo

NO CHARGE
Recorded at Request of
Board of Supervisors

RIGHT OF

THIS INDENTURE made and entered into th
and between the State of Ariz

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

OCT 2 '63 -11 55 DOCKET & Page ... and indexed in ...

MARICOPA CO. BD. OF SUPERVISORS

Fee No 02-DEN

Witness my hand and official seal.

N. C. ... Moore
County Recorder

By ...
Deputy Recorder

When recorded, return to:
Maricopa County Board of Supervisors

NO CHARGE

Compared
Photostated
Fee:

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. Z-547 ~~DD-2457~~ R/W

Martin L. Colvin

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The West Forty(40) feet of the North One-half(N½) of Section One(1) South, Range One(1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona;
also a strip of land 110 feet wide being Fifty-five(55) feet on each side, adjacent and parallel with the following described centerline lying in said Section 1; Beginning at the Northwest corner of said Section 1; thence East 3476.49 feet along the North line of said Section 1, to the Point of Curve of a 3°15' Curve concave Northwesterly having a central angle of 90°39'43" and a Tangent of 1783.43 feet; thence Northeasterly along the arc of said Curve until a measurement of Fifty-five(55) feet at right angles to the arc of said curve will intersect the North line of said Section 1.
ALSO the East Fifty-five(55) feet of the North One-half(N½) of said Section 1.

RE-RECORDED TO CLARIFY LEGAL DESCRIPTION -- Should be Section One(1), Township One(1) South, Range One(1) West.

Checked 7/4/63
Approved 7/9/63

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 18th day of September 1963

_____ (Seal) ... (Seal)

_____ (Seal) _____ (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 18th day of September 1963 by Martin L. Colvin.

FORM 95-18 (REV 7-24-63)

Notary Public

My commission expires May 22, 1966

D15568

83 161924

Sale No. R/W 218

County of Maricopa

Lease No. 16-83812

RETURN TO: Highway Dept.

STATE LAND DEPARTMENT
STATE OF ARIZONA

Project #30118 - 115th Avenue at Gila River
Item #U-1131

RIGHT OF WAY
SOLD AT PUBLIC AUCTION

THIS INDENTURE, made and entered into this 13th day of October, 19 82, by, and between the STATE OF ARIZONA, hereinafter called the Grantor, and MARICOPA COUNTY, hereinafter called the Grantee.

WITNESSETH, that in accordance with the provisions of Section 37-461, Article 9, Arizona Revised Statues, the Grantee herein has filed with the State Land Commissioner an application for a right-of-way for the purpose of constructing, operating and maintaining and widening an existing roadway and installing public utilities, and

WHEREAS, the said map and field notes thereon have been adopted by the Grantee herein as the line of definite location of the aforesaid right-of-way, and which said right-of-way map is herein referred to and made a part hereof as fully as though set out herein, and

WHEREAS, it is understood and agreed by the Grantee herein that, as a condition precedent to the granting of the right-of-way applied for, the land covered by the said right-of-way shall be used for no purpose other than the location, construction and maintenance of said right-of-way over and across the following State lands, to-wit:

STATE OF ARIZONA
LAND DEPARTMENT

02 08 83 (MO DAY YR)

MARICOPA COUNTY
3325 W DURANGO ST
PHOENIX AZ 85009

15 83812 00

		LOCATION		DESCRIPTION	ACRES		FUND
07	36	01.0 N	01.0 W	M&B THRU SESE	0.34	M38	030 04

RECORDED IN OFFICIAL RECORDS
OF MARICOPA COUNTY, ARIZONA
APR 29 '83 -4 55
BILL HENRY, COUNTY RECORDER
FEE N-C PGS 6

D15568 2of3

SPECIAL CONDITIONS

83 161924

1. The State of Arizona, through its State Land Department, retains ownership of the land. The use of this Right-of-Way is to be non-exclusive. This easement is sold SUBJECT to existing reservations, easements of Rights-of-Way heretofore legally obtained and now in full force and effect.

2. The Department does not represent or warrant that access exists over other State lands which intervene respectively between this Right-of-Way easement and the nearest public roadway.

3. Permittee agrees to abide by the Maricopa County Air Pollution Control District rules and regulations.

4. Roadway will be built to Maricopa County specifications as to width and construction.

5. Grantee shall promptly notify the Commissioner of the amount of flora, if any, which will be cut, removed, or destroyed in the construction and maintenance of the project and shall pay the State Land Department such sum of money as the Commissioner may determine to be the full value of the flora to be so cut, removed or destroyed. Grantee shall notify the State Land Department and the Commission of Agriculture and Horticulture 30 days prior to any destruction or removal of native plants to allow salvage of those plants where possible.

Notice of State authority to cancel this contract:

A. The State may cancel any contract, without penalty or further obligation, made after September 4, 1978 by the State or any of its departments or agencies if any person significantly involved in initiating, negotiating, securing, drafting or creating the contract on behalf of the State or any of its departments or agencies is, at any time while the contract or any extension of the contract is in effect, an employee of any other party to the contract in any capacity or a consultant to any other party of the contract with respect to the subject matter of the contract

B. The cancellation shall be effective when written notice from the Governor is received by all other parties to the contract unless the notice specifies a later time.

SPECIAL CONDITION

If the removal of plants protected under the Arizona native plant law is necessary to enjoy the privilege of this document, the permittee hereunder must previously acquire the written permission of the Arizona State Land Department and Arizona Commission of Agriculture and Horticulture to remove those plants.

30118 - 115th Avenue at Gila River
Item - U-1131

D15568 3 of 5

83 161924

EXHIBIT A

M.C.H.D.
Plotted
Checked
Approved

That part of the Southeast one-quarter of the Southeast one-quarter (SE¼ of SE¼) of Section Thirty-six (36), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona described as having for its Southeasterly line the Northwesterly line of the right-of-way described in Docket 4732 on Page 74, M.C.R. as being that part of said Southeast one-quarter of the Southeast one-quarter (SE¼ of SE¼) of Section 36 lying within a strip of land 110.0 feet in width being Fifty-five (55) feet on each side of the following described center line; beginning at the Southwest corner of said Section 36; thence East along the South line of Section 36 for a distance of 3468.57 feet to the point of curve of a 3°15' curve concave Northwesterly, having a central angle of 90°39'43"; thence Northeasterly along the arc of said curve 2789.6 feet to the intersection of the East line of Section 36 at a point North 0°39'43" West 1783.43 feet from the Southeast corner of said Section 36.

EXCEPT that part as covered in Book 2 of Road Maps, Page 14, M.C.R.

With its Northwesterly line beginning at the Northwesterly prolongation (measured radially) of Engineer's Highway Station 12+00 and lying Southeasterly of a line extended in a straight line from a point 90 feet left of said Station 12+00 to a point 80 feet left of Engineer's Highway Station 15+00; thence in a straight line to a point 65 feet left of Engineer's Highway Station 17+00; thence in a straight line to a point 55 feet left of Engineer's Highway Station 19+00 and the terminus of the herein described permanent right-of-way.

For the purpose of this description the P.C. of the herein described curve is on the South line of said Section 36 and is also Engineer's Highway Station 0+00.

_6226

4732 PAGE 4-72

STATE OF ARIZONA }ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

Fee No. 168983

SEP 17 '63 -8 00 AM DOCKET & Page DKT 4732 PAGE 71 and indexed in

Phoenix Title & Trust Co.

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.
N. C. 'Kelly' Moore
County Recorder

By [signature] Deputy Recorder

Compared
Photostated
Fee:

EASEMENT

HIGHWAY PURPOSES

R/W 43-345, 11[illegible]th Avenue

Item [illegible]

Policy No. [illegible]

VALLEY NATIONAL BANK OF ARIZONA

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The West Twenty-two (22) feet of the East Fifty-five (55) feet of the North One-half of the Southeast One-quarter (N½ of SE¼) of Section Thirty-six (36), Township One (1) North, Range One (1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

WH MES 81363

Also that part of said (N½ of SE¼) lying within a strip of land 110.0 feet in width being Fifty-five (55) feet on each side of the following described centerline: Beginning at the Southwest corner of said Section 36; thence East along the South line of Section 36 for a distance of 3468.57 feet to the Point of Curve of a 2°15' curve concave Northwesterly, having a central angle of 90°39'43"; thence Northeasterly along the arc of said curve 2789.6 feet to the intersection of the East line of Section 36 at a point North 0°39'43" West 1783.43 feet from the Southeast corner of said Section 36 EXCEPT that part as covered in Book 2 of Road Maps, page 14, records of Maricopa County Recorder.

WH 81363

WH 81363

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed, they will apply to either masculine, feminine or neuter as the context requires.

Dated this 16th day of August 19 63

_______________ (Seal)
_______________ (Seal)
_______________ (Seal)

Valley National Bank of Arizona (Seal)
by [signature] (Seal)
Manager
Tolleson Office (Seal)

STATE OF ARIZONA }ss.
County of MARICOPA

This instrument was acknowledged before me this 16th day of August, 19 63 by

Peter Falbo, Manager of Valley National Bank of Arizona

FORM 95-18 (REV. 8-15-61)

[signature] Notary Public

My commission expires Jan 1 - 1967

.02

5510 279

STATE OF ARIZONA } ss I hereby certify that the within instrument was filed and recorded 1965 MAR 6 3 01

County of Maricopa

IN DOCKET & Page 5510 page 279 and indexed in

OF SUPER

Witness my hand and official seal.

County Recorder

By

Deputy Recorder

Fee No

85810

Compared
Photostated
Fee:

N/C

When recorded, return to:
Maricopa County Board of Supervisors

EASEMENT FOR HIGHWAY PURPOSES

Pol. No. 28,332

ITEM NO. E-2011

R/W 53-382 El Mirage Road

J. HOLLY SMITH AND LEONA B. SMITH, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The West Fifty-five(55) feet and the South Twenty-two(22) feet of the North Fifty-five(55) feet of the West One-half of the Northwest One-quarter(W½ of NW¼) of Section Thirty-six(36), Township One(1) North, Range One(1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

M.C.H.D.
Traced
PK
MSS
3 4 65
PK
3 17 65
WX
3 17 65

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 10th day of March 1965

(Seal) J. Holly Smith (Seal)

(Seal) Leona B. Smith (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 10th day of March 1965 by

J. HOLLY SMITH AND LEONA B. SMITH, his wife

FORM 95-10 (REV. 7-24-63)

Notary Public

My commission expires

STATE OF ARIZONA
County of Maricopa } ss I hereby certify that the within instrument was filed and recorded

IN DOCKET & Page 5565 and indexed in

MARICOPA CO. BD. OF SUPERVISORS

1965 MAY 26

Witness my hand and official seal.

CLIFFORD H. WARD

County Recorder

By

Deputy Recorder

Fee No

99565

Compared
Photostated
Fee:

When recorded, return to:
Maricopa County Board of Supervisors

NO CHARGE
Recorded at Request of

EASEMENT FOR HIGHWAY PURPOSES

Pol. No. 28,332

ITEM NO. E-2011

R/W 53-382 El Mirage Road

ROSE ELOISE CASTER, an undivided one-fourth interest

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The West Fifty-five(55) feet and the South Twenty-two(22) feet of the North Fifty-five(55) feet of the West One-half of the Northwest One-quarter($W\frac{1}{2}$ of $NW\frac{1}{4}$) of Section Thirty-six(36), Township One(1) North, Range One(1) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 7th day of April, 19

(Seal) (Seal)

(Seal) (Seal)

STATE OF ~~ARIZONA~~ California } ss.
County of ~~MARICOPA~~ Los Angeles

This instrument was acknowledged before me this day of May, 1965 by

ROSE ELOISE CASTER, an undivided one-fourth interest

FORM 93-18 (REV. 7-24-63)

JACKQUELEAN ROADY
NOTARY PUBLIC · CALIFORNIA
COUNTY OF LOS ANGELES

My commission expires

Notary Public

JACKQUELEAN ROADY
My Commission Expires Feb. 24, 1968

BK 14958 PG 66 D 1483

ATE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded IN DOCKET 14958 Page 66-67 and indexed in deeds

AMERICAN TITLE

JAN 15 1981 -8 00

Witness my hand and official seal.

BILL HENRY County Recorder

By Michael Deputy Recorder

Fee No. 14553

Compared
Photostated
Fee:

When recorded, return to:

Maricopa County Board of Supervisors ☐
Maricopa County Engineer ☐
Attn: Tom Galkowski
500,890

68084-Tuthill Road Bridge Approaches
Item U-348
400-6-1

Quit-Claim Deed

For the consideration of One Dollar, and other valuable considerations, I or we Larry Dixon and Dean Dixon grantor hereby quit-claim to MARICOPA COUNTY, a political subdivision of the State of Arizona, grantee, all right, title, or interest in the following real property situated in Maricopa County, Arizona:

See Exhibit "A"

ATTEST:

Rhea Wordall
Clerk of the Board

Date NOV 10 1980

ACCEPTED:
MARICOPA COUNTY BOARD OF SUPERVISORS

By: Fred Koory Jr.
Chairman of the Board

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee, its successors and assigns forever, for the use and benefit to the public as a right of way, for highway purposes.

Dated this 14 day of Oct 19 80

x Larry Dixon
Larry Dixon

x Dean Dixon
Dean Dixon

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this 14 day of October 19 80, by Larry Dixon and Dean Dixon

Thomas T. Galkowski
Notary Public

My commission expires My Commission Expires Jan. 23, 1984

FORM 65-18

68084 - Tuthill Road Bridge Approaches
[illegible]
[illegible]

EXHIBIT A

All of that portion of the south one-half of the southwest one-quarter (S½ of SW¼) of Section Five (5), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona lying within the following described parcel of land:

A strip of land 100 feet wide lying 50 feet on each side of a center line described as follows:

Beginning at the Southwest corner of Section Eight (8), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona with said Southwest corner of Section Eight (8) being also designated as Engineers Highway Station 0+00 as shown on the plans for Tuthill Road Bridge Approaches, Maricopa County Highway Department Work Order No. 68084; thence North 2°39' East (B.L.M. Bearing) along the West line of said Section 8 to the East-West Mid-Section line of said Section 8 and the True Point of Beginning for the herein described 100-foot wide strip of land: THENCE North 2°39' East along said West line of Section Eight (8) to Engineers Highway Station 34+11.22 and the beginning of a curve concave Southeasterly having a radius of 763.94 feet and a central angle of 52°00'00"; thence along the arc of said curve 693.33 feet in a Northerly and Northeasterly direction to Engineers Highway Station 41+04.55 and the beginning of a tangent; thence North 54° 39' East, 1870.83 feet to Engineers Highway Station 59+75.38 and the beginning of a curve concave Northwesterly having a radius of 1909.86 feet and a central angle of 53°43'11"; thence along the arc of said curve 1790.66 feet in a Northeasterly and Northerly direction to the beginning of a tangent that is also the center line of the existing Rainbow Valley Road as shown in Book 10 of Road Maps, Pages 25 and 26 and the Point of Ending for said center line.

10 24 90

EXCEPT any portion thereof lying within existing right-of-way of Rainbow Valley Road as shown in Book 10 of Road Maps, Pages 25 and 26, M.C.R.

EXCEPT any part thereof lying in the right-of-way for Beloat Road as shown in Book 1 of Road Maps, Page 61, M.C.R.

AND ALSO granting herein an easement over that part of said South one-half of the Southeast one-quarter (S½, SE¼) of Section 5 lying between the Easterly line of the herein described 100 foot wide strip of land and the westerly right of way line of said Rainbow Valley Road.

D1632

Quit-Claim Deed

THIS INDENTURE, Made the 25th day of June 1955

between MARION W. PACE, and Estelle H. Pace his wife

Grantor and COUNTY OF MARICOPA, a politcial subdivision of the State of Arizona,

Grantee,

WITNESSETH: That the said grantor, for and in consideration of the sum of - - - -ONE AND NO/100- DOLLARS to him in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, has released and quit-claimed, and by these presents does release and quit-claim unto the said grantee, and to its successors ~~heirs~~ and assigns forever, all the right, title, interest, claim and demand which the said grantor has; in and to the following described property situated in the County of MARICOPA, and State of Arizona, to-wit:

All that part within the N½ SW¼ of Section 5, T1S, R2W, G&SRB&M, of a strip 80 feet wide, for the use and benefit of the public, the survey line for said strip being described as follows:

Beginning at the north quarter corner (Sta. 634 + 37.6) of said Section 5 on U.S. 80 and Baseline, the bearing of which line is S89º 19' E; thence on a tangent bearing S2º 07' W. a distance of 1300.9 feet to a P.I. (Sta. 621 +.36.7) with an angle to the left of 0º 55'; thence on a tangent bearing S1º 12' W. a distance of 2839.09 feet to the P.T. (Sta. 592 + 97.61 of a curve to the left having a radius of 2864.79 feet and central angle of 16º 26'. This P.T. (Sta. 592 + 97.61) point is some distance south of the south boundary of said N½ SW¼ of Section 5 and lies 87.03 feet westerly from the north-south midsection line of said Section 5. At the north boundary of this property (Sta. 607 + 71.88) the west right of way line is 36.9 feet from the survey line and the east right of way line is 43.1 feet; also the survey line at this point is 63.07 feet westerly of the north-south [redacted] midsection line. The right of way lines at P.T. (Sta. 592 + 97.61) are 40 feet each side of center line.

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee its successors ~~heirs~~ and assigns forever.

IN WITNESS WHEREOF, the said grantor has hereunto set his hand the day and year first above written.

Marion W. Pace

Estelle H. Pace

Rainbow Valley

DKT 13268 PG 197

D 14 011

I hereby certify that the within named instrument was recorded at request of MARICOPA CO. BD. OF SUPERVISORS

Fee No.:

Docket 13268 Page 197-198

394526

NOV 8 - 1978 -4 55

_________________, Records of Maricopa County, Arizona.

WITNESS my hand and official seal the day and year aforesaid.

Fee:

BILL HENRY By ________

County Recorder Deputy Recorder

n.c

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-5-5
400-6-2 & 4

Project No. DD-6513 Rev.

Item No. Z-77-106

LUECK INVESTMENT COMPANY, a general partnership,

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed F.B. BHC 6/16/78 Checked 10/11/78 Approved 10/11/78

4

A parcel of land lying in the North one-half of the South one-half ($N\frac{1}{2}$ of $S\frac{1}{2}$) of Section Five(5), Township One(1) South, Range Two(2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, more particularly described as follows:

A strip of land 15.00 feet wide having as its West line the East right-of-way line of Rainbow Valley Road as described in Docket 1662, page 551, M.C.R., Beginning at the South line of the $N\frac{1}{2}$ of $S\frac{1}{2}$ of said Section 5 and extending Northerly to the North line of the $N\frac{1}{2}$ of $S\frac{1}{2}$ of said Section 5.

ALSO the South Sixty(60) feet of the North one-half of the Southeast one-quarter($N\frac{1}{2}$ of $SE\frac{1}{4}$) of said Section Five(5), all being in Township One(1) South, Range Two(2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

MARICOPA COUNTY RECORDER ARIZONA

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

(See Reverse Side For Agreement and Signatures)

C1053

Quit-Claim Deed

THIS INDENTURE, Made the 25th day of [illegible], 19[illegible],

between E.M. SHEPARD & MILDRED H. SHEPARD, his wife

Grantors and COUNTY OF MARICOPA, a political subdivision of the State of Arizona

Grantee,

WITNESSETH: That the said grantors, for and in consideration of the sum of - - -ONE AND NO/100- -DOLLARS to them in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, have released and quit-claimed, and by these presents do release and quit-claim unto the said grantee, and to its / successors ~~heirs~~ and assigns forever, all the right, title, interest, claim and demand which the said grantors have; in and to the following described property situated in the County of Maricopa, and State of Arizona, to-wit:

All that part within E½ E½ NW¼ of Section 5, T1S, R2W, G&SRB&M, of a strip of land 80feet wide, for the use and benefit of the public, the survey line for said strip being described as follows:

Beginning at the north quarter corner (Sta. 634 + 37.6) of said Section 5 on U.S. 80 and Baseline, the bearing of which line is S89° 19' E; thence on a tangent bearing S2° 07' W a distance of 1300.9 feet to a P.I. (Sta. 621 + 36.7) with an angle to the left of 0° 55'; thence on a tangent bearing S1° 12' W. a distance of 1364.82 feet to a point (Sta. 607 + 71.88) on east-west mid-section line of Section 5, which is the south boundary of said E½ E½ NW¼ Section 5, and this point (Sta. 607 + 71.88) is westerly 63.07 feet from center of said Section 5.

The distances from the survey line to the right of way lines vary as follows: at the north quarter corner (Sta. 634 + 37.6) of said Section 5 both distances are 40 feet, at P.I. (Sta. 621 + 36.7) the distance on the west is 34.0 feet and on the east is 46.0 feet, and at the south boundary of said E½ E½ NW¼ of Section 5 (Sta. 607 + 71.88) the distance on the west is 36.9 feet and on the east is 43.1 feet

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee its successors ~~heirs~~ and assigns forever.

IN WITNESS WHEREOF, the said grantors have hereunto set their hands the day and year first above written.

E. M. Shepard

Mildred H. Shepard

Rainbow Valley

D113C

FAS 283 (7)

McDowell Road

E A S E M E N T

KNOW ALL MEN BY THESE PRESENTS: DOCKET 1769 PAGE 193

That the SALT RIVER VALLEY WATER USERS' ASSOCIATION, a corporation, for and in consideration of the sum of One and No/100-Dollars and other valuable consideration to it in hand paid, receipt of which is hereby acknowledged, on behalf of the COUNTY OF MARICOPA, a municipal corporation, has granted and does hereby grant unto the said COUNTY OF MARICOPA an easement FOR ROADWAY PURPOSES upon and across

The North 40 feet of the East 24 feet of the Northwest quarter of Section 5, Township 1 North, Range 2 East, Gila and Salt River Base and Meridian, and

The North 40 feet of the West 7.5 feet of the Northeast quarter of said Section 5, Township 1 North, Range 2 East, Gila and Salt River Base and Meridian.

PROVIDED that the plans and specifications of the roadway to be constructed by said COUNTY OF MARICOPA are approved by the Chief Engineer of said SALT RIVER VALLEY WATER USERS' ASSOCIATION prior to construction, and provided that said roadway does not interfere with the operation and/or maintenance of the lateral ditch and roadway of the grantor located upon said property.

IT IS MUTUALLY UNDERSTOOD that title to said property is vested in the UNITED STATES OF AMERICA, but the right of operation, control and management is vested in the grantor herein.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purpose herein granted, all rights herein granted shall cease and revert to the grantor, its successors or assigns.

IN WITNESS WHEREOF the said SALT RIVER VALLEY WATER USERS' ASSOCIATION has hereunto set its corporate name and seal this 9th day of Nov. 1955.

SALT RIVER VALLEY WATER USERS' ASSOCIATION

ATTEST [signature] Secretary By [signature] President

STATE OF ARIZONA) ss.
County of Maricopa)

On this the 9th day of November, 1955, before me Earl J. Jolly the undersigned officer personally appeared V. I. CORBELL and J. F. GRISWOLD, who acknowledged themselves to be the President and Secretary of the Salt River Valley Water Users' Association, a corporation and that they as such officers being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by themselves as President and Secretary.

IN WITNESS whereof I hereunto set my hand and official seal.

Earl J. Jolly
Notary Public

My Commission expires:
January 16, 1958

(Filed by County Engineer-returned to Board of Supervisors)

D1126

Quit-Claim Deed

THIS INDENTURE, Made the 1st day of November, 19 55, between W. O. Shepard and Lydia E. Shepard, man and wife

Grantor and COUNTY OF MARICOPA, a political subdivision of the State of Arizona Grantee,

WITNESSETH: That the said grantor, for and in consideration of the sum of ONE AND NO/100 Dollar and other valuable considerations ~~DOLLARS~~ to him in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, has, released and quit-claimed, and by these presents does release and quit-claim unto the said grantee, and to its successors ~~heirs~~ and assigns forever, all the right, title, interest, claim and demand which the said grantor has; in and to the following described property situated in the County of Maricopa, and State of Arizona, to-wit:

Beginning at a point on the south line of U. S. Highway 80 and 33 feet south of the north quarter corner of Section 5, T.1 S., R.2 W. of G.& S.R.B.& M. and running S 89° 19' E along the north line of said Section 5 a distance of 40.00 feet; thence S 1° 51' W 1302.83 feet; thence S 1° 19' W 218.27 feet, more or less to a point on the north and south mid-section line of said Section 5; thence N 0° 16' W 1519.00 feet to the point of beginning; containing .70 acres and for the use and benefit of the public.

As further consideration herein, the grantee agrees to relocate grantor's fence to the east line of the above described property as now staked, to provide steel posts and wire needed in addition to the salvagable wire from grantor's present fence all at no cost to grantor.

It is further hereby agreed that no other structures or buildings will be moved by the grantee.

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee its successors ~~heirs~~ and assigns forever.

IN WITNESS WHEREOF, the said grantor has hereunto set his hand the day and year first above written.

W. O. Shepard

Lydia E. Shepard

FORM 93-10

86-3516

I do hereby certify that the within named instrument was ded at request of

Fee No.

______________, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

Fee:

______________ By ______________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

D17343

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

4/

Project No. 400-8-2 68272 - Beloat Road (Rainbow Rd. to Tuthill Rd.)

Item No. W-56

Larry Dixon, a single man and Dean Dixon, a single man

GRANTORS.

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Prorated
mj/MAN 7/16/86
K/D 1/16/86
Checked 234 4/22/86
Approved 4/22/86

The South Seven (7) feet of the North Forty (40) feet of the East Thirty-three (33) feet of the East one-half of the Northwest one-quarter (E½ of NW¼) of Section Seven (7), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY ARIZONA
JUL 9 - '86 -3 00
KEITH POLETIS, County Recorder
FEE. NC PGS 2 PH.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85

(See Reverse Side For Agreement and Signatures)

Escrow Number 70031481-9 TRANSAMERICA TITLE INS. CO. D16594

I do hereby certify that the within named instrument was recorded at request of

Fee No.

__________, Records of Maricopa County, Arizona.
WITNESS my hand and official seal the day and year aforesaid.

86 351600
Fee:

__________ By __________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

4/

400-8-4C

Project No. 68272 - Beloat Road
(Rainbow Rd. to Tuthill Rd.)
Item No. W-57

Larry W. Dixon, a single man and Dean W. Dixon, a single man

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Precept
[illegible]
4/16/86
[illegible]
4/11/86
E34
4/28/86
Recorded
[illegible]

The South Seven (7) feet of the North Forty (40) feet of the West 429.58 feet of the Northwest one-quarter of the Northeast one-quarter (NW¼ of NE¼) of Section Seven (7), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

RECORDED IN OFFICIAL RECORDS
OF MARICOPA COUNTY ARIZONA
JUL 9 - '86 -3 00
KEITH POLETIS, County Recorder
FEE N/C PGS 2 PH

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85

(See Reverse Side For Agreement and Signatures)

8-21-62

TE OF RIZONA
County of Maricopa } ss. I hereby certify that the within in...ument was filed and recorded

Fee No. D5565

SEP 21 '62 -8 00 AM in DOCKET & Page 4205 397 and indexed in

164883

Phoenix Title & Trust Co.

01-DEED

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.

N. C. 'Kelly' Moore Recorder

By [signature] Deputy Recorder

Compared
Photostated
Fee: NC

EASEMENT

HIGHWAY PURPOSES

R/W ____

Item ____

HENRY E. DRAKE AND PEARL M. DRAKE, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The West Forty (40) feet of Lots One (1) and Two (2) of Section Seven (7) Township One (1) South, Range Two (2) West of the Gila and Salt River Base & Meridian, according to the final plat of the survey of said land in the Bureau of Land Management.

M.C.H.D.
Plotted
Checked
Approved

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed, they will apply to either masculine, feminine or neuter as the context requires.

Dated this 21 day of August 1962

____ (Seal) Henry E. Drake (Seal)

____ (Seal) Pearl M. Drake (Seal)

____ (Seal) ____ (Seal)

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this 21 day of August 1962 by

HENRY E. DRAKE AND PEARL M. DRAKE, his wife

FORM 95-19 (REV 8-15-61)

DKT 4205 PG 397

L. R. Turner
Notary Public

My commission expires July 20, 1963

WHEN RECORDED RETURN TO Highway Dept.

Right Of Way Contract

23510

D14834

Maricopa County, State of Arizona

Project No. 68084 - Tuthill Rd Bridge Approaches Date December 5, 1980

Item No. U-341

WHEREAS a document, dated October 14, 19 80, in the form of Quit-Claim Deed covering the following described property:

14975 2SS

EASEMENT (ES)

SEE D14838

See Exhibit "A"

has been executed and delivered by Grantor to Maricopa County,

NOW THEREFORE, in consideration of the same and further consideration hereinafter set forth, it is agreed, that this instrument contains the entire agreement between the parties hereto there being no further consideration paid than herein specified.

THE COUNTY OF MARICOPA AGREES:

A. To use the above-described land for the general welfare and benefit of the public.

B. To pay the sum of Four Thousand Nine Hundred Ten Dollars ($4,910) as payment in full for the right-of-way as described herein.

C. To pay the sum of Six Thousand Dollars ($6,000) as payment in full for severence damages to the remaining property, resulting from the partial taking.

THE GRANTOR AGREE:

1. To grant right-of-way over the above-described land to the County of Maricopa for the general welfare and benefit of the public.

2. To accept the sum of Four Thousand Nine Hundred Ten ($4,910) as payment in full for the right-of-way as described herein.

3. To accept the sum of Six Thousand Dollars ($6,000) as payment in full for severence damages, to the remaining property, resulting from the partial taking.

IN WITNESS WHEREOF, the parties have executed this agreement the day and year first above written.

Grantor

Grantor Larry W. Dixon

Grantor Conservator for Kate Dixon aka

Grantor KATHRYN ELIZABETH DIXON

STATE OF ARIZONA }
COUNTY OF MARICOPA } ss.

Subscribed and sworn to before me this 5th day of December, 1980.

My commission expires My Commission Expires June 6, 1983 SEAL.

Notary Public

Recommended for approval Thomas J. Galkowski × Deputy

ACCEPTED:
MARICOPA COUNTY BOARD OF SUPERVISORS

by Hawley Atkinson ACTING Chairman of the Board

ATTEST:

Rhea Wardell
Clerk of Board of Supervisors

Date JAN 19 1981

DKT 14975PG 267

D 14839 2 of 2

68084 - Tuthill Road Bridge Approaches
400-8-8
U-341

EXHIBIT A

That part of the South one-half of the Northeast one-quarter (S½ of NE¼) of Section Seven (7), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona lying within a parcel of land described as follows:

A strip of land 100 feet wide lying 50 feet on each side of a center line described as follows:

Beginning at the Southwest corner of Section Eight (8), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, with said Southwest corner of Section Eight (8) being also designated as Engineers Highway Station 0+00 as shown on the plans for Tuthill Road Bridge Approaches, Maricopa County Highway Department Work Order No. 68084; thence North 2°39' East (B.L.M. Bearing) along the West line of said Section 8 to the East-West Mid-Section line of said Section 8 and the True Point of Beginning for the herein described 100-foot wide strip of land; THENCE North 2°39' East along said West line of Section Eight (8) to Engineers Highway Station 34+11.22 and the beginning of a curve concave Southeasterly having a radius of 763.94 feet and a central angle of 52°00'00"; thence along the arc of said curve 693.33 feet in a Northerly and Northeasterly direction to Engineers Highway Station 41+04.55 and the beginning of a tangent; thence North 54°39' East, 1870.83 feet to Engineers Highway Station 59+75.38 and the beginning of a curve concave Northwesterly having a radius of 1909.86 feet and a central angle of 53°43'11"; thence along the arc of said curve 1790.66 feet in a Northeasterly and Northerly direction to the beginning of a tangent that is also the center line of the existing Rainbow Valley Road as shown in Book 10 of Road Maps, Pages 25 and 26 and the Point of Ending for said centerline.

M.C.H.D. Proofed
7/22/80
7.3.80
7.7.81

ALSO that part of a 20-foot wide strip of land having for its Easterly line the Westerly line of the herein described 100-foot wide strip of land lying in said South one-half of the Northeast one-quarter (S½ of NE¼) of Section Seven (7) Northerly of Engineers Highway Station 33+89.50.

ALSO the West 50 feet of the East 100 feet of said South one-half of the Northeast one-quarter (S½ of NE¼) of Section Seven (7) lying between Engineers Highway Station 33+89.50 and the East-West Mid-Section line of Section Seven (7).

AND ALSO the West Thirty (30) feet of the East 130 feet of that part of said South one-half of the Northeast one-quarter (S½ of NE¼) of Section Seven (7) lying between Engineers Highway Station 33+89.50 and Engineers Highway Station 31+29.50

JAN 22 1981 -11 30

STATE OF ARIZONA } ss
County of Maricopa }

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

MARICOPA CO. BD. OF SUPERVISORS

in Docket 14975
on page 266-267
Witness my hand and official seal the day and year aforesaid.
Bill Henry
County Recorder
By [signature]
Deputy Recorder

N-C

DKT 14805 PG 493
D 14774
360766

Right Of Way Contract

Maricopa County, State of Arizona

Project No. 68084 Tuthill Road Bridge Approaches Date October 15, 1980
Item No. U-340 400-8-17

WHEREAS a document, dated October 15, 1980, in the form of Quit-Claim Deed covering the following described property:

The East 100 feet of the Northeast one-quarter of the Southeast one-quarter (NE¼ of SE¼) of Section Seven (7), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

AND the West Sixty (60) feet of the East 160 feet of that part of said Northeast one-quarter of the Southeast one-quarter (NE¼ of SE¼) of Section Seven (7) lying South of Engineers Highway Station 15+54.30 as shown on the plans for Tuthill Bridge Approaches, Maricopa County Highway Department Work Order No. 68084.

M.C.H.D. Prepared [illegible] 9/26/80 Checked 9/26/80 Approved 10/10/80

has been executed and delivered by Grantor to Maricopa County,

NOW THEREFORE, in consideration of the same and further consideration hereinafter set forth, it is agreed, that this instrument contains the entire agreement between the parties hereto there being no further consideration paid than herein specified.

THE COUNTY OF MARICOPA AGREES:

A. To use the above described land for the general welfare and benefit of the public.

B. To pay the sum of Five Hundred and Five Dollars ($505) as payment in full for the right-of-way as described herein.

NOV 3 1980 -2 00

I hereby certify that the within named instrument was recorded at request of AMERICAN TITLE Docket 14805 Page 493 Records of [illegible]
WITNESS my hand and official seal the day [illegible]
BILL HENRY, Maricopa County Recorder, By [signature]

THE GRANTOR AGREE:

1. To grant right-of-way over the above described land to the County of Maricopa for the general welfare and benefit of the public.

2. To accept the sum of Five Hundred and Five Dollars ($505) as payment in full for the right-of-way as described herein.

M/C

MARICOPA COUNTY RECORDER ARIZONA

IN WITNESS WHEREOF, the parties have executed this agreement the day and year first above written.

[signature] Grantor

Grantor

Grantor

STATE OF ARIZONA }
COUNTY OF MARICOPA } ss.

Subscribed and sworn to before me this 15 day of October, 1980

My commission expires My Commission Expires Jan. 23, 1984 [signature] SEAL:
Notary Public

Recommended for approval [signature] Right of Way Agent

[signature] Deputy County Engineer

ACCEPTED:
MARICOPA COUNTY BOARD OF SUPERVISORS

by [signature] ACTING Chairman of the Board

ATTEST:
[signature] Clerk of Board of Supervisors

Date OCT 2 7 1980

99-23

STATE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded

DKT 14805 PG 494

Fee No. D14775

IN DOCKET 14805 Page 494 and indexed in deeds

AMERICAN TITLE

NOV 3 1980 -2 00

360767

Witness my hand and official seal.

When recorded, return to:

Maricopa County Board of Supervisors ☐
Maricopa County Engineer ☐

BILL HENRY County Recorder

By M. Levantini Deputy Recorder

Compared
Photostated
Fee: N/C

Quit-Claim Deed

68084-Tuthill Road Bridge Approaches
Item U-340
400-8-17

For the consideration of One Dollar, and other valuable considerations, I or we,

Eva J. Anderson, Grantor,

hereby quit-claim to W. F. Anderson, Grantee, all right, title, or interest in the following real property situated in Maricopa County, Arizona:

M.C.H.D.
Proofed
[illegible]
10/14/80
Checked
[illegible]
10/14/80
Approved
[illegible]
10/14/80

The East 100 feet of the Northeast one-quarter of the Southeast one-quarter (NE¼ of SE¼) of Section Seven (7), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

AND the West Sixty (60) feet of the East 160 feet of that part of said Northeast one-quarter of the Southeast one-quarter (NE¼ of SE¼) of Section Seven (7) lying South of Engineers Highway Station 15+54.30 as shown on the plans for Tuthill Bridge Approaches, Maricopa County Highway Department Work Order No. 68084.

MARICOPA COUNTY RECORDER ARIZONA

Dated this 15 day of October, 1980.

Eva J. Anderson

W. F. Anderson

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this 15 day of October, 1980, by Eva J. Anderson, W. F. Anderson

My Commission expires: My Commission Expires Jan. 23, 1984

Thomas J. Halbrook
Notary Public

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this ______ day of ______, 195__, by ______

My Commission expires:

Notary Public

DKT 14805 PG 495

Tuthill Road Bridge Approaches
U-340

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

IN DOCKET 14805 Page 495 and indexed in deeds

NOV 3 1980 -2 00

Fee No. D14776

360768

AMERICAN TITLE

When recorded, return to:

Maricopa County Board of Supervisors ☐
Maricopa County Engineer ☐

Witness my hand and official seal.

County Recorder

By M. Levandowski Deputy Recorder

Compared
Photostated
Fee N/C

Quit-Claim Deed

For the consideration of One Dollar, and other valuable considerations, I or we,

W. F. Anderson grantor

hereby quit-claim to MARICOPA COUNTY, a political subdivision of the State of Arizona, grantee, all right, title, or interest in the following real property situated in Maricopa County, Arizona:

M.C.H.D.
Proofed
9/26/80
Checked
9/26/80
Approved
10/16/80

The East 100 feet of the Northeast one-quarter of the Southeast one-quarter (NE¼ of SE¼) of Section Seven (7), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

AND the West Sixty (60) feet of the East 160 feet of that part of said Northeast one-quarter of the Southeast one-quarter (NE¼ of SE¼) of Section Seven (7) lying South of Engineers Highway Station 15+54.30 as shown on the plans for Tuthill Bridge Approaches, Maricopa County Highway Department Work Order No. 68084.

MARICOPA COUNTY ARIZONA

Recommended for approval: Thomas T. Halbrook
Right-of-way Agent

Deputy County Engineer

ACCEPTED:
MARICOPA COUNTY BOARD OF SUPERVISORS

Tom Freestone
ACTING Chairman of the Board

ATTEST:

Clerk of the Board

Date OCT 27 1980

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee, its successors and assigns forever, for the use and benefit to the public as a right of way, for highway purposes.

Dated this 15 day of October 1980

W. F. Anderson

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 15 day of October 1980 by W. F. Anderson

Thomas T. Halbrook
Notary Public

My commission expires My Commission Expires Jan. 23, 1984

.TE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded JAN 23 1-80 DKT 14977 373
County of Maricopa

IN DOCKET 14977 Page 373-374 and indexed in deeds

Fee No. D14840 1 of 24418

AMERICAN TITLE

When recorded, return to:

Maricopa County Board of Supervisors ☐
Maricopa County Engineer ☒
3325 W. Durango
Phx. Az. 85009
attn: Tom Holkowski

Witness my hand and official seal.

BILL HENRY County Recorder

By [signature] Deputy Recorder

Compared
Photostated
Fee: n/c

500,892 AP

Quit-Claim Deed

68084-Tuthill Road Bridge Approaches
Item U-344
400-7-3, 4A, 4B, & 4C

For the consideration of One Dollar, and other valuable considerations, I or we, Steve Bales and Barbara Bales, his wife grantor hereby quit-claim to MARICOPA COUNTY, a political subdivision of the State of Arizona, grantee, all right, title, or interest in the following real property situated in Maricopa County, Arizona:

See Exhibit "A"

Recommended for approval: [signature] Right-of-way Agent [signature] Deputy County Engineer

ACCEPTED:
MARICOPA COUNTY BOARD OF SUPERVISORS

[signature] Chairman of the Board

ATTEST:

[signature] Clerk of the Board

Date NOV 10 1980

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee, its successors and assigns forever, for the use and benefit to the public as a right of way, for highway purposes.

Dated this 23 day of October 1980

x Steve Bales

x Barbara Bales

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 23 day of Oct 1980, by Steve Bales & Barbara Bales

[signature] Notary Public

My Commission Expires Jan. 26, 1982

My commission expires

FORM 41-10

D14840 2 of 2

DKT 14977 PG 374

68084 - Tuthill Road Bridge Approaches
400-7-3, 4A, 4B & 4C
Item U-344

EXHIBIT A

All of that portion of the Northwest one-quarter (NW¼) of Section Eight (8), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona lying within the following described parcel of land:

A strip of land 100 feet wide lying 50 feet on each side of a center line described as follows:

Beginning at the Southwest corner of said Section 8, with said Southwest corner of Section 8 being also designated as Engineers Highway Station 0+00 as shown on the plans for Tuthill Road Bridge Approaches, Maricopa County Highway Department Work Order Number 68084; thence North 2°39' East (B.L.M. Bearing) along the West line of said Section 8 to the East-West Mid-Section line of Section 8 and the True Point of Beginning for the herein described 100-foot wide strip of land; THENCE North 2°39' East along said West line of Section 8 to Engineers Highway Station 34+11.22 and the beginning of a curve concave southeasterly having a radius of 763.94 feet and a central angle of 52°00'00"; thence along the arc of said curve 693.33 feet in a Northerly and Northeasterly direction to Engineers Highway Station 41+04.55 and the beginning of a tangent; thence North 54°39' East, 1870.83 feet to Engineers Highway Station 59+75.38 and the beginning of a curve concave Northwesterly having a radius of 1909.86 feet and a central angle of 53°43'11"; thence along the arc of said curve 1790.66 feet in a Northeasterly and Northerly direction to the beginning of a tangent that is also the center line of the existing Rainbow Valley Road as shown in Book 10 of Road Maps, Pages 25 and 26 and the Point of Ending for said center line.

ALSO the East Fifty (50) feet of the West 100 feet of the South one-half of the Northwest one-quarter (S½ of NW¼) of Section Eight (8) lying between Engineers Highway Station 33+89.50 and the East-West Mid-Section line of said Section 8.

ALSO the East 170 feet of the West 270 feet of that part of said South one-half of the Northwest (S½ of NW¼) of Section Eight (8) lying between Engineers Highway Station 31+29.50 and Engineers Highway Station 33+89.50.

ALSO that part of a 20-foot wide strip of land having for its Easterly line the Westerly line of the herein described 100-foot wide strip of land lying in said South one-half of the Southwest one-quarter (S½ of SW¼) of Section Eight (8).

ALSO any part of a 50-foot wide strip of land having for its Westerly line the Easterly line of the herein described 100-foot wide strip of land lying in said South one-half of the Northwest one-quarter (S½ of NW¼) of Section Eight (8) Northerly of Engineers Highway Station 33+89.50.

AND ALSO that part of the Northwest one-quarter (NW¼) of Section Eight (8) lying within the parcel of land described as follows:

Beginning at the intersection of the center line of said 100-foot wide strip of land and the North line of said Section 8 thence Westerly, 286.38 feet along the North line of said Section 8 to the True Point of Beginning for the parcel of land described as follows:

A strip of land 80 feet wide, lying 40 feet on each side of the center line described as having a radius of 191.01 feet and a degree of curve of 29°59'49"; thence along said curve to the Westerly line of said 100-foot wide strip of land. With the sidelines to lengthen or shorten to end on the West line of said 100-foot wide strip of land.

1540 PAGE 023

D1652

Quit-Claim Deed

THIS INDENTURE, Made the .... day of ...., 19.....,

between Thelma Harer, Administratrix of Estate of Robert Paul Harer

Grantor ... and COUNTY OF MARICOPA, a political subdivision of the State of Arizona

Grantee ......,

WITNESSETH: That the said grantor......, for and in consideration of the sum of ---------ONE AND NO/100---------DOLLARS

to her in hand paid by the said grantee......, the receipt whereof is hereby confessed and acknowledged, has......, released and quit-claimed, and by these presents does........ release and quit-claim unto the said grantee......, and to its heirs and assigns forever, all the right, title, interest, claim and demand which the said grantor........ has......; in and to the following described property situated in the County of Maricopa ...., and State of Arizona, to-wit:

All that part within the N½ NW¼ of Section 8, T1S, R2W, G&SRB&M of a strip of land 80 feet wide, for the use and benefit of the public, the center line of said strip is described as follows:

Beginning at the south quarter corner (sta. 527 + 77.7), Section 8, T1S, R2W, G&SRB&M; thence along the north south midsection line, bearing N2° 45' E, a distance of 1893.7 feet to P.C. (Sta. 546 + 71.4) of a curve to the left having a radius of 5729.58 feet and a central angle of 14° 48'; thence along said curve to the left a distance of 1480.0 feet to P.T. (Sta. 561 + 51.4) of said curve; thence on a tangent to said curve bearing N 12° 03' W, a distance of 475.6 feet to P.C. (Sta 566 + 27.0) of a curve to the right having a radius of 3015.57 feet and central angle of 29° 41'; thence along said curve to the right a distance of 1562.28 ft. to the P.T. (Sta. 581 + 89.28) of said curve, which crosses the north line of said N½ NW¼ of Section 8, whose bearing is N 89° 49' W, and at a distance of 331.94 feet from the north quarter corner of Section 8.

.545 ac

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee .... its .... heirs and assigns forever.

IN WITNESS WHEREOF, the said grantor...... has .... hereunto set her hand........ the day and year first above written.

Thelma Harer

DKT 15165 PG 574

D 14895

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

January 6, 1981

123210

IN REPLY REFER TO:

LA-Arizona-
Gila River WMA
(R-1) Maricopa County
Highway Department

68084 - Tuthill Rd Bridge
Approaches
Item U-345

PERMIT (R-1)

THE SECRETARY OF THE INTERIOR, through his authorized representative, the Regional Director, U.S. FISH AND WILDLIFE SERVICE, in accordance with applicable authorities, in accordance with regulations published October 1, 1979, in 50 CFR 29.21, and with the concurrence of the Arizona Game and Fish Department, does hereby grant a permit to the MARICOPA COUNTY HIGHWAY DEPARTMENT, herein referred to as the Permittee, to construct and maintain a roadway across lands of the Gila River Wildlife Management Area in Maricopa County, Arizona, for a 30-year period commencing November 12, 1980.

The 3.36 acres of Federal land authorized for use by this permit are included in the 6,896.14 acres that were withdrawn by the Secretary of the Interior under Public Land Order 1015 to be managed by the Arizona Game and Fish Department, and described as follows:

> The West 100 feet of the North one-half of the Southwest one-quarter (N½ of SW¼) of Section Eight (8), Township One (1) South, Range Two (2) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. AND the East Sixty (60) feet of the West 160 feet of that part of said North one-half of the Southwest one-quarter (N½ of SW¼) of Section Eight (8) lying South of Engineers Highway Station 15+54.30 containing 3.36 acres as shown on the plat for Tuthill Road Bride Approaches, Maricopa County Highway Department Work Order No. 68084. A copy of said plat is attached to and made a part of this permit.

By accepting this permit, Permittee agrees to the following terms and conditions:

The Arizona Game and Fish Department is the coordinating agency having immediate jurisdiction over and adminstrative responsibility for the premises.

The Regional Director has waived the requirement for compensation, by the authority specified under section 29.21-7(a) of 50 CFR.

This grant is limited to a term of thirty (30) years, and may be renewed subject to regulations existing at the time of renewal and such other terms and conditions deemed necessary to protect the public interest.

N-C

SEE MAP FILE

I do hereby certify that the within named instrument was recorded at request of MARICOPA CO. HD OF SU
APR 15 1981 -3 15 Docket 15165 Page 579-583 Records of Maricopa Co., Arizona
Witness my hand and official seal the day and year aforesaid
BILL HENRY, Maricopa County Recorder, By ______ Deputy

BK 2955 PAGE 592 STATE LAND DEPARTMENT 1 of 4
STATE OF ARIZONA

RIGHT OF WAY LEASE R/W No. 1404

THIS INDENTURE made and entered into this 27th day of September, 19 55, by and between the State of Arizona, hereinafter called the Grantor, and

MARICOPA COUNTY

of Phoenix, State of Arizona, hereinafter called the Permittee,

WITNESSETH, that pursuant to the authority vested in the State Land Commissioner, the Permittee is hereby granted a right of way on, over and across the state lands hereinafter described under the provisions of Article 10, Chapter 11, Arizona Code, 1939, as amended.

The granting of said right of way is predicated upon an application duly filed by the Permittee and approved by the Governor of the State of Arizona, together with an alignment map showing the definite location and establishing the width of said right of way, both of which are made and become a part of this permit.

It is understood and agreed by Permittee that the state lands covered by said right of way will be used for no purpose other than the location, construction, operation and maintenance of a highway on, over and across these state lands, which are described as:

Subdivision	Section	Township	Range
See insert sheets for description			

running ______ miles and/or containing 7.73 acres, more or less, and extending a width of 40 feet on each side of the center line.

TO HAVE AND TO HOLD the same as long as used for a county highway, but subject to the conditions and reservations herein set forth.

IT IS UNDERSTOOD AND AGREED that:

1. The Permittee shall not sublet or assign the Right of Way Lease herein granted, or any part thereof, without the written consent of Grantor first obtained, nor shall Permittee grant any franchise, permit or other right of way on the lands described herein, or any part hereof.

2. The Grantor reserves the right to grant easements and rights of way for public utilities and other purposes over and across the state lands described herein, subject to the approval of the Permittee.

3. The Grantor also reserves the right, as provided by law, to grant to the United States rights of way and easements over, across or upon the lands embraced in this permit for canals, reservoirs, dams, power or irrigation plants or works, railroads, tramways, transmission lines or other purposes, for irrigation works in connection with any Federal Government reclamation project.

4. The Permittee will not permit any loss, nor commit or cause any waste in, to or upon said land; nor cut or remove nor allow to be cut or removed any timber or standing trees that may be upon said land, save and except only such as may be necessary for the improvement of said land, (and then only with the written consent of the State Land Commissioner) or for fuel for the domestic use of said Permittee; provided that nothing herein contained shall be construed to permit the cutting of saw timber for any purpose.

OCT 1 1 ENTD

STATE LAND DEPARTMENT

PHOENIX, ARIZONA

C596 2of4

LEASE SUPPLEMENT

LEASE NO. / REFERENCE NO.

ACCOUNTING FUND	ACCOUNTING SUB	DESCRIPTION	SEC	TWP	RANGE	ACREAGE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

APPROVED
MARICOPA COUNTY ENGINEER

MARICOPA COUNTY BOARD OF SUPERVISORS
BY James S Hart — SIGNATURE OF LESSEE — CHAIRMAN — April 26, 1956 DATE

Acting Deputy — STATE LAND COMMISSIONER — APR 9 - 1956 DATE

C596 3 of 4

STATE LAND DEPARTMENT

PHOENIX, ARIZONA

1404
9

MARICOPA COUNTY
BOARD OF SUPERVISORS
PHOENIX ARIZONA

	GR	DESCRIPTION	SEC	TWP	RANGE		ACREAGE
31		Thru S2SW	8	1 S	2 W		1 21
31		Thru NESE	17	1 S	2 W		1 21
40		Thru SENW	8	1 S	2 W		2 89
30		Thru S2	2	2 S	2 W		2 42
							7 73 *

DKT 2955 PAGE 593

SIGNATURE OF LESSEE DATE Acting Deputy STATE LAND COMMISSIONER NOV 1 7 19__

C596. 4 of 4

STATE LAND DEPARTMENT
STATE OF ARIZONA

AMENDMENT TO RIGHT-OF-WAY
NO. 09-1404

This amendment between the State of Arizona, Grantor, and Maricopa County, Grantee, by mutual consent, has been amended as follows:

The purpose of Right-of-Way 09-1404 shall be amended for <u>only</u> those Sections indicated herein:

Section 8, T1S, R2W	M&B thru SENW	2.89 acres
Section 2, T2S, R2W	M&B thru S2 except W80ft. of N200ft. of NWSW	4.47 acres

to include:

Underground water and sewer

Upon execution by the Grantor and Grantee, this Right-of-Way Amendment, when affixed, shall be made a part of the original Right-of-Way. All other terms and conditions of said Right-of-Way shall remain in full force and effect.

IN WITNESS HEREOF, the parties hereto have signed this Document effective the day and year set forth below.

STATE OF ARIZONA, GRANTOR
Arizona State Land Commissioner

By: Rozanna Sedillo 10/21/91
Date

(SEAL)

MARICOPA COUNTY
GRANTEE **Date**

By Betsey Bayless
Chairman of the Board
ACTING CHAIRMAN
Date 9.16.91

2901 W. Durango St.
Address

Phoenix AZ 85009
City **State** **Zip**

Multi-Amend ROW 4/91

Recommended for approval: [signature]
Right-of-Way Agent

[signature]
D.C. Black, Highway Director

DOCKET 1678 PAGE 478

D1C51

Quit-Claim Deed

THIS INDENTURE, Made the 19th day of July, 1955,

between CLARENCE HUFFINE and THELMA FARLEY HUFFINE, Husband & Wife

Grantor and COUNTY OF MARICOPA, a political subdivision of the State of Arizona, Grantee,

WITNESSETH: That the said grantor, for and in consideration of the sum of - - - ONE AND NO/100 - - - DOLLARS to him in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, has, released and quit-claimed, and by these presents does release and quit-claim unto the said grantee, and to its / successors ~~heirs~~ and assigns forever, all the right, title, interest, claim and demand which the said grantor has; in and to the following described property situated in the County of Maricopa, and State of Arizona, to-wit:

All that part of N½ SE¼, Section 8, T1S, R2W, G&SRB&M, lying within a 40 foot strip east of the following described center line:

Beginning at a point on the north-south mid-section line of said Section 8 (Sta. 541 + 00.5) and thence on bearing N2° 45'E. a distance of 570.9 feet to the PC (Sta. 546 + 71.4) of a curve to the left having a radius of 5729.58 feet and a central angle of 14° 48'; thence along this curve to the left a distance of 755.0 feet to a P.O.C. (Sta. 554 + 26.4) where said curve intersects the east-west midsection line has a bearing of N89° 59½' West and is 28.9 feet west of the center of said Section 8, for the use and benefit of the public.

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee its successors ~~heirs~~ and assigns forever.

IN WITNESS WHEREOF, the said grantor has hereunto set his hand the day and year first above written.

Clarence Huffine

Thelma Farley Huffine
(Mrs. Clarence Huffine)

1C

TRANSAMERICA TITLE INS. CO.

D16915
Fee No.

I do hereby certify that the within named instrument was recorded at request of

DEC 10 '86 -3 00

, Records of Maricopa County, Arizona

DEC 10 '86 -3 00

WITNESS my hand and official seal the day and year aforesaid.

Fee: 2

By

County Recorder — Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

86 682015

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

Project No. 400-10-6 68272 - Beloat Road (Rainbow Rd. to Tuthill Rd.)

Item No. W-44

Ettarrea C. Nichols, as Trustee of the Nichols Family Trust

Agreement dated October 29, 1976 GRANTORS.

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The North Seven (7) feet of the South Forty (40) feet of the West one-half of the Southwest one-quarter (W½ of SW¼) of Section One (1), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

EXCEPT the West Thirty-three (33) feet thereof.

ALSO BEGINNING at the Point of Intersection of the North line of the South Forty (40) feet and the East line of the West Thirty-three (33) feet of said West one-half of the Southwest one-quarter (W½ of SW¼) of Section One (1); THENCE Northerly, Thirty (30) feet along said East line of the West Thirty-three (33) feet to a point; THENCE in a Southeasterly direction to a point on said North line of the South Forty (40) feet that is Thirty (30) feet Easterly from said Point of Intersection; THENCE Westerly to the Point of Intersection.

Prepared 7/1/86 — 7/2/86 — Checked 7/3/86 — Approved 7/31/86

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85 (See Reverse Side For Agreement and Signatures)

TRANSAMERICA ~ ~LE INS. CO.

D-17344

I do hereby certify that the within named instrument was recorded at request of

Fee No.:

_______________ , Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

Fee:

_______________ By _______________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

86 675815

7700302

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-10-2
Project No. 68272 - Beloat Road
(Rainbow Rd. to Tuthill Rd.)
Item No. W-45

Martha Beverly Alexander, wife of Allen A. Alexander, dealing with her sole and separate property GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Proofed
mj/mr
1/6/86
R/W
1/6/86
Checked
ESH
3/11/86
Approved
3/19/86

The North Seven (7) feet of the South Forty (40) feet of the Southeast one-quarter of the Southwest one-quarter (SE¼ of SW¼) of Section One (1), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

RECORDED IN OFFICIAL RECORDS
OF MARICOPA COUNTY, ARIZONA
DEC 0 8 '86 -3 00
KEITH POLETIS, County Recorder
FEE NC PGS 2 P.L

1987 APR -7 PM 3:23

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85 (See Reverse Side For Agreement and Signatures)

Beth Grandy

STATE OF ARIZONA)
)ss.
County of Maricopa) This instrument acknowledged before me this 2 day of December, 1986, by Stephen Grandy & Beth Grandy.

Douglas W. McLaughlin
Notary Public

My commission expires: _______________

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded DKT 4176 PAGE 318 D5764
County of Maricopa
JUN 1 - IN DOCKET & Page DKT 4176 PAGE 318 and indexed in
REQ - Phoenix Title & Trust Co.

Fee No. 102153

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.
N. C. 'Kelly' Moore
County Recorder
By A.D. Good
Deputy Recorder

Compared
Photostated
Fee: N/C

EASEMENT
HIGHWAY PURPOSES

R/W 23-314 Airport Rd.
Item 2-2146

ESSIE MAE BURK, a widow

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permament easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed MES 5/7/62 Checked MEG 5/4/62 Approved WH 5/7/62 (326)

The West Seven(7) feet of the East Forty(40) feet of the South One-half of the Southeast One-quarter of the Southeast One-quarter(S½ of SE¼ of SE¼) of Section One(1), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.
Also that part of the South One-half of the Southeast One-quarter of the Southeast One-quarter(S½ of SE¼ of SE¼) described as follows: Beginning at a point situated North Thirty-three(33) feet along the East line of said Section One(1), and West 40 feet parallel with the South line thereof, from the Southeast corner of said Section One(1); thence West Forty(40) feet parallel with the South line of Section One(1); thence North Seven(7) feet parallel with the East line of said Section One(1); thence Northeasterly to a point Forty(40) feet West of the East line and Eighty(80) feet North of the South line of said Section One(1); thence South Forty-seven(47) feet to the place of beginning.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed, they will apply to either masculine, feminine or neuter as the context requires.

Dated this 7 day of May, 1962

Essie M. Burk (Seal) ______ (Seal)
______ (Seal) ______ (Seal)
______ (Seal) ______ (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 7th day of May, 1962 by

ESSIE MAE BURK, a widow

FORM 95-10 (REV. 6-15-61)

Sam Hirsh
Notary Public

My commission expires 3-2-63

D5750

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

JUN ... IN DOCKET & Page DKT 4164 PAGE 187 and indexed in

Phoenix Title & Trust Co.

Witness my hand and official seal.

When recorded, return to:

Maricopa County Board of Supervisors

County Recorder

By A.C. Gooch Deputy Recorder

Fee No. 96011

DEED

Compared
Photostated
Fee:

EASEMENT

HIGHWAY PURPOSES

R/W 23-304 Airport Rd.

Item B-2137

EVERETT G. HINKLE and LOUISE HINKLE, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Proofed
MES 5/7/62
Checked
5/7/62
Approved
5/17/62

The West Seven(7) feet of the East Forty(40) feet of the North One-half of the South One-half of the Southeast One-quarter($N\frac{1}{2}$ of $S\frac{1}{2}$ of $SE\frac{1}{4}$) of Section One(1) Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed, they will apply to either masculine, feminine or neuter as the context requires.

Dated this 14 day of May 19 62

Everett G. Hinkle (Seal) (Seal)

Louise Hinkle (Seal) (Seal)

(Seal) (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 14th day of May 19 62 by Everett G. Hinkle & Louise Hinkle, his wife

FORM 93-18 (REV 6-15-61)

L. R. Turner
Notary Public

My commission expires July 20, 1963

DKT 4164 PAGE 187

TRANSAMERICA TITLE INS. CO.

D16977
Fee No.

I do hereby certify that the within named instrument was recorded at request of

_______________ Records of Maricopa County, Arizona

WITNESS my hand and official seal the day and year aforesaid.

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY, ARIZONA
JAN 22 '87 -3 00
KEITH POLETIS, County Recorder
FEE 70 PGS 2 R.D.

87 041255

_______________ By _______________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-12-5D
Project No. 68272 - Beloat Road
(Rainbow Rd. to Tuthill Rd.)
Item No. W-42

William J. Kerr and Sine R. Kerr, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Procted
mj/Man
1/6/86
Prvw
JK/D
1/6/86
Checked
CSH
1/20/86
Approved
1/23/86

The North Seven (7) feet of the South Forty (40) feet of the South one-half of the South one-half of the Southeast one-quarter (S½ of S½ of SE¼) of Section Two (2), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

EXCEPT the East Thirty-three (33) feet thereof.

EXCEPT beginning at the Southeast corner of Section Two (2); THENCE West 1190 feet to the Point of Beginning; THENCE North 580 feet; THENCE West 141 feet; THENCE South 580 feet; THENCE East 141 feet to the Point of Beginning.

ALSO beginning at the Point of Intersection of the North line of the South Forty (40) feet and the West line of the East Thirty-three (33) feet of said South one-half of the South one-half of the Southeast one-quarter (S½ of S½ of SE¼) of Section Two (2); THENCE Westerly, Thirty (30) feet along said North line of the South Forty (40) feet to a point; THENCE in a Northeasterly direction to a point on said West line of the East Thirty-three (33) feet that is Thirty (30) feet Northerly from said Point of Intersection; THENCE Southerly to the Point of Intersection.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85

(See Reverse Side For Agreement and Signatures)

D169C4

I do hereby certify that the within named instrument was recorded at request of

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY ARIZONA
NOV 14 86 -3 00
KEITH POLETIS, County Recorder
FEE NC PGS 2 P.L.

_______________ Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

_______________ By _______________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

86 630291

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

700314 9 C

Project No. 400-12-5B 68272 - Beloat Road (Rainbow Rd. to Tuthill Rd.)

Item No. W-40

Richard J. Tedder and Patsy J. Tedder, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

Prooled 79/Mar 11/6/86 P W LK/D 11/6/86 Checked E3H 4/30/86 Approved 4/30/86

The North Seven (7) feet of the South Forty (40) feet of the following described parcel;

Part of Section Two (2), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona;

Beginning at the Southeast corner of Section Two (2); THENCE West 1190 feet to the point of beginning; THENCE North 580 feet; THENCE West 141 feet; THENCE South 580 feet; THENCE East 141 feet to the Point of Beginning.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85

(See Reverse Side For Agreement and Signatures)

STATE OF ARIZONA)
)ss.
County of Maricopa) This instrument acknowledged before me this _______ day of

_______________, 19_____, by _______________

____

____
Notary Public

My commission expires: _______________

DC 3861 S

I do hereby certify that the within named instrument was recorded at request of

TITLE USA COMPANY of Arizona

Fee No.

88 025184

, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

Fee:

County Recorder By Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

Esc. No. 203861-8

017331 1of 2

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-13-2

Project No. 68378 - Beloat Road
(7th Street to Rainbow Road)

Item No. W-712

Burnie Boyd Benbow, husband of Judith A. Benbow, dealing with his sole and separate property

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

SEE EXHIBIT "A"

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY, ARIZONA
JAN 21 '88 -8 00
KEITH POLETIS, County Recorder
FEE 11 PGS 3 R.D

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

8400-023 R1-87

(See Reverse Side For Agreement and Signatures)

D 17331 2of2

88 028151

400-13-2
68378 - Beloat Road
(7th Street to Rainbow Road)

EXHIBIT "A"

Three parcels of land lying within the South one-half of the Southwest one-quarter (S½ of SW¼) of Section Three (3), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona described as follows:

Parcel No. 1: The North 22.00 feet of the South 55.00 feet of the West 650.00 feet of said South one-half of the Southwest one-quarter (S½ of SW¼);

EXCEPT, the West 33.00 feet, thereof.

Parcel No. 2: The North 45.00 feet of the South 100.00 feet of the East 7.00 feet of the West 40.00 feet, of said South one-half of the Southwest one-quarter (S½ of SW¼).

Parcel No. 3: Beginning at the Point of Intersection of the East line of the West 40.00 feet and the North line of the South 55.00 feet of said South one-half of the Southwest one-quarter (S½ of SW¼) of Section Three (3); THENCE North 20.00 feet along said East line of the West 40.00 feet to a point; THENCE in a Southeasterly direction to a point on said North line of the South 55.00 feet that is 20.00 feet East from said Point of Intersection; THENCE West to the Point of Intersection.

252139 DKT 11865 PAGE 485 D13075

I do hereby certify that the within named instrument was recorded at request of MARICOPA CO. BD. OF SUPERVISORS
Docket 11865 Page 485-486
SEP 22 1976 -9 45, Records of Maricopa County, Arizona.
WITNESS my hand and official seal the day and year aforesaid.

TOM FREESTONE By ______
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

Fee No.: 240847

Fee: N.C

DKT 11886 1068

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-15-8

Project No. DD-6180

Item No. Z-76-45

ELDON H. TOWNER and CAROLYN B. GRAY

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Prepared 6.H. DMC 9/7/76
Checked 6.H. 9/7/76
Approved 9/21/76

The East Forty(40) feet and the South Fifty-five(55) feet of the South 300 feet of the East 800 feet of the Southeast one-quarter(SE¼) of Section Four(4), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

RERECORDED TO SHOW BOARD OF SUPERVISORS ACCEPTANCE

I do hereby certify that the within named instrument was recorded at request of ~~MARICOPA CO. BD. OF~~ SUPERVISORS
Docket 11886 Page 1068-1069 Records of Maricopa Co., Arizona
OCT 5 - 1976 -12 20 WITNESS my hand and official seal the day and year aforesaid
TOM FREESTONE, Maricopa County Recorder, By ______ Deputy

N/C

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

(See Reverse Side For Agreement and Signatures)

(52)

203991-8

TITLE USA Company of Arizona

I do hereby certify that the within named instrument was recorded at request of

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY
MAY 3 - '88 - 4 00
KEITH POLETIS
FEE N/C PGS
Fee No.
Fee 3

________________, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

________________ By ________________
County Recorder   Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

88 212679

Esc. No. 203991-8

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

U

400-43-7 D17426 1of

Project No. 68378 - Beloat Road
(7th Street to Rainbow Road)
Item No. W-711

E. Garth Lamb and M. Elaine Lamb, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

See EXHIBIT "A"

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85

(See Reverse Side For Agreement and Signatures)

88 212679 D17426

400-43-7
68378 - Beloat Road
(7th Street to Rainbow Road)
W-711

EXHIBIT "A"

Two parcels of land lying within the Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼) of Section Nine (9), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, said parcels are described as follows:

Parcel No. 1: The South 22.00 feet of the North 55.00 feet of the East 650.00 feet of said Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼).

Parcel No. 2: The South 45.00 feet of the North 100.00 feet of the East 40.00 feet of said Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼).

EXCEPT all minerals reserved to the United States of Amerida, as disclosed in Patent from the State of Arizona.

5180

STATE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded FEB 10 '61 -3 55

Fee No. 25160

IN DOCKET Page and indexed in deeds. DKT 3555 PAGE 193

Req. of MARICOPA CO. BD. OF SUPERVISORS

Witness my hand and official seal.

When recorded, return to:

N. G. 'Kelly' Moore
County Recorder

Maricopa County Board of Supervisors ☒
Maricopa County Engineer ☐

By [signature]
Deputy Recorder

ELWOOD IMPROVEMENT DISTRICT

Compared
Photostated
Fee:

Quit-Claim Deed

For the consideration of One Dollar, and other valuable considerations, I or we M. W. Mahoney and Emma Mahoney grantor hereby quit-claim to MARICOPA COUNTY, a political subdivision of the State of Arizona, grantee, all right, title, or interest in the following real property situated in Maricopa County, Arizona:

The north 33 feet and the east 25 feet of the north 150 feet of the east 118.45 feet of the NW¼ SE¼ Section 20, T1N, R3E, G&SRB&M.

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee, its successors and assigns forever, for the use and benefit to the public as a right of way, for highway purposes.

Dated this 15 day of March, 1960

x M. W. Mahoney

Emma Mahoney

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this 15 day of March 1960 by M. W. Mahoney and EMMA MAHONEY

Robert B. Showers
Notary Public

My commission expires

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this ____ day of ____ 195__ by ____

Notary Public

My commission expires

DKT 3555 PAGE 193

FORM 55-10

88 000047

I do hereby certify that the within named instrument was recorded at request of TITLE USA COMPANY of Arizona

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY, ARIZONA
JAN 04 1988 -8 00
KEITH POLETIS, County Recorder
FEE / PGS

_____________, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

_____________ By _____________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

Escrow NO. 203862-8

017308 1cf

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-14-4D

Project No. 68378 - Beloat Road (7th Street to Rainbow Road)

Item No. W-714

Frederick K. Benbow and Martha A. Benbow, Husband and Wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

See Exhibit "A"

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land: that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R1-87

(See Reverse Side For Agreement and Signatures)

D17308 2of

within named instrument was recorded at ...
COMPANY of ...

88 000047

88 000047

400-14-4D

68378 - Beloat Road
(7th Street to Rainbow Road)
W-714

Exhibit "A"

Three parcels of land lying within the North one-half of the Northwest one-quarter (N½ of NW¼) of Section Ten (10), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, said parcels are described as follows:

Parcel No. 1: The South 22.00 feet of the North 55.00 feet of the West 650.00 feet of said North one-half of the Northwest one-quarter (N½ of NW¼).

Parcel No. 2: The South 45.00 feet of the North 100.00 feet of the West 40.00 feet of said North one-half of the Northwest one-quarter (N½ of NW¼).

Parcel No. 3: Beginning at the Point of Intersection of the East line of the West 40.00 feet and the South line of the North 55.00 feet of said North one-half of the Northwest one-quarter (N½ of NW¼) of Section Ten (10); THENCE East 20.00 feet along said South line of the North 55.00 feet to a point; THENCE in a Southwesterly direction to a point on said East line of the West 40.00 feet that is 20.00 feet South from said Point of Intersection; THENCE North to the Point of Intersection.

TRANSAMERICA TITLE INS. CO.

D16975

I do hereby certify that the within named instrument was recorded at request of

RECORDED IN OFFICIAL RECORDS
COUNTY, ARIZONA
JAN 22 '87 -3 00
County Recorder
Fee:
PGS 2 R.D.
87 041234

4

_________________, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

_________________ By _________________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-11-12B

Project No. 68272 - Beloat Road (Rainbow Road to Tuthill Road)

Item No. W-37A

William M. Lueck and Mary R. Lueck, husband and wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD Prepared 9/15/86 R/W 9/15/86 Checked 9/30/86 Approved 9/30/86

That portion of the Northwest one-quarter of the Northwest one-quarter (NW¼ of NW¼) of Section Eleven (11), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, described as:

A strip of land being Ten (10) feet on each side of the following described center line;

Beginning at a point on the North line of said Northwest one-quarter of the Northwest one-quarter (NW¼ of NW¼) of said Section 11, 217.5 feet East of the Northwest corner thereof; THENCE in a Southwesterly direction along a straight line to a point on the West line of said Northwest one-quarter of the Northwest one-quarter (NW¼ of NW¼) of said Section 11, said point being 322.5 feet Southerly from the Northwest corner of said Northwest one-quarter of the Northwest one-quarter (NW¼ of NW¼) of said Section 11.

EXCEPT the West and North Forty (40) feet of said Northwest one-quarter of the Northwest one-quarter (NW¼ of NW¼) of said Section 11.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R 11-85

(See Reverse Side For Agreement and Signatures)

TRANSAMERICA TITLE INS. CO.

D16976

I do hereby certify that the within named instrument was recorded at request of

JAN 22 '87 -3 00 PM

OFFICIAL RECORDS OF MARICOPA COUNTY ARIZONA

County Recorder

__________ , Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

__________ By __________
County Recorder Deputy Recorder
When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

87 051245

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-11-12B & 9B & 10B
Project No. 68272 - Beloat Road
(Rainbow Rd. to Tuthill Rd.)
Item No. W-37

William M. Lueck and Mary R. Lueck, husband and wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Drafted
mj/mar
1/6/86
R/W
1/8/86
Checked
4/15/86
Approved
4/18/86

The South Seven (7) feet of the North Forty (40) feet of the Northwest one-quarter ($NW\frac{1}{4}$) of Section Eleven (11), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

EXCEPT the West Thirty-three (33) feet thereof.

EXCEPT the East one-half of the East one-half ($E\frac{1}{2}$ of $E\frac{1}{2}$) of said Northwest one-quarter ($NW\frac{1}{4}$) of Section Eleven (11).

1987 APR 15 PM 1 02

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85

(See Reverse Side For Agreement and Signatures)

I do hereby certify that the within named instrument was recorded at request of

____

______________ , Records of Maricopa County, Arizona

WITNESS my hand and official seal the day and year aforesaid.

______________ By ______________

County Recorder — Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

Fee No.: 91 320419

Fee:

D18399

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

Project No. 400-11-6B & 7B 68272 - Beloat Road (Rainbow Rd. to Tuthill Rd.)

Item No. W-39

Beloat Road Partnership, an Arizona General Partnership

______________________________ GRANTORS.

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC
Proofed
TJ/MM
1/6/86
R/W
1/8/86
Checked
EDH
6/10/86
Approved
6/18/86

The South Seven (7) feet of the North Forty (40) feet of the West one-half of the Northwest one-quarter of the Northeast one-quarter (W½ of NW¼ of NE¼) of Section Eleven (11) and the South Seven (7) feet of the North Forty (40) feet of the East one-half of the Northeast one-quarter of the Northwest one-quarter (E½ of NE¼ of NW¼) of said Section 11, all in Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85

(See Reverse Side For Agreement and Signatures)

216793 86 448262 Fee No. 1/2

I do hereby certify that the within named instrument was recorded at request of TRANSAMERICA TITLE INS. CO.

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY ARIZONA AUG 22 '86 -9 00 KEITH POLETIS County Recorder C.W

_______________, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

_______________ By _______________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

72031544

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

Project No. 400-11-4C 68272 - Beloat Road (Rainbow Rd. to Tuthill Rd.)

Item No. W-41

John A. Beaver and Vickie H. Beaver, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD Prepared rg/man 1/16/86 Any 1/16/86 Checked EBH 6/23/86 Approved 6/26/86

The South Seven (7) feet of the North Forty (40) feet of the Northeast one-quarter (NE¼) of Section Eleven (11), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

EXCEPT the West one-half of the West one-half (W½ of W½) of said Northeast one-quarter (NE¼) of Section Eleven (11).

EXCEPT the East Thirty-three (33) feet of said Northeast one-quarter (NE¼) of Section Eleven (11).

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R11-85 (See Reverse Side For Agreement and Signatures)

Asst. Secretary & Asst. Treasurer

STATE OF ARIZONA)
) ss.
County of Maricopa) This instrument acknowledged before me this 13th day of August, 19 86, by Jack T. Walker, Jr.

Notary Public James Montiel

My commission expires: January 28, 1987

I do hereby certify that the within named instrument was recorded at request of

TRANSAMERICA TITLE INSURANCE COMPANY

______________, Records of Maricopa County, Arizona

WITNESS my hand and official seal the day and year aforesaid.

Keith Poletis ______ By ______
County Recorder — Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

Fee No.: 87 134763

Fee:

D17121

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

TA #70031480-6 LP

400-2-1B

Project No. 68272 - Beloat Road (Rainbow Rd. to Tuthill Dr.)

Item No. W-43

James R. Carter aka James R. Carter, Jr. and Connie E. Carter, husband and wife as to an undivided one-half interest and Edna C. Herrera and Paul L. Herrera as to an undivided one-half interest

GRANTORS.

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Proofed
[illegible]
8/29/86
0 [illegible]
9/2/86
Checked
[illegible]
9/3/86
Approved
[illegible]
9/4/86

The South Seven (7) feet of the North Forty (40) feet of the North one-half of the Northwest one-quarter (N½ of NW¼) of Section Twelve (12), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

EXCEPT the West Thirty-three (33) feet thereof.

RECORDED IN OFFICIAL RECORDS
OF MARICOPA COUNTY, ARIZONA
MAR 06 1987 -9 00
KEITH POLETIS, County Recorder
FEE 9.00 PGS 2 C.W.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

TRANSAMERICA TITLE INS. CO.

I do hereby certify that the within named instrument was recorded at request of

D16978
Fee No.:

____________________, Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

JAN 22 '87 -3 00

FEE 10 PGS 3 R.D.

____________________ By ____________________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

87 041256

7003 1486

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

400-2-9D
Project No. 68272 - Beloat Road
(Rainbow Rd. to Tuthill Rd.)
Item No. W-46

Jerry W. Kerr and Christy L. Kerr, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Procd
MJ/ma
1/16/86
R/W
1/18/86
Checked
5/21/86
Approved
5/22/86

The South Seven (7) feet of the North Forty (40) feet of the Northwest one-quarter of the Northeast one-quarter (NW¼ of NE¼) of Section Twelve (12), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

(See Reverse Side For Agreement and Signatures)

WHEN RECORDED RETURN TO: Maricopa County Highway Department
TRANSAMERICA TITLE INS. CO. Real Estate Division
770 03093

89 586006 Fee No.:

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY, ARIZONA
DEC 21 '89 -8 00
HELEN PURCELL, County Recorder
FEE N C PGS 3

I do hereby certify that the within named instrument was recorded at request of

Maricopa County Board of Supervisors

_______________, Records of Maricopa County, Arizona

WITNESS my hand and official seal the day and year aforesaid.

_______________ By _______________
County Recorder Deputy Recorder

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

D18133

Project No. 400-2-9F
68272 - Beloat Road
(Rainbow Rd. to Tuthill Rd.)

Item No. W-48

GRAND CANYON TITLE AGENCY, an Arizona corporation, as Trustee under Trust No. 1050 and SECURITY TITLE AGENCY, an Ariozna corporation, as Trustee under Trust No. 5847
GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

MC HD
Proofed
R/W
5/5/89
Checked
Approved

The South Seven (7) feet of the North Forty (40) feet of the Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼) of Section Twelve (12), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona;
EXCEPT the East Forty (40) feet thereof.

ALSO BEGINNING at the Point of Intersection of the South line of the North Forty (40) feet and the West line of the East Forty (40) feet of said Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼) of Section Twelve (12); THENCE Southerly, Thirty (30) feet along said West line of the East Forty (40) feet to a point; THENCE in a Northwesterly direction to a point on said South line of the North Forty (40) feet that is Thirty (30) feet Westerly from said Point of Intersection; THENCE Easterly to the Point of Intersection.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

[illegible]

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

DKT 4298 PAGE 485 SEP 25 '62 -8 00 AM

IN DOCKET & Page and indexed in

Phoenix Title & Trust Co.

Witness my hand and official seal.

N. C. 'Kelly' Moore County Recorder

By Bernice H. Taylor Deputy Recorder

When recorded, return to:

Maricopa County Board of Supervisors
4701 E. Washington Street,
Phoenix, Arizona.

A5867

Fee No.

166553

01-DEED

Compared
Photostated
Fee:

MC.

EASEMENT

HIGHWAY PURPOSES

R/W 33-202, Airport Road

Item B-2184
400-2-9F

JOHN W. WHITMORE AND JENNIE M. WHITMORE, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The East Forty (40) feet of the North One-half of the Northeast One-quarter ($N\frac{1}{2}$ of $NE\frac{1}{4}$) of Section Twelve (12), Township One (1) South, Range Three (3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

M.C.H.D.
Proofed
Mcy
T.R.D.
8/27/62
Checked
Mcy
8/31/62
Approved
WK
8/31/62

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed, they will apply to either masculine, feminine or neuter as the context requires.

Dated this 31st day of August, 1962.

_______________ (Seal) John W. Whitmore (Seal)

_______________ (Seal) x Jennie M. Whitmore (Seal)

_______________ (Seal) _______________ (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 31st day of August, 1962, by

John W. Whitmore and Jennie M. Whitmore, his wife

FORM 93-16 (REV. 8-15-61)

Lo Ro Turner
Notary Public

DKT 4298 PAGE 485

My commission expires July 20, 1963

(31) (48)

DKT 9235 PAGE 234

D10705

TE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within ument was filed and recorded

IN DOCKET & Page 9235-234-235 MARICOPA CO. BD. OF SUPERVISORS and indexed in

FEB 10 '72 -12 35

Witness my hand and official seal.
PAUL N. MARSTON
County Recorder
By Jean John
Deputy Recorder

Fee No.
24-R. AGR.
33432
Compared
Photostated
Fee: N/C

When recorded, return to:
Maricopa County Board of Supervisors

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. L-2110 400-2-6 R/W #21000 Airport Rd.

Angie Smith

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The East Forty(40) feet of the Southeast one-quarter of the Northeast one-quarter ($SE\frac{1}{4}$ of $NE\frac{1}{4}$) of Section Twelve(12), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

M.C.H.D. Proofed
9/16/71
Checked
9/16/71
Approved
1/24/72

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 17 day of Jan 1972

(Seal) X Angie Smith (Seal)

(Seal) (Seal)

STATE OF ~~ARIZONA~~ Calif.
County of ~~MARICOPA~~ Santa Clara } ss.

This instrument was acknowledged before me this 17 day of Jan. 1972 by

OFFICIAL SEAL
NELLIE E. MUELLER
NOTARY PUBLIC-CALIFORNIA
SANTA CLARA COUNTY
My Commission Expires May 14, 1975
155 Senter Rd., San Jose, Calif. 95111

Nellie E Mueller
Notary Public

My commission expires May 14-1975

14

DKT 9208 PAGE 752

D106-5

24-R. AGR

STATE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded IN DOCKET & Page

MARICOPA CO. BD. OF SUPERVISORS

and indexed in

JAN 28 '72 -2 55 9208 - 752 - 753

Witness my hand and official seal.

PAUL M. [illegible] County Recorder

By Jean John Deputy Recorder

Fee No. 22396

Compared
Photostated
Fee: N/C

When recorded, return to:
Maricopa County Board of Supervisors

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. L-2110 400-2-6 R/W #21000 Airport Rd.

Ruby Evans

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land, and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed [illegible] 9/16/71 Checked [illegible] 9/16/71 Approved [illegible] 1/10/72

The East Forty(40) feet of the Southeast one-quarter of the Northeast one-quarter (SE¼ of NE¼) of Section Twelve(12), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 7 day of Jan 1972

Ruby Evans (Seal) (Seal)

(Seal) (Seal)

STATE OF ~~ARIZONA~~ CALIFORNIA
County of ~~MARICOPA~~ SANTA CRUZ } ss.

This instrument was acknowledged before me this 7th day of JANUARY 1972 by Ruby Evans

Wallace W. Lew
Notary Public

My commission expires

FORM 93-16 (REV. 7-24-63)

OFFICIAL SEAL
WALLACE W. LEW
NOTARY PUBLIC-CALIFORNIA
SANTA CRUZ COUNTY
My Commission Expires Feb. 16, 1975

WALLACE W. LEW
NOTARY PUBLIC CALIFORNIA
SANTA CRUZ COUNTY

NOV 3 '71 -11 10   3045 PAGE 177

24-R. AGR.

STATE OF ARIZONA } ss.
County of ~~Maricopa~~

I hereby certify that the within instrument was filed and recorded

MARICOPA CO. BD. OF SUPERVISORS

IN DOCKET & Page 9045-177-178 and indexed in

Fee No.

250515

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.

PAUL N. MARSTON County Recorder

By Jean Johnson
Deputy Recorder

Compared
Photostated
Fee:
7/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. L-2109   400-2-3B   R/W #21000 Airport Rd.

Glenn M. Frew and Joan Frew, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The West Seven(7) feet of the East Forty(40) feet of the East one-half of the East one-half of the North one-half of the South one-half($E\frac{1}{2}$ of $E\frac{1}{2}$ of $N\frac{1}{2}$ of $S\frac{1}{2}$) of Section Twelve(12), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

M.C.H.D.
Proofed
9/16/71
Checked
9/16/71
Approved
10/7/71

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 7th day of October 1971

(Seal)   Glenn M. Frew (Seal)

(Seal)   Joan Frew (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 7th day of October 1971 by

Glenn M. Frew and Joan Frew, his wife

FORM 25-16 (REV. 7-24-63)

Joseph C. Alexander
Notary Public

My commission expires June 22, 1974

NOV 3 '71 -11 10 BOOK 9045 PAGE 150

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

MARICOPA CO. BD. OF SUPERVISORS

IN DOCKET & Page 9045 -150-151 and indexed in

24-R. AGR

Fee No.

250500

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.

PAUL N. MARSTON County Recorder

By Jean John

Deputy Recorder

Compared
Photostated
Fee:

N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. L-2109 400-2-3B R/W #21000 Airport Rd.

Virginia T. Hagenmaier

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The West Seven(7) feet of the East Forty(40) feet of the East one-half of the East one-half of the North one-half of the South one-half($E\frac{1}{2}$ of $E\frac{1}{2}$ of $N\frac{1}{2}$ of $S\frac{1}{2}$) of Section Twelve(12), Township One(1) South, Range Three(3) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

9/16/71

9/16/71

10/12/71

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 12th day of October 1971

_______________ (Seal) Virginia T. Hagenmaier (Seal)

_______________ (Seal) _______________ (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 12th day of October 1971 by

Virginia T. Hagenmaier

FORM 95-16 (REV. 7-24-63)

Joseph C. Cleland
Notary Public

My commission expires June 22, 1974

DKT 6327 PAGE 61

7738

STATE OF ARIZONA } ss.
County of ~~Maricopa~~

I hereby certify that the within instrument was filed and recorded

1966 NOV 29 2 38

IN DOCKET & Page DKT 6327 PAGE 61 and indexed in

MARICOPA CO. BD. OF SUPERVISORS

Witness my hand and official seal.

CLIFFORD H. WARD

County Recorder

By

Deputy Recorder

Fee No.

228398

Compared
Photostated
Fee: N/C

When recorded, return to:
Maricopa County Board of Supervisors

NO CHARGE

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. G-2244 401-33-22 R/W 70-301(2), 323rd Ave.

CARL MUMME, a widower,

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The East Thirty-three (33) feet of the Southeast One-quarter of the Southeast One-quarter (SE¼ of SE¼) of Section Twenty-seven (27), Township One (1) South, Range Five (5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

M.C.H.D.
Prov'd
10 5 66
Checked
10 15 66
Approved
10 15 66

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 10th day of October 1966

_______________(Seal) x Carl Mumme (Seal)

_______________(Seal) x _______________(Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 10th day of October 1966 by

CARL MUMME, a widower,

FORM 95-16 (REV. 7-24-63)

Joseph C. Wieland
Notary Public

My commission expires My Commission Expires June 22, 1970

DKT 6326 PAGE 215 27736

STATE OF ARIZONA } ss.
County of Maricopa

I hereby certify that the within instrument was filed and recorded IN DOCKET & Page DKT 6326 PAGE 215 and indexed in

NOV 29 '66 - 8 00 Transamerica Title Ins. Co.

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.
CLIFFORD H. WARD
County Recorder
By [signature] Deputy Recorder

Fee No.
17
227953
Compared
Photostated
Fee: N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. E-2636

Pol. No. 1137-100
R/W 61-426, Gilbert Rd S-229

EZRA LANE VINES AND MARY ELLEN VINES, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Plotted UWC

The South Seven (7) feet of the North Forty (40) feet of that part of the Northeast One-quarter of the Northeast One-quarter (NE¼ of NE¼) of Section Twenty-four (24), Township One (1) North, Range Five (5) East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, described as follows:

BEGINNING at a point on the North line of said (NE¼ of NE¼) which is 771.05 feet Westerly from the Northeast corner thereof, and identical with the Northwest corner of that certain tract of land conveyed to M. Glenn Guthrie, et ux, by Deed recorded in Docket 4607, page 335, records of Maricopa County, Arizona; thence South along the West line of said Guthrie Tract, to a point on the Northeasterly right of way line of the Consolidated Canal; thence Northwesterly along said right of way line to its intersection with the North line of sad (NE¼ of NE¼); thence East along said North line to the beginning.

WH 10-20-66
WH 1-9-70

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 11th day of October, 1966

_____ (Seal) Ezra Lane Vines (Seal)

_____ (Seal) Mary Ellen Vines (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 11th day of OCTOBER, 1966 by EZRA LANE VINES AND MARY ELLEN VINES, his wife

FORM 65-18 (REV. 7-24-63)

J B Walker Jr.
Notary Public

My commission expires June 16, 1967

1966 NOV 29 2 58 DKT 6327 PAGE 63 D7737 1-1

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

Fee No. 1

IN DOCKET & Page DKT 6327 PAGE 63 and indexed in
1966 NOV 29 2 58 MARICOPA CO. BD. OF SUPERVISORS

228400

Witness my hand and official seal.

When recorded, return to:
Maricopa County Board of Supervisors

CLIFFORD H. WARD
County Recorder

By [signature]
Deputy Recorder

Compared
Photostated
Fee: N/C

NO CHARGE
Recorded at Request of
Board of Supervisors.

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. G-2240 401-33-19 R/W 70-301(2), 323rd Ave.

H. G. GABLE and ETHEL M. GABLE, his wife,

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The East Thirty-three (33) feet of the Northeast One-quarter (NE¼) of Section Twenty-seven (27), Township One (1) South, Range Five (5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

M.C.H.D.
Proofed
10 5 66
WA
10 5 66
Approved
WA
10 5 66

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 21 day of October 1966

__________ (Seal) x H G Gable (Seal)

__________ (Seal) x Ethel M. Gable (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

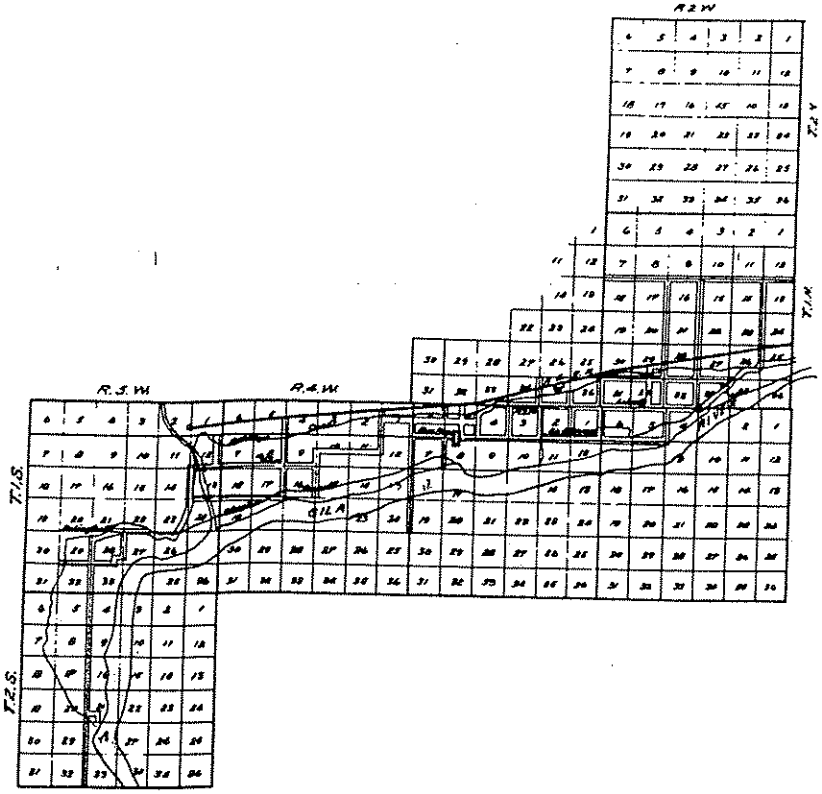
This instrument was acknowledged before me this 21st day of October 1966 by

H. G. GABLE and ETHEL M. GABLE, his wife,

FORM 95-18 (REV. 7-24-63)

Joseph C. Alexander
Notary Public

My commission expires My Commission Expires June 22, 1970



Map Showing [illegible]
Scale [illegible] 1 Mile

8236 PAGE 318 D 9815

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

JUL 24 70 -3 30 IN DOCKET & Page 8236 PAGE 318-319 and indexed in

MARICOPA CO. BD. OF SUPERVISORS

Witness my hand and official seal.

PAUL N. MAR...

County Recorder

By [signature]

Deputy Recorder

When recorded, return to:
Maricopa County Board of Supervisors

Fee No.
24-R. AGR.
134820

Compared
Photostated
Fee:
N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. 401-59 7, 8 R/W DD-4037

Sam K. Richardson, and Marion Richardson, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Proofed
[initials]
7/24/70
Checked
[initials]
7/24/70
Approved
[initials]
7/24/70

The North Thirty-three(33) feet of the North one-half of the Northwest one-quarter($N\frac{1}{2}$ of $NW\frac{1}{4}$) of Section Eight(8), Township Two(2) South, Range Five(5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 9th day of July 19 70

_______________ (Seal) Sam K. Richardson (Seal)

_______________ (Seal) Marion F. Richardson (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 9th day of July 19 70 by

Sam K. Richardson and Marion Richardson, his wife

FORM 95-10 (REV. 7-24-63)

[signature]
Notary Public

My commission expires Jun 22, 1974

WHEN RECORDED RETURN TO:
Maricopa County Highway Dept.
[illegible] Division

4 I do hereby certify that the within named instrument was recorded at request of

D16824 1 of 2

Fee No. 513891

______________________ , Records of Maricopa County, Arizona
WITNESS my hand and official seal the day and year aforesaid.

______________________ By ______________________
County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

Fee:

Recorded at Request of Board of Supervisors.

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

401-61-3, 11

Project No. DD-8044

Item No. O.R.

Eugene E. Jagow and Betty Jagow, husband and wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

See EXHIBIT "A"

RECORDED IN OFFICIAL RECORDS
OF MARICOPA COUNTY, ARIZONA
SEP 24 '86 -4 55
KEITH POLETIS, County Recorder
FEE PGS 3 H.L.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby convenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

(See Reverse Side For Agreement and Signatures)

D16824 2of 2

86 519901

401-61-3, 11
DD-8044
O.R.

EXHIBIT "A"

A portion of Old U.S. 80 lying within the Southeast one-quarter of the Southeast one-quarter (SE¼ of SE¼) of Section Twenty (20) and the Southwest one-quarter of the Southwest one-quarter (SW¼ of SW¼) of Section Twenty-one (21), all in Township Two (2) South, Range Five (5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, said portion being a strip of land 100 feet wide, Fifty (50) feet on each side of the following described center line:

MC HD
Project
Prelim
R/W
Checked
Approved
8/14/86
8/14/86
8/20/86

Beginning at the P.I. of a curve, said point being a bridge spike, which bears, South 69°54'58" East 836.43 feet from the corner common to Sections Twenty (20), Twenty-one (21), Twenty-eight (28) and Twenty-nine (29); THENCE along the tangent of said curve North 49°16'46" West 365.00 feet to the point of tangency; THENCE continuing North 49°16'46" West 147.73 feet to a tangent curve to the right having a radius of 1894.90 feet, a central angle of 12°31'28"; THENCE along said curve a distance of 414.40 feet to a nontangent compound curve to the right, having a radius of 3490.58 feet and a central angle of 9°00'30" and an initial tangent bearing North 36°44'48" West; THENCE along said curve 548.81 feet; THENCE North 27°44'18" West 730.48 feet to a tangent curve; THENCE continuing along the tangent of said curve North 27°44'48" West 152.76 feet to the P.I. of said curve and terminus of said center line.

O

JAN 31 1977 -4 10 D 13198

I do hereby certify that the within named instrument was recorded at request of Fee No.:

Dkt 12057 Pg 1164-1165 ~~MARICOPA CO. BD. OF SUPERVIS.~~ 26001

_______________, Records of Maricopa County, Arizona.

WITNESS my hand and official seal the day and year aforesaid. Fee:

TOM FREESTONE By _______________

County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

DKT 12057 PG 1164

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

401-61-17, 18,

Project No. 56900, Old U S. #80 at Gillespie Dam

Item No. S-2000

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY,

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

All that part of the West one-half of the Northwest one-quarter(W½ of NW¼) of the Northeast one-quarter(NE¼), and of the Northeast one-quarter of the Southeast one-quarter(NE¼ of SE¼) of Section Twenty-eight(28), Township Two(2) South, Range Five(5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, which lies within a strip of land One hundred ten(110) feet in width, being Fifty-five(55) feet wide (measured at right angles) on each side of the following described centerline:

M.C.H.D. Proofed 10/5/76 Checked 10/5/76 Approved 1/16/77

BEGINNING at the East one-quarter corner of Section Twenty-eight(28), Township Two(2) South, Range Five(5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona; thence West (assumed bearing) 492.58 feet along the East-West mid-section line to a point; thence South 49°22' East 50.89 feet to the true point of beginning. Said true point of beginning is the center of existing road and is the point of curve of a 10° curve concave southwesterly having a central angle of 40°38' and a tangent of 212.13 feet; thence Northwesterly 406.33 feet along the arc of said curve to the point of tangency thereof; thence West 1983.86 feet along a line which lies Northerly of, parallel with and 105 feet right angle distance from said mid-section line, to a point which lies 105 feet North of the 16/13 corner (Center of Section 28); thence continuing West 366.75 feet to the point of curve of a 13° curve concave Northeasterly having a central angle of 67°01'40" and a tangent of 291.87 feet; thence Northwesterly 515.60 feet along the arc of said curve to the point of tangency thereof, said point of tangent being the point of termination and is center of existing road.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

(See Reverse Side For Agreement and Signatures)

DKT 7440 PAGE 249

STATE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded

D 8987
Fee No.

1989 JAN 20 3 05 IN DOCKET & Page 7440 549-250 and indexed in

10794

MARICOPA CO. BD. OF SUPERVISORS

Witness my hand and official seal.

When recorded, return to:
Maricopa County Board of Supervisors

PAUL N. MARSTON County Recorder

By [signature] Deputy Recorder

Compared
Photostated
Fee:
N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. I-2001 401-72-18 R/W 932-62, Pierpont Road

GIFFEN, INC.

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Proofed
[initials]
[initials]
7.9.68
[initials]
7.9.68
[initials]
7/9/68

The South Forty (40) feet of the Southwest One-quarter (SW¼) of Section Nine (9), Township Four (4) South, Range Four (4) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 1st day of August, 1968

_______________ (Seal) GIFFEN, INC. (Seal)

_______________ (Seal) [signature] President (Seal)

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this _____ day of _______________, 19___ by _______________

FORM 95-16 (REV. 7-24-63)

____
Notary Public

My commission expires _______________

DKT 7440 PAGE 245

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa }
1969 JAN 20 3 05 IN DOCKET & Page DKT 7440 PAGE 245 and indexed in
MARICOPA CO. BD. OF SUPERVIS

Witness my hand and official seal.

PAUL K. MA... County Recorder

By Dorothy Jones Deputy Recorder

When recorded, return to:
Maricopa County Board of Supervisors

D 8985
Fee No.

10790
01-DEE

Compared
Photostated
Fee: N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. I-2011 401-72-23 & 24A R/W 932-62, Pierpont Road

FARREL C. LAYTON and BESSIE LAYTON, husband and wife,

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed 7/8/68 7/8/68 Approved 7/8/68

The North Forty (40) feet of the East One-half of the West One-half ($E\frac{1}{2}$ of $W\frac{1}{2}$) and that portion of the East One-half ($E\frac{1}{2}$) of Section Sixteen (16), Township Four (4) South, Range Four (4) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, lying West of Old U.S. Highway No. 80.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 15th day of July 1968

Farrel C. Layton (Seal) _______________ (Seal)

Bessie Layton (Seal) _______________ (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA }

This instrument was acknowledged before me this 15th day of July 1968 by

FARREL C. LAYTON and BESSIE LAYTON, husband and wife.

FORM 95-16 (REV. 7-24-63)

Virginia Van Landingham
Notary Public

My commission expires_______________

WHEN RECORDED RETURN TO:
Maricopa County Highway Dept.
St... ...ate Division

hereby certify that the within named instrument recorded at request of

Fee No.: D15672

83 411882

______________________, Records of Maricopa County, Arizona.
WITNESS my hand and official seal the day and year aforesaid.

Fee:

______________________ By______________________
County Recorder Deputy Recorder

Recorded at Request of Board of Supervisors.

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

401-73-019, 020, 029, 030 & 016

4

Project No. DD 7582

Item No. 0.8

John Fornes and Patricia L. Fornes, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed Mar ny 7/13/83 Checked 8/3/83 Approved 8/2/83

The South Forty (40) feet of BLM Lot 8, Section Thirty (30), Township Four (4) South, Range Four (4) West; and the North Forty (40) feet of the East 742.5 feet of the Northeast one-quarter of the Northeast one-quarter (NE¼ of NE¼) of Section Thirty-one (31), Township Four (4) South, Range Four (4) West; and the North Forty (40) feet of the Northwest one-quarter (NW¼) of Section Thirty-two (32), Township Four (4) South, Range Four (4) West; and the South Forty (40) feet of the Southwest one-quarter (SW¼) of Section Twenty-nine (29), Township Four (4) South, Range Four (4) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY, ARIZONA
OCT 12 '83 -4 30
BILL HENRY, COUNTY RECORDER
FEE n/c PGS 2

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

(See Reverse Side For Agreement and Signatures)

DKT 8027 PAGE 96 38886 24-F GR.

IRE F 320420

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

Fee No.

IN DOCKET & Page 8027 96-97 and indexed in

MAR 4 '70 -1 35

D9574

~~MARICOPA CO. BD. OF SUPERVISORS~~

Witness my hand and official seal.
PAUL N. MARSTON

When recorded, return to:
Maricopa County Board of Supervisors

County Recorder

Compared
Photostated
Fee: N/C

By Alyce Ketner
Deputy Recorder

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. J-2240 402-5-15 R/W 23-144 Watermelon Rd.

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Proofed
Checked
Approved

The South Forty(40) feet of the West one-half of the West one-half($W\frac{1}{2}$ of $W\frac{1}{2}$) of Section Nineteen(19), Township Five(5) South, Range Four(4) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 4th day of February 1970 THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY

Marion Schaefer (Seal) By: John F. Konrad (Seal)
Marion Schaefer John F. Konrad, Vice President
Joanne Peck (Seal) Attest: George M. Higbee (Seal)
Joanne Peck George M. Higbee, Ass't Secretary

STATE OF ~~ARIZONA~~ WISCONSIN }
County of ~~MARICOPA~~ MILWAUKEE } ss.

This instrument was acknowledged before me this 4th day of February 1970 by John F. Konrad, Vice President and George M. Higbee, Ass't Secretary of The Northwestern Mutual Life Insurance Company, the corporation that executed the foregoing instrument, and known to me ~~to be the persons who executed said instrument on behalf of the corporation therein named,~~ and acknowledged to me that such corporation executed the same.

FORM 95-10 (REV. 7-24-63)

Marion Schaefer
Marion Schaefer, Notary Public

My commission expires January 3, 1971

70069 24... AGR. DKT 8097 PAGE 91

STATE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded

Fee No. D9627

APR 20'70 -1 55 DOCKET & Page 8097 PAGE 91-92 and indexed in

MARICOPA CO. BD. OF SUPERVISORS

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.
PAUL N. MARSTON
County Recorder
By Alyce Ketner
Deputy Recorder

Compared
Photostated
Fee: N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. J-2244 402-5-17, 18 R/W 23-144 Watermelon Rd.

A. H. Stout, Jr. and Effie V. Stout, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed 3/19/70 Checked 3/18/70 Approved 3/18/70

The South Thirty-three(33) feet of the East one-half of the West one-half($E\frac{1}{2}$ of $W\frac{1}{2}$), and the South Thirty-three(33) feet of the Southeast one-quarter($SE\frac{1}{4}$), both in Section Nineteen(19), Township Five(5) South, Range Four(4) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 24th day of March 1970

_____ (Seal) A. H. Stout Jr. (Seal)

_____ (Seal) Effie V. Stout (Seal)

STATE OF ARIZONA
County of MARICOPA } ss.

This instrument was acknowledged before me this 24th day of March 1970 by

A. H. Stout, Jr., aka Albert H. Stout, Jr., and Effie V. Stout, his wife

FORM 95-10 (REV. 7-24-63)

Joseph C. [signature]
Notary Public

My commission expires June 22, 1970

765 PAGE 587

R/F 553
1 of 3

County of Maricopa

State of Arizona

Office of the Clerk

State of Arizona }
County of Maricopa } ss.

I, W. O. Glick, *Clerk of the Board of Supervisors do hereby Certify That* the following is a true and correct extract from the minutes of the Board of Supervisors' meeting held June 14, 1951:

(Attached)

In Witness Whereof, *I have hereunto set my hand and affixed the Official Seal of the Board of Supervisors. Done at Phoenix, the County Seat this* 14th *day of* June, 1951

Engineer
Assessor
Recorder
File

W O Glick
Clerk of the Board of Supervisors

12 76 588

R/F 593
2 of 3

ROAD OF MAP (FIL. NO. 593)

Upon motion and by unanimous vote the following resolution was passed and adopted;

WHEREAS, on the 14th day May, 1951, the Board set for final hearing on Thursday, June 14, 1951, the petition filed by the County Engineer, praying the Board to open and declare as a County Highway the following described lines to-wit;

> A roadway having a total width of 100 feet and lying 50 feet on each side of the following described centerline;
>
> Beginning at a railroad spike on the centerline of U. S. Highway 80 lying 3597.02 feet S 0 degrees 38' 30" E of the SE corner of section 31, T5S, R5W, G&SR B&M; thence N 0 degrees 38' 30" W 3597.02 feet to said SE corner of section 31; thence continuing N 0 degrees 38' 30" W 7602.98 feet to the beginning of a 2 degree curve to the left; having a central angle of 13 degrees 20' 00"; thence along said 2 degree curve to the left 666.67 feet to the end of said curve, thence N 13 degrees 58' 30" W 403.33 feet to the beginning of a 1 degree curve to the right, having a central angle of 23 degrees 30' 00", the P.I. of which bears S 30 degrees 23' 30" W 863.25 feet from the section corner common to sections 19, 20, 29 and 30, T5S, R5W, G&SR B&M; thence along said 1 degree curve to the right 2350.00 feet to the end of said curve; thence N 9 degrees 31' 30" E 944.60 feet to the beginning of a 1 degree curve to the left, having a central angle of 9 degrees 38' 00"; thence along said 1 degree curve to the left 963.38 feet to the end of said curve; Thence N 0 degrees 06' 30" W 2771.02 feet to the beginning of a 28 degree curve to the left having a central angle of 89 degrees 27' 00"; thence along said 28 degree curve to the left 319.46 feet to the end of said curve; thence N 69 degrees 33' 30" W 5161.49 feet to a point from which the section corner common to sections 19 and 30 T5S, R5W and sections 24 and 25, T5S, R6W bears S 1 degree 25' 00" W 5298.20 feet. All situated in the County of Maricopa, State of Arizona

and that day and hour having arrived the Board proceeded to consider the petition and the objections thereto and all claims for damages and heard all evidence on said matters; and

WHEREAS, it appears to the Board that a Board of Appraisers has been duly appointed to view out and locate, appraise and report all damages caused by the said location and the Board of Appraisers having filed its report on May 12, 1951 for viewing, locating, appraising and reporting all damages caused by said location of such highway and it appearing from said report that none of the land holders whose lands abut on said highway will be damaged by it but rather will be benefited thereby and that said land owners are therefore entitled to no damage or compensation and it further appearing that no objections to the establishment of such highway and no claim for damages have been filed and the Board believing that the granting of the petition and the establishment of the highway as prayed for in said petition were for the best interest of Maricopa County,

RF 553
3 of 3

NOW THEREFORE, it is ordered that the report of said Board of Appraisers as filed in this office on the 12th day of May, 1951, be and the same is hereby accepted and the road as located by the said Board of Appraisers be and the same is hereby declared to be a public highway according to the report and recommendation of the County Engineer, and that the County Engineer is hereby directed to make a plat of the survey of said highway and cause the same to be recorded in the office of the County Recorder as provided by law.

'2857 24-R. AGR. DKT 7968 PAGE 356

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

IN DOCKET & Page 7968 PAGE 356-357 and indexed in

JAN 22 '70 -3 35

MARICOPA CO. BD. OF SUPERVISORS

Witness my hand and official seal.

Fee No.

When recorded, return to:
Maricopa County Board of Supervisors

PAUL N. MARSTON
County Recorder
By Dorothy Jones
Deputy Recorder

Compared
Photostated
Fee: n/c

EASEMENT FOR HIGHWAY PURPOSES

IRE F-320820

ITEM NO. J-2241 — 403-15-49 D, 50; 403-16-10 B; 403-45-14, 15, 18 — R/W 23-144 Watermelon Rd.

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY **GRANTORS,**

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Prepared 10/31/69
Checked 10/31/69
Approved 10/31/69

The South Forty(40) feet of Section Twenty(20), and the North Forty(40) feet of Sections Twenty-seven(27), Twenty-eight(28), and Twenty-nine(29), all in Township Five(5) South, Range Five(5) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.
ALSO, the South Forty(40) feet of that part of Section Nineteen(19), and the North Forty(40) feet of that part of Section Thirty(30), both in said Township Five(5) South, Range Five(5) West of said G&SRB&M; lying East of the Easterly right of way of Citrus Valley Road.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 11th day of December 19 69

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY

Marion Schaefer (Seal)
Marion Schaefer

By: [signature] (Seal)
Robert B. Barrows, Vice President

Joanne Peck (Seal)
Joanne Peck

Attest: [signature] (Seal)
George M. Higbee, Ass't. Secretary

STATE OF ~~ARIZONA~~ WISCONSIN } ss.
County of ~~MARICOPA~~ MILWAUKEE

This instrument was acknowledged before me this 11th day of December 19 69 by Robert B. Barrows, Vice President, and George M. Higbee, Ass't. Secretary of The Northwestern Mutual Life Insurance Company, ~~the corporation that executed the foregoing instrument, and known to me~~ to be the persons who executed said instrument on behalf of the corporation therein named, and acknowledged to me that such corporation executed the same.

FORM 83-18 (REV. 7-24-63)

Marion Schaefer
Marion Schaefer
Notary Public

My commission expires January 3, 1971.

0817

403-15-1
7

Quit-Claim Deed

THIS INDENTURE, Made the 22 day of July, 19 54
between S.L. NARRAMORE and ALICE NARRAMORE, his wife

Grantor s and COUNTY OF MARICOPA, a political subdivision of the State of Arizona
Grantee,

WITNESSETH: That the said grantor s, for and in consideration of the sum of ----ONE AND NO/100---- DOLLARS to them in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, have, released and quit-claimed, and by these presents do release and quit-claim unto the said grantee, and to its heirs and assigns forever, all the right, title, interest, claim and demand which the said grantors have; in and to the following described property situated in the County of Maricopa, and State of Arizona, to-wit:

The East 40' of the NE¼, Section 2 and the West 40' SW¼ Section 1, all in T5S, R6W, G&SRB&M, for the use and benefit of the public

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee its heirs and assigns forever.

IN WITNESS WHEREOF, the said grantors have hereunto set their hands the day and year first above written.

S. L. Narramore

Alice Narramore

Maricopa County Highway Dep...
4701 East Washing...
Phoenix, Arizona

ES11

403-15-

Quit-Claim Deed

THIS INDENTURE, Made the 23rd day of July, 1954, between W. O. NARRAMORE and ELIZA NARRAMORE, his wife

Grantors and COUNTY OF MARICOPA, a political subdivision of the State of Arizona

Grantee,

WITNESSETH: That the said grantors, for and in consideration of the sum of ONE AND NO/100 DOLLARS to them in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, have released and quit-claimed, and by these presents do release and quit-claim unto the said grantee, and to its heirs and assigns forever, all the right, title, interest, claim and demand which the said grantors have; in and to the following described property situated in the County of Maricopa, and State of Arizona, to-wit:

The East 40' of the SE$\frac{1}{4}$, Section 2 and the West 40' of the W$\frac{1}{2}$, Section 12, all in T5S, R6W, G&SRB&M, for the use and benefit of the public.

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee its heirs and assigns forever.

IN WITNESS WHEREOF, the said grantors have hereunto set their hands the day and year first above written.

W. O. Narramore

Eliza Narramore

Form No. 16—Quit-Claim Deed—Short Form—A. P. Line Legal Blanks—Phoenix, Arizona

Citrus Valley Rd

Maricopa County Highway Department
4701 East Washington
Phoenix, Arizona

5

1405 PAGE 137

1

403-15-17
18
22

Quit-Claim Deed

THIS INDENTURE, Made the 26th day of July, 1954

between E.L. SISSON and ALICE A. SISSON, his wife

Grantor s and COUNTY OF MARICOPA, a political subdivision of the State of Arizona

Grantee,

WITNESSETH: That the said grantor s, for and in consideration of the sum of ONE AND NO/100 DOLLARS to them in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, ha ve, released and quit-claimed, and by these presents do release and quit-claim unto the said grantee, and to its heirs and assigns forever, all the right, title, interest, claim and demand which the said grantor s ha ve; in and to the following described property situated in the County of Maricopa, and State of Arizona, to-wit:

The East 40' of Section 11, T5S, R6W, G&SRB&M for the use and benefit of the public.

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging; to the grantee its heirs and assigns forever.

IN WITNESS WHEREOF, the said grantors ha ve hereunto set their hand s the day and year first above written.

E. L. Sisson

Alice A. Sisson

(4)

Form No. 15—Quit-Claim Deed—Short Form—A. P. Lino Legal Blanks—Phoenix, Arizona

Rainbow Valley Road

DKT 7768 PAGE 749

159475 24-R. AGR.

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

SEP 4 - '69 - 11 50

IN DOCKET & Page DKT 7768 PAGE 749 and indexed in

County Highway

Fee No. D9315

Witness my hand and official seal.

When recorded, return to:
Maricopa County Board of Supervisors

PAUL N. MARSTON County Recorder

By [signature] Deputy Recorder

Compared
Photostated
Fee: N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. I-2129   403-29-60, 61   R/W 932-97, Sentinel-Agua Calier

John Chudy and Josephine Chudy, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Plotted [initials] C/A 7-21-69 [initials] 8-13-69 [initials] 8-13-69

The East Eighty(80) feet of the Southeast one-quarter of the Southeast one-quarter (SE¼ of SE¼), and the East Eighty(80) feet of the Northeast one-quarter of the Southeast one-quarter(NE¼ of SE¼) of Section Seventeen(17), Township Five(5) South, Range Ten(10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

~~I do hereby certify that the within named instrument was recorded at request of ______ Docket ______ Page ______ Records of Maricopa Co., Arizona. WITNESS my hand and official seal the day and year aforesaid. PAUL N. MARSTON, Maricopa County Recorder, By ______ Deputy~~

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 22 day of July 1969

______ (Seal)   John Chudy (Seal)

______ (Seal)   Josephine Chudy (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 22nd day of JULY 22 1969 by JOHN CHUDY AND JOSEPHINE CHUDY, his wife

[signature] Notary Public

My commission expires My Commission Expires Mar. 4, 1972

FORM 95-1C (REV 7-24-63)

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa SEP 4 - '69 - 11 50

159477 24-R. AGR. DKT 7768 PAGE 751

IN DOCKET & Page DKT 7768 PAGE 751 and indexed in
County Highway

Witness my hand and official seal.

When recorded, return to:
Maricopa County Board of Supervisors

PAUL N. MARSTON County Recorder
By Dorothy Jones Deputy Recorder

Fee No. 99318

Compared
Photostated
Fee: N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. I-2131 403-29-87,89 R/W 932-97, Sentinel-Agua Cali

Phinoclade Modesti

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Plotted 7/21/69 Checked 8/13/69 Approved 8/13/69

The East Forty(40) feet of the East one-half of the Northeast one-quarter($E\frac{1}{2}$ of $NE\frac{1}{4}$) of Section Twenty(20), Township Five(5) South, Range Ten(10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

EXCEPT the North 500 feet thereof.

ALSO, all that part of the said ($E\frac{1}{2}$ of $NE\frac{1}{4}$) of said Section 20 lying East of a line beginning at a point 500 feet Southerly along the East line of said Section 20 and Forty(40) feet West from the Northeast corner of said Section 20, and running thence Northerly on a straight line to a point Eighty(80) feet West of said Northeast corner of said Section 20 on the North line thereof.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 7 day of August 1969

_________________(Seal) Phinoclade Modesti (Seal)

_________________(Seal) _________________(Seal)

STATE OF ARIZONA } ss.
County of ~~MARICOPA~~ Yuma

This instrument was acknowledged before me this 7th day of August, 1969 by Phinoclade Modesti

FORM 55-10 (REV. 7-24-63)

Mary McCloud
Notary Public

My commission expires June 1, 1973

DKT 7824 PAGE 527 183766 24-R. AGR. D9353

STATE OF ARIZONA
County of Maricopa } ss. I hereby certify that the within instrument was filed and recorded OCT 14 '69 12 -5

IN DOCKET & Page County Highway and indexed in DKT 7824 PAGE 527

Witness my hand and official seal.

When recorded, return to:
Maricopa County Board of Supervisors

PAUL N. MARSTON County Recorder

By Mae. Morgan Deputy Recorder

Fee No

Compared
Photostated
Fee: N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. I-2133 403-29-77 R/W ~~932-97~~ 23-047, Sentinel-Agua Caliente

Elsie P. Provo, dealing with her sole and separate property;

H. M. Bohlman and Mary E. Bohlman, his wife GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D.
Plotted
7/21/69
Checked
9/18/69
Approved
9/22/69

The East Forty(40) feet of the North one-half of the Southeast one-quarter (N½ of SE¼) of Section Twenty(20), Township Five(5) South, Range Ten(10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 18 day of September 1969

H M Bohlman (Seal) Elsie P. Provo (Seal)

Mary E. Bohlman (Seal) (Seal)

STATE OF ARIZONA
County of MARICOPA } ss. This instrument was acknowledged before me this 18th day of September 1969 by

Elsie P. Provo, dealing with her sole and separate property;

H. M. Bohlman and Mary E. Bohlman, his wife

FORM 95-16 (REV. 7-24-63)

[signature] Notary Public

My commission expires My Commission Expires Mar. 10, 1970

1969 AUG 20 11 03 24-R AGR. DKT 7747 PAGE 758

150413

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa

IN DOCKET & Page 7747 PAGE 758 and indexed in

MARICOPA CO. BD. OF SUPERVISORS

Fee No. D9292

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.

PAUL [illegible] County Recorder

By Mae Morgan Deputy Recorder

Compared
Photostated
Fee: N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. I-2139 403-30-28 R/W 932-97, Sentinel-Agua Calie:

Wilhelmina Helen Hoople Gardner

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed 7/31/69 Checked 8/5/69 Approved 8/5/69

The West Forty(40) feet of the Southwest one-quarter(SW¼) of Section Twenty-eight (28), Township Five(5) South, Range Ten(10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

EXCEPT the Northwest one-quarter of the Southwest one-quarter(NW¼ of SW¼) of said Section 28 thereof.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 30 day of July 1969

(Seal) X Wilhelmina Helen Hoople Gardner (Seal)

(Seal) (Seal)

STATE OF ~~ARIZONA~~ CONNECTICUT } ss. NEW CANAAN
County of ~~MARICOPA~~ FAIRFIELD

This instrument was acknowledged before me this 30 day of July 1969 by WILHELMINA HELEN HOOPLE GARDINER

FORM 95-10 (REV. 7-24-63)

[signature] Notary Public

My commission expires April 1 1971

ARTHUR H. SOHL, JR., Notary Public

AUG 4 1969

I do hereby certify that the within named instrument was recorded at request of

Fee No.: D17361

88 100448

________________, Records of Maricopa County, Arizona

WITNESS my hand and official seal the day and year aforesaid.

Fee:

________________ By ________________

County Recorder Deputy Recorder

When recorded return to: MARICOPA COUNTY BOARD OF SUPERVISORS

EASEMENT AND AGREEMENT FOR HIGHWAY PURPOSES

403-30-28A

Project No. 68246 - Agua Caliente Bridge Road at the Gila River

Item No. W-2318

Katherine Elizabeth Caskey, and Patricia A. Kanipe

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

The South 80.00 feet of the West 400.00 feet of the Northeast one-quarter of the Southwest one-quarter (NE¼ of SW¼) of Section Twenty-eight (28), Township Five (5) South, Range Ten (10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

Posted Rw/my 10/29/87 R/W JJS 11/2/87 Checked 2/13/88 Approved 2/13/88

RECORDED IN OFFICIAL RECORDS OF MARICOPA COUNTY, ARIZONA MAR 3 '88 -1 00 KEITH POLETIS, County Recorder FEE PGS 2 H.L.

88 FEB 29 PM 4:

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed of this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons, subject to easements of record; that they accept the consideration paid hereunder as full payment for all damages to their property including any severance damages resulting from the grant of this easement and right-of-way.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and whenever words indicating gender and employed they will apply to either masculine, feminine or neuter as the context requires.

6400-023 R1-87

(See Reverse Side For Agreement and Signatures)

DKT 7768 PAGE 757

159483 24-R. AGR. D-95-7

STATE OF ARIZONA } ss. I hereby certify that the within instrument was filed and recorded
County of Maricopa SEP 4 - '69 -11 50

IN DOCKET & Page DKT 7768 PAGE 757 and indexed in

County Highway

Fee No.

Witness my hand and official seal.

When recorded, return to:
Maricopa County Board of Supervisors

PAUL N. MARSTON County Recorder

By Dorothy Jones Deputy Recorder

Compared
Photostated
Fee:
N/C

EASEMENT FOR HIGHWAY PURPOSES

ITEM NO. I-2141 403-30-47, 50, 51 R/W 932-97, Sentinel-Agua Calie

K. K. Skousen and Elizabeth Skousen, his wife

GRANTORS,

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

M.C.H.D. Proofed 7/21/69 Checked 8/13/69 Approved 8/13/69

The West Forty(40) feet of the North one-half(N½), and the West Forty(40) feet of the West one-half of the Southwest one-quarter(W½ of SW¼), both in Section Thirty-three(33), and the East Forty(40) feet of the East one-half of the Southeast one-quarter(E½ of SE¼) of Section Thirty-two(32), all in Township Five(5) South, Range Ten(10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.
EXCEPT the South 629.35 feet of said Sections 32 and 33.
ALSO, all that part of the South 629.35 feet of said Sections 32 and 33 which lies within a strip of land Eighty(80) feet in width, being Forty(40) feet(measured at right angles) on each side of the following described centerline: BEGINNING at a point on the section line common to Sections Thirty-two(32) and Thirty-three(33), Township Five(5) South, Range Ten(10) West of the G&SRB&M bearing North (assumed bearing) 629.35 feet from the Southwest corner of said Section 33; which point is the point of curve of a 1°00' curve concave northeasterly having a central angle of 45°12'55" and a tangent of 2385.85 feet; thence Southeasterly along the arc of said curve 4521.53 feet to the point of tangency thereof; which point lies East (right angle from west line) 1693.38 feet along the South line of said Section 33 and South (right angle from said South line) 3437.20 feet from the Southwest corner of said Section 33.

To have and to hold the said easement and right-of-way unto Maricopa County, a political subdivision of the State of Arizona and unto its successors and assigns forever, together with the right of ingress and egress to permit the economical operation and maintenance of said public highway and all incidents thereto, and together with the right to authorize, permit, and license the use thereof for utilities or other public purposes not inconsistent with its primary use as a highway.

And the Grantors hereby covenant that they are lawfully seized and possessed on this aforementioned tract or parcel of land; that they have a good and lawful right to sell and convey it; and that they will warrant the title and quiet possession thereto against the lawful claim of all persons.

The said easement to include the right to cut back and trim such portion of the branches and tops of the trees now growing or that may hereafter grow upon the above described premises, as may extend over said right-of-way, so as to prevent the same from interfering with the efficient maintenance and operation of said public highway.

In the event the right, privilege and easement herein granted shall be abandoned and permanently cease to be used for the purposes herein granted all rights herein granted shall cease and revert to the grantors, their heirs or assigns.

Wherever in the foregoing instrument the plural is used, it will be read as singular when necessary, and wherever words indicating gender are employed they will apply to either masculine, feminine or neuter as the context requires.

Dated this 28 day of July 1969

(Seal) K.K. Skousen (Seal)

(Seal) Elizabeth Skousen (Seal)

STATE OF ARIZONA } ss.
County of MARICOPA

This instrument was acknowledged before me this 28 day of July 1969 by K.K. SKOUSAN & ELIZABETH SKOUSAN, his wife

John H. Wake
Notary Public

My commission expires 4/14/1972

FORM 9510 (REV. 7-24-63)

DOCKET 1531 PAGE 514

Quit-Claim Deed

THIS INDENTURE, Made the 21ST day of OCTOBER, 1952

between W. L. Hostetter, dealing in his sole and separate property

Grantor and The County of Maricopa, Arizona

Grantee,

WITNESSETH: That the said grantor, for and in consideration of the sum of ONE and no/100 - DOLLARS to him in hand paid by the said grantee, the receipt whereof is hereby confessed and acknowledged, has, released and quit-claimed, and by these presents does release and quit-claim unto the said grantee, and to heirs and assigns forever, all the right, title, interest, claim and demand which the said grantor has; in and to the following described property situated in the County of Maricopa, and State of Arizona, to-wit:

The east 33 feet of the NE¼ of Section 32, T5S-R10W, G & SRB & M to be used by said county for road purposes.

TO HAVE AND TO HOLD the same together with all the appurtenances thereunto belonging, to the grantee heirs and assigns forever.

IN WITNESS WHEREOF, the said grantor has hereunto set his hand the day and year first above written.

W. L. Hostetter

D10204

8602 PAGE 754

STATE OF ARIZONA } ss
County of Maricopa

I hereby certify that the within instrument was filed and recorded

IN DOCKET & Page 8602 PAGE 754-757 and indexed in

Fee No

24-R. AGR
59284

MAR 26 '71 -2 20
MARICOPA CO. BD. OF SUPERVISORS

When recorded, return to:
Maricopa County Board of Supervisors

Witness my hand and official seal.
PAUL N. MARSTON
County Recorder
By
Deputy Recorder

Compared
Photostated
Fee:

403-30-47, 50, 51

AMENDED EASEMENT

HIGHWAY PURPOSES

R/W #23-047, Sentinel-Agua Calier

Item I-2141

K. K. Skousen and Elizabeth Skousen, his wife **GRANTORS,**

for and in consideration of the sum of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, do hereby grant to MARICOPA COUNTY, a political subdivision of the State of Arizona, its successors, and assigns, a permanent easement and right-of-way, for the following purposes, namely: The right to enter upon the hereinafter described land and grade, level, fill, drain, pave, build, maintain, repair and rebuild a road or highway, including incidental purposes consistent therewith, together with such bridges, culverts, ramps and cuts as may be necessary, on, over, under, and across the ground embraced within the right-of-way situated in the County of Maricopa, State of Arizona, and described as follows:

This instrument is to correct an error in the legal description of the Easement recorded in Docket 7768 at page 757.

That part of the description to be corrected begins on line six(6) and ends on line eighteen(18), to-wit:

The West Forty(40) feet of the North one-half(N½), and the West Forty(40) feet of the West one-half of the Southwest one-quarter(W½ of SW¼), both in Section Thirty-three(33), and the East Forty(40) feet of the East one-half of the Southeast one-quarter(E½ of SE¼) of Section Thirty-two(32), all in Township Five(5) South, Range Ten(10) West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.
EXCEPT the South 629.35 feet of said Sections 32 and 33.
ALSO, all that part of the South 629.35 feet of said Sections 32 and 33 which lies within a strip of land Eighty(80) feet in width, being Forty(40) feet (measured at right angles) on each side of the following described centerline: BEGINNING at a point on the section line common to Sections Thirty-two(32) and Thirty-three(33), Township Five(5) South, Range Ten(10) West of the G&SRB&M bearing North (assumed bearing) 629.35 feet from the Southwest corner of said Section 33; which point is the point of curve of a 1°00' curve concave northeasterly having a central angle of 45°12'55" and a tangent of 2385.85 feet; thence Southeasterly along the arc of said curve 4521.53 feet to the point of tangency thereof; which point lies East (right angle from west line) 1693.38 feet along the South line of said Section 33 and South (right angle from said South line) 3437.20 feet from the Southwest corner of said Section 33.

M.C.H.D. Proofed 3/5/71 Checked 3/9/71 Approved 3/9/71

That description shall be changed to read as follows:

EXCEPT the South 503.55 feet of said Sections 32 and 33.
ALSO, all that part of the South 503.55 feet of said Sections 32 and 33 which lies within a strip of land Eighty(80) feet in width, being Forty(40) feet (measured at right angles) on each side of the following described centerline: BEGINNING at a point on the section line common to said Sections 32 and 33 bearing North 0°54'30" East (assumed bearing) 503.55 feet from the Southwest corner of said Section 33; which point is the point of curve of a 1°15' curve concave easterly having a central angle of 11°48'50" and a tangent of 474.24 feet; thence Southerly 504.44 feet along the arc of said curve to a point on the south line of said Section 33; which point lies South 89°20'18" East 27.53 feet from the said Southwest corner of said Section 33.

7

FRIENDS OF ARIZONA RIVERS

96-003-007

503 E Medlock Dr
Phoenix, AZ 85012
542-7331 W

Gila River
01

ORIGINAL

August 19, 1996

RECEIVED 9-3-96

Arizona Navigable Stream Adjudication Commission
1700 W Washington; Room 404
Phoenix, Arizona 85007

Dear Commissioners:

In response to your request for evidence regarding characteristics of navigability of the Gila River, I submit the following information.

Over the past 15 years I and others in my party have boated the Gila River and its tributaries many times on various reaches. The specific segments that we have rafted or kayaked include:

1. The Gila River Box, launch at the Old Hwy 666 bridge located south of Clifton, takeout at the BLM takeout point 1-2 miles past Bonita Creek. (About 3 trips in mid-late 1980's)

2. Starting on the San Francisco River at the old pizza parlor in Clifton (near the DPS office), to the takeout on the Gila River at past Bonita Creek. (Two trips in the 1980's)

3. The lower quarter-mile of Eagle Creek to its confluence with the Gila River. (One time)

4. Gila River, launching at its confluence with Dripping Springs or "The Shores" (3 miles above Winkelman), takeout at the backwaters at the Ashurst-Hayden Dam. (Two times all the way through; two times to Winkelman; once to Kearny; dates were in mid 1980's and early 1990's)

5. Starting at the Salt River at the 91st avenue crossing in Phoenix, connecting with the confluence of the Gila river, and taking out at the road crossing at Bullard Avenue. (Two trips; dates were on Jan 29, 1992 and April 1992)

6. Salt/Gila confluence, starting at 115th Avenue, take out at Bullard Avenue; date: Apr 16, 1992. Two rafts; Boatmen: Tim Flood, Bob Rink. Passengers: Mayor Paul Johnson, Councilman Rimsza, and 4 staff from City of Phoenix.

~~1915 West Hazelwood Pkwy.~~ ~~Phoenix, Arizona 85015~~ ~~(602) 242-8478~~

7. Gila River, launch from Poco Dinero Road at Dendora Valley below Painted Rock Dam, takeout at the road crossing at Rocky Point. (One trip, flow was about 1,000 cfs; date of trip: March 26, 1995.)

I have listed only the trips that I personally made. Others may have made trips in which I did not participate.

The flow rates on the streams ranged from a high of 5,000 cfs (Salt River) to a low of about 25 cfs (Eagle Creek). Stream depths at the time ranged from over the height of my paddle (about 7 feet) to as low as 6 inches. I could dig up a photograph or slide from most trips; if you want to see them please let me know.

I have enclosed an article from Arizona Highways (Feb 1996) that describes a recent canoe trip on the lower Gila; and a trip taken in 1906 by Peter Aleshire's great-grandfather and brother; they boated from Florence to Yuma.

I would consider the Gila River one of the more well documented and navigated streams in the state. Thus, the Gila River is more than "navigable"; it is actually "navigated." If the water were to flow more frequently there would be a lot more use of the Gila River for recreational boating and wildlife viewing.

Sincerely,

Timothy J. Flood

Timothy J Flood

enclosures

96-003-007

Gila River
02

Desert Waves

CENTRAL ARIZONA
PADDLERS CLUB

Volume 5, Issue 2 (Spring 1992)

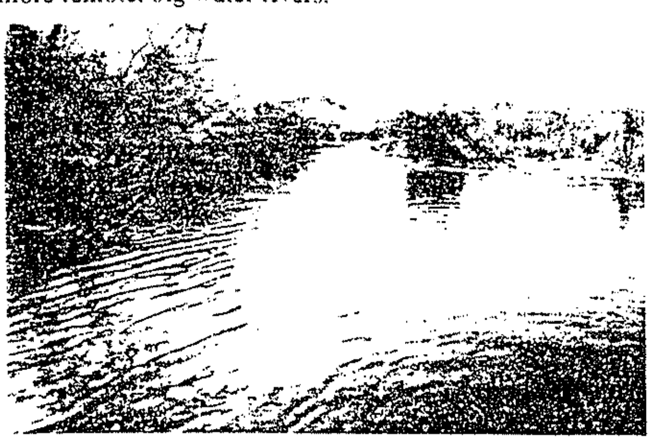
Photos: Jan 1992

Suburban kayaking. Dick Juetten stands ready to tackle the snags and braided channel below the 91st Avenue wastewater treatment plant. Flows in the Salt River this year have been the best in a decade.

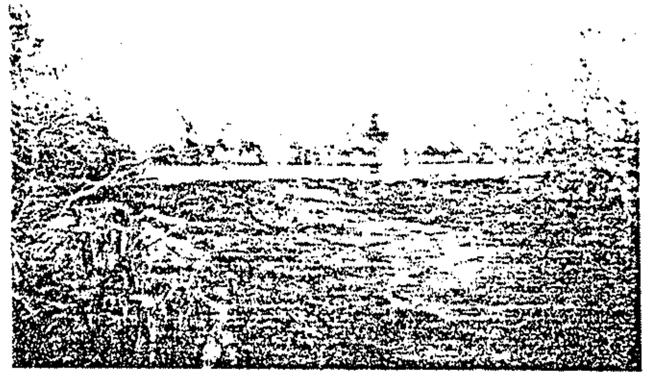
Salt River Flows Through Phoenix

by Tim Flood

For the first time in years, the Salt River has flowed continuously through Phoenix for several months. With the warm weather fast approaching, many CAPC members may be tempted to run this stretch. The Salt River is deceptively calm when viewed from the bridge crossings. In fact, the Salt River is not the unobstructed flatwater river found above town on the tuber's run. Rather, there are numerous hazards, snags, and strainers waiting to seize the ill prepared river runner. Navigation of the Salt/Gila Rivers through Phoenix should not be undertaken lightly. It requires whitewater gear, experience in "reading" swift current, and the skills and strength to avoid obstacles. Treat it with the same respect you would give to any of Arizona's more remote, big water rivers.



Backwater marsh along the Salt-Gila confluence. Phoenix sewage effluent supports a lush riparian area and bird life west of the metro area.



Salt-Gila River in February. Treated effluent below 91st Avenue supports cottonwood and willow trees and abundant bird life, including hawks, great blue herons and egrets. The many snags present a technical challenge for experienced boaters.

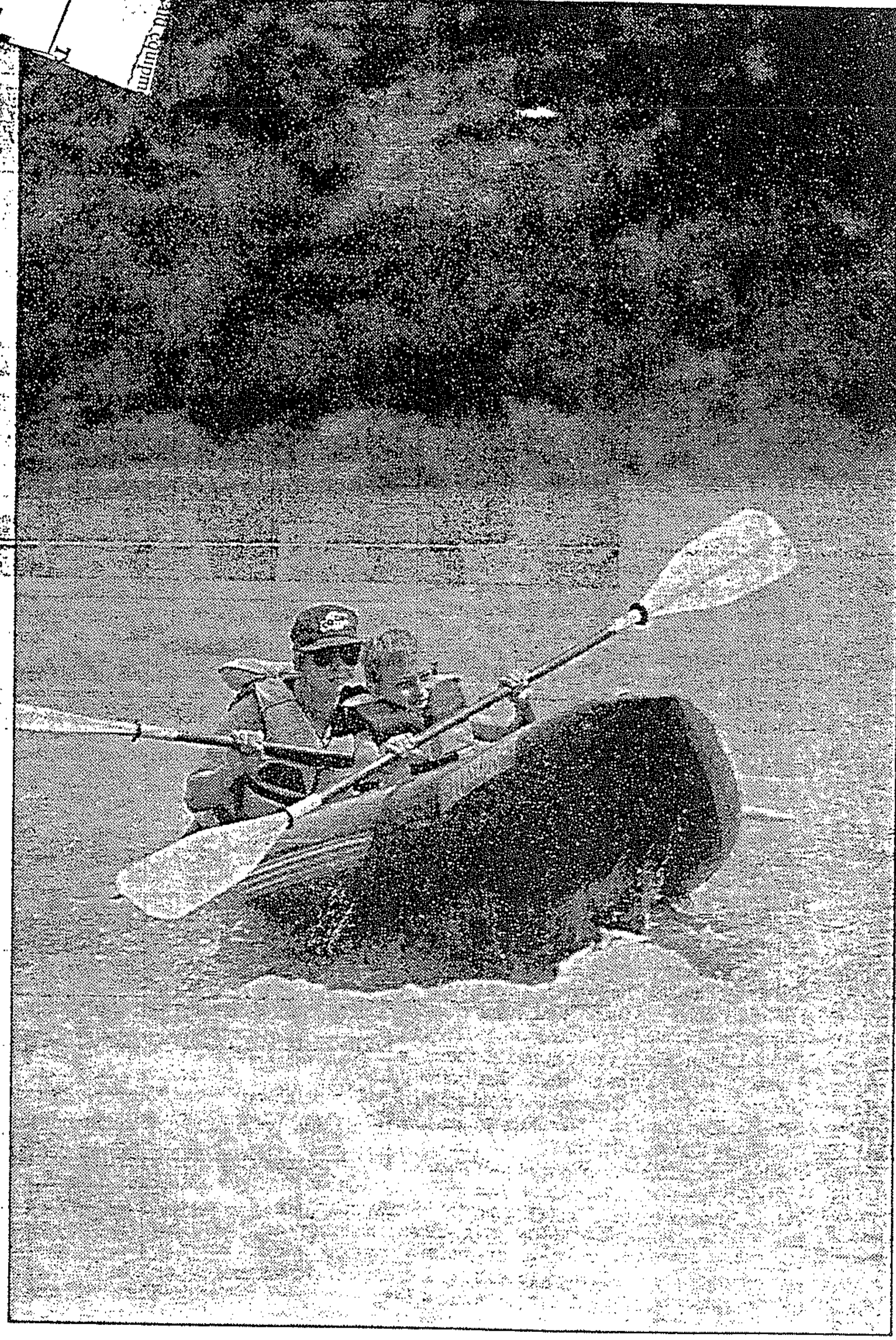
Salt River at 107th Avenue. Flows through Phoenix this spring have provided a unique opportunity to view this once mighty river. The river still supports dense stands of cottonwood-willow and abundant bird life.

MARK YOUR CALENDAR!
Next Meeting
Wednesday April 8, 1992

96-003-007

Gila River
03

de through wilderness



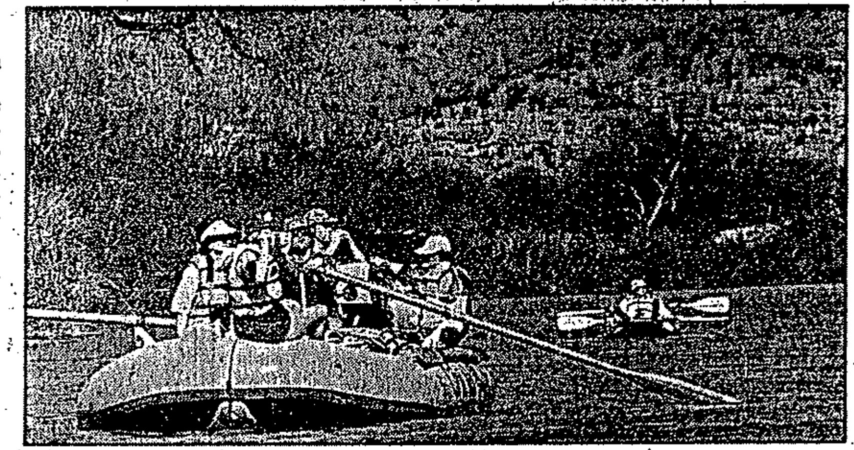
Suzanne Starr/The Arizona Republic

River runners in a two-man kayak, paddle and bob along the Gila River, which rafting companies have begun to explore in recent years. Story, E6.

REC & FITNESS

Gila River has ballerina's grace

By Carol Sowers
The Arizona Republic



Suzanne Starr/The Arizona Republic

Rafters and kayakers relax along a stretch of serene water and enjoy some of the plentiful scenery along the Gila River in southeastern Arizona.

The upper Gila River is like an aging ballerina.

She moves gracefully through the towering box canyons she has carved over the centuries in southeastern Arizona. But like a practiced dancer, she is strong and athletic, and still can surprise her river-running guests with a twirl or two through her playful waters.

On a recent two-day raft trip through the upper Gila, Andy Dennerback, a Cimarron River Co. oarsman, eyed the peppy water boiling around a boulder and told his five passengers: "I think we may bounce off that one."

We did, but it was an amiable bump and there was only the passengers on our other raft and two accompanying kayaks to cheer and jeer.

That is the beauty of the Gila. There is hardly anyone there. The river is what Cimarron owners call a "seldom visited wilderness river." She is remote and known better to local boaters. But in the last few years, commercial companies like Cimarron have begun exploring her expanses of serene water and huge helpings of quiet.

Staff Sgt. Denise Potett, stationed at Luke Air Force Base, said she welcomed the calm, brown waters of the Gila.

"I've been on other trips where I had to spend all my time paddling," she said. "Here I can just pay attention to the scenery."

And the scenery did not disappoint.

Wise old tamarack trees grow like gentle guardians from the banks, and mud swallows flicker in and out of their nests bulging from cliff walls. Hawks are silently overhead, tracing an invisible route in the blue desert sky.

Float begins with camp

Our quiet voyage with Scottsdale's Cimarron River Co. — the only company to hold a federal permit to commercially raft the Gila — began on a Friday afternoon in Phoenix, where we boarded a van trailing our two 18-foot rafts and two rubber kayaks en route to Clifton in southern Greenlee County. We camped just outside Clifton along the Gila at a campground called the "Old Bridge Site," named in honor of a span across the river built in 1918.

Saturday morning, fueled with pancakes and bacon from the Cimarron crew's expansive outdoor kitchen, we aired up the rafts and the kayaks, loaded our waterproof gear bags onto the boats and pushed gingerly off into the water for two days and 20 miles of floating toward our put-out point near Safford.

Dennerback guided us over the rippling water, keeping his eye on the four passengers in the two-man kayaks, who paddled and bobbed ahead, or behind, the monster rafts.

The first day we passed riverside ranches and hiked up to an old water wheel and abandoned house where oarsman Scott Hynes insisted he saw Elvis.

"He's up there," he said.

We stopped for lunch at the hot springs, where 8-year-old John Riddle flirted with the smoking water boiling up from under the beaches.

"Try it," he said, inviting his mother, Dorothy, to tiptoe through water so hot it sent our 160-degree thermometer into a tailspin.

Dorothy, an accomplished kayaker and veteran mother, declined.

River unusually lush

A mile farther, we squished through the quicksand where the San Francisco River meets the Gila. We washed off in the Gila's warm pools, made deep and inviting by this winter's generous rain and snow.

The Gila is not always so lush. Dave Insley of Cimarron said that some springs on the Gila are not deep enough for commercial rafters, but still is tempting for small boats like canoes. This year, Cimarron's oarsmen said the Gila may be running enough to play host to boaters through June.

Our group camped Saturday night on the sandy beaches where Eagle Creek's blue waters blend with the dowdy brown of the Gila. Atop the bluffs rising above the river, remnants of stone utensils used to grind corn offered faded reminders of an ancient Indian civilization that lived along the Gila.

Floating is hungry work, so the crew fed us barbecued steak and salmon. And oarsman Chris Pomeroy read us the comic poem, "The Cremation of Sam McGee," as we sat around the campfire and waited for a carrot cake to bake in a dutch oven.

The next morning, Katie Cassidy of Phoenix took her first laugh-a-minute ride with Dorothy Riddle piloting a rubber kayak. Dipping her paddle into the river, and occasionally whirling the boat sideways, Cassidy said, "I feel like a kid again."

The two-day $230 adventure was over by 5 p.m. Sunday, when we lifted the boats out just beyond the clear, bubbly waters of Bonita Creek near Safford.

John Riddle, who splashed up the cool creek waters in his bare feet, said what everyone else was thinking: "I don't want it to be over with."

Suzanne Starr/The Arizona Republic

...ng the Gila River, which rafting companies h...

rand Canyon Chapter • Arizona

October 1992

96-003-007

Gila River

04

Sierra Club: Canyon Echo

Is It the Gila Box Riparian National Conservation Area?

Is it the Gila Box Riparian National Conservation Area or the Gila Box Riparian National Annihilation Area? You probably thought that when the Gila Box was designated as a RIPARIAN National Conservation Area (RNCA) in the Arizona Desert Wilderness Act of 1990 that the area would be protected for RIPARIAN values. Think again.

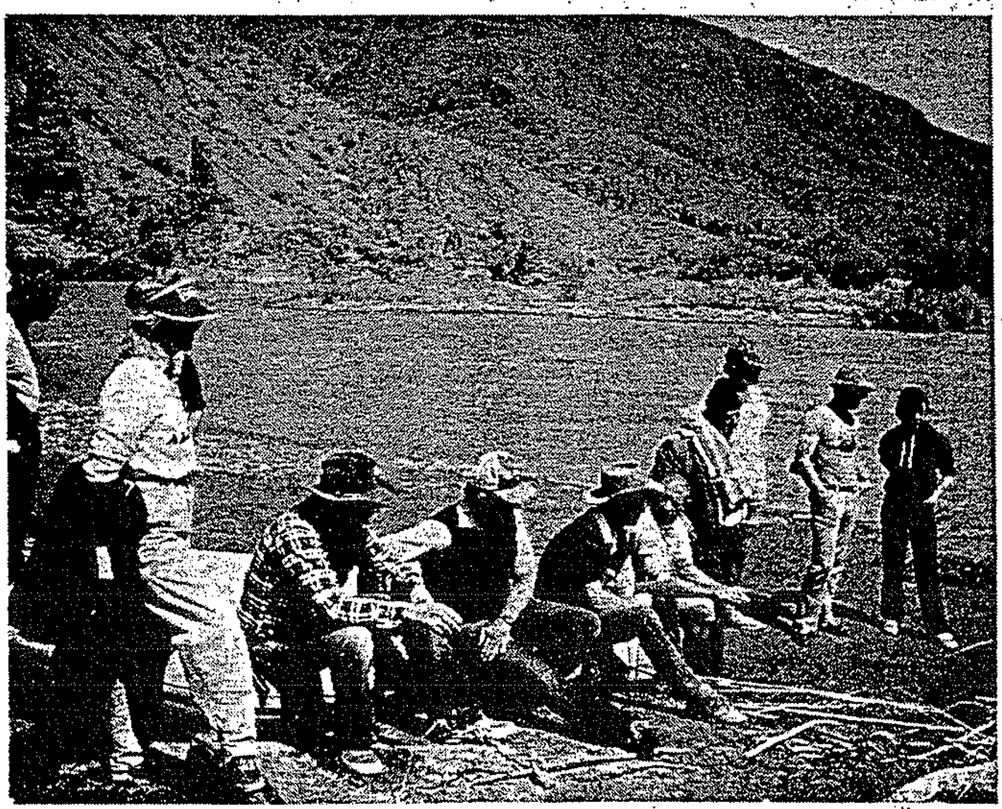
Congress authorized the RNCA "in order to conserve, protect, and enhance the riparian and associated areas described in subsection (b) and the aquatic, wildlife, archeological, paleontological, scientific, cultural, recreational, educational, scenic, and other resources and values of such areas."

Although the House Report accompanying the act clearly states that the intent of Congress is to "terminate" ORV use in the river bottoms, the Safford District BLM recently revealed a proposed plan to designate the Gila River as a road in order to allow the ORV use.

The BLM has also allowed 300 head of cattle in a pasture on Bonita Creek for "the past 2½ months." Clearly this activity during the growing season does not conserve, protect or enhance riparian values.

And, according to a story in the Sept. 4, 1992, *Arizona Republic*, BLM officials have now approved a 60-day permit for a mining company to begin operations which involve transporting 150 tons of ore from lower Bonita Creek.

For more information, contact the Safford BLM office at 425 E. Fourth St., Safford, AZ 85546, or call them at (602) 428-4040. Tell them you want to be on their mailing list for the management plan of the area and kept informed of all decisions affecting the RNCA. To ensure that your letters are not ignored, send copies to Advisory Committee member, Gail Peters at American Rivers, 3601 N. 7th Ave., Phoenix, AZ 85013.



Efforts to protect the Gila Box have been going on for years. Here is then Representative John McCain (in striped shirt) preparing to raft down the Gila River in 1983.

96-003-007

Gila River
05

CANOEING GILA BOX CANYON

Text and Photographs
by George Wuerthner

In 1826 James Ohio Pattie, a Kentucky frontiersman, and a group of mountain men trekked the 600-mile length of the Gila River from its headwaters in New Mexico to its confluence with the Colorado near present-day Yuma. Beaver were so abundant, Pattie's men subsisted largely on the meat of the animals they trapped.

In places the deep Gila waters forced Pattie to construct a boat to cross the river. Today the Gila, reduced by dams, water table depletion, and irrigation diversions, would be mostly unfamiliar to Pattie and his men.

But there is one stretch that remains free-flowing, resembling the natural landscape Pattie knew. It's in a canyon called the Gila Box.

My wife, Mollie, and I are standing on a hill overlooking the end of the canyon where Bonita Creek joins the Gila River. It was here, more than a century and a half ago, that James Ohio Pattie killed a grizzly bear. The huge bruins have long since vanished from the Southwest.

From our hilltop vantage point, we survey the river to determine its navigability. We plan to park our pickup at Bonita Creek, drag a canoe upstream to the upper end of the Gila Box, and then float back to our starting point. During the height of spring runoff, the turbulent Gila would be difficult to run in an open canoe; during low water periods, it would be too shallow. We have arrived between these extremes, and the river waits to accommodate us.

The Gila Box is managed by the U.S. Bureau of Land Management and remains relatively unspoiled. Its scenery, wildlife habitats, and other attributes had prompted the BLM's Safford District Office to include the area in a study of lands that might be added to the National Wilderness System. As it turned out, the Gila Box was the most controversial of the nine areas investigated.

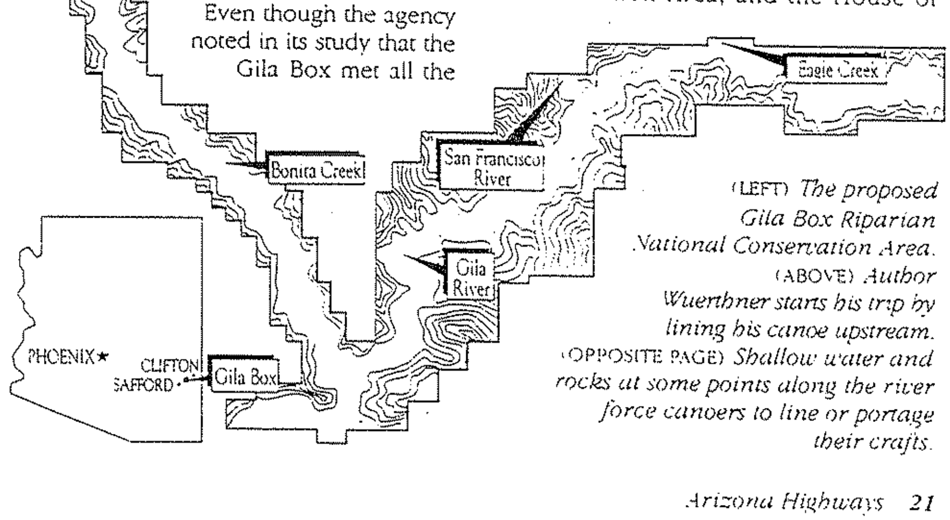
Opposition came from off-road vehicle users, ranchers, and resource development interests, such as mineral, power, and oil companies.

Off-road vehicle users feared being displaced because wilderness areas prohibit motorized access. Ranchers worried that various range developments, such as pipelines and large fencing projects that could improve livestock usage and management efficiency, would be limited. Mining companies expressed concern that mineral deposits would be out of reach in a wilderness area.

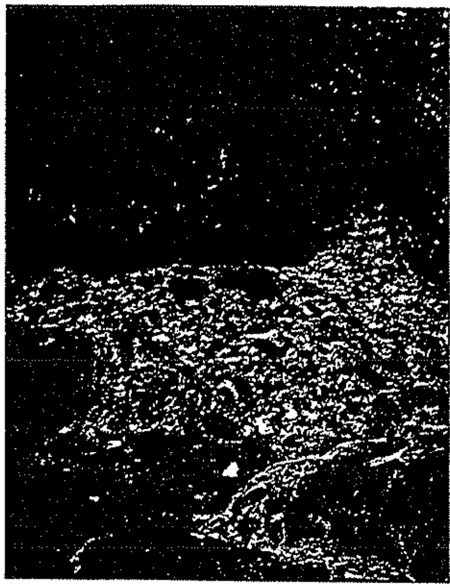
Supporters included the U.S. Fish and Wildlife Service, which said that wilderness designation would "benefit wildlife and wildlife habitat." The Arizona Game and Fish Department called the Gila Box the "last significant free-flowing, undeveloped river in Arizona" and concluded that "wilderness status for this unique area is the best means to insure long-term protection." Jim Norton, Southwest regional director of the Wilderness Society, described the Gila Box Canyon as "the most remarkable BLM area in Arizona."

Even though the agency noted in its study that the Gila Box met all the requirements for wilderness designation, including "outstanding opportunities for solitude, a diversity of plants and animals, outstanding scenery, opportunities for primitive recreation, and riparian vegetation uncommon to the Southwestern United States," the agency recommended against wilderness designation. The BLM maintained it could "protect wilderness values" while simultaneously allowing off-road vehicle usage and geothermal and mineral development in the area. BLM also said rehabilitating the area would be more difficult under wilderness designation restrictions.

The issue essentially was resolved when the state's Congressional delegation reached a consensus early this year on designating the site a Riparian National Conservation Area, and the House of



(LEFT) *The proposed Gila Box Riparian National Conservation Area.* (ABOVE) *Author Wuerthner starts his trip by lining his canoe upstream.* (OPPOSITE PAGE) *Shallow water and rocks at some points along the river force canoers to line or portage their crafts.*



(ABOVE) *In ancient times, lava flowed to the surface in the Gila Box region, leaving basalt formations.*
(OPPOSITE PAGE) *Fortress-like rocks dominate the scene in the Eagle Creek area.*
(FOLLOWING PANEL, PAGES 24 AND 25) *The Gila River has plenty of room to maneuver in its channel as it bends to join Bonita Creek at the lower end of the Gila Box.*

Representatives approved such a measure. At this writing, the bill was pending before the Senate, but was expected to pass.

A riparian conservation area designation allows motorized access on selected roads and is less restrictive in other ways than a wilderness area. But the legislation directs the BLM to manage the land for the protection and enhancement of its riparian values. It also authorizes the federal government to acquire private lands within the boundaries of the conservation area through donation, exchange, or purchase with consent of the owner.

We climb into our pickup, slowly bounce down the last potholed, boulder-strewn pitch of road to the mesquite bosque that lies at the mouth of Bonita Creek, and pull into a well used campsite.

The solitude is filled with the twit and warble of a great variety of birds. An old sycamore just above us serves as a virtual condominium for them. A kingfisher is perched on a branch overlooking the river, waiting for prey to go swimming by. Also in the area are a mourning dove, Gila woodpecker, yellow-rumped warbler, black phoebe, vermilion flycatcher, black-chinned hummingbird, and hooded oriole.

Bonita Creek supports an extensive mix of both water and desert birds. Some believe it has as diverse a collection of bird species as any location in the country.

Binoculars and bird book in hand, we exit the truck and walk to the river. A great blue heron, stalking fish or frogs in the creek, spooks at our approach and takes flight. Seeing a wading bird in the middle of a desert isn't as strange as it may seem because water flows here continuously. Perennial waterways, never abundant in the Southwest, are exceptionally rare in these days of dams and reservoirs and attract water-dependent birds like the heron. The Gila Box also is used frequently by wintering waterfowl and often by sandhill cranes.

We cross five-foot-wide Bonita Creek and spot the object of the heron's interest: schools of tiny fish. There are at least 13 species native to the Gila drainage. More than half are threatened or endangered, such as the Gila chub, razorback sucker, spikedace, and loach minnow.

The creek itself is sparkling clear as it flows placidly through rocks laced with wavy green moss shaded by large cottonwoods, sycamores, and other vegetation.

At its confluence with Bonita Creek, the Gila flows with a determined current but is not particularly swift. Should be no trouble lining our boat upstream. We begin ferrying camera gear, food, water, and canoe to the riverside.

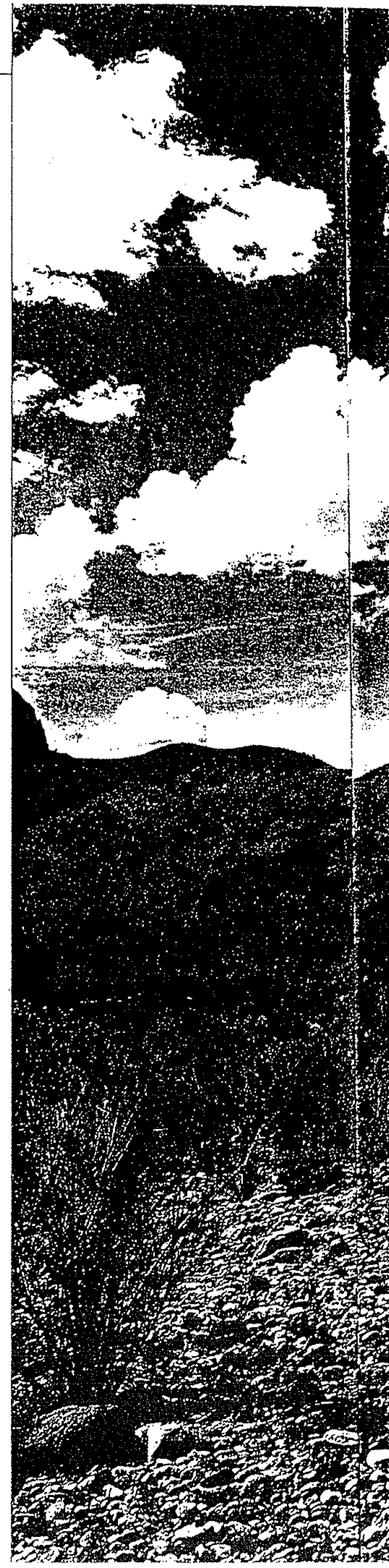
Lining is an old trick that Pattie would have understood. By attaching ropes to the bow and stern and alternately shortening and lengthening one or the other, it is possible to steer the craft around obstacles. Lining is also a surprisingly easy way to move a canoe (and its load) upstream.

I take the first shift with the canoe, shuffling up through the shallows, boat in tow, while Mollie, binoculars in hand, walks the wide spacious sandbars looking for birds, tracks, and other tidbits of natural history. We pass the mouth of Deadman Canyon and Cat Canyon. Then rounding a bend, we move beneath a 30-foot-high cliff face made up of a tawny colored band of volcanic tuff. The cliff probably formed when nearly liquid ash flowed down some ancient stream valley and hardened in place, later to be cross-sectioned and exposed by the river.

In other areas there are great dark bodies of blue-black basalt, which once oozed out on the surface as lava. Throughout the canyon, we find andesite flows, breccias, and conglomerates. Seen occasionally are dikes and sills, formed when molten rock was intruded into existing rock beds through cracks, later to cool in place. All these relatively hard rock formations make wonderful cliff faces and explain why the Gila Box is here in the first place. In a few sections of the canyon, softer mixtures of ash, gravel, and small boulders have eroded into pillars and fins.

We pull the canoe ashore for lunch — crackers, cheese, apples, juice — and a rest in the shade of a mesquite tree.

Text continued on page 27



Fickle Gila sometimes runs through state's history

JAMES E. COOK
Republic Columnist

We crossed the dry, brushy Gila River on Interstate 10 a couple of years ago while bound for Old Tucson.

My irrepressible granddaughter, Jacque Wullkotte, then 6, echoed the reaction of winter visitors in normal years:

"This is a river?"

Raconteurs tell of the Gila Bend native who went to New York for the first time. When he returned, he was approached by his neighbor, a former New Yorker.

"What did you think of the Hudson?" the transplanted Easterner asked.

"Couldn't tell. It had water in it the whole time I was there."

But now the Gila is rolling as it hasn't for many years, washing away livelihoods, soil and dreams. This is a good day to reconstruct times when the river had water in it much of the time.

The Gila Trail served as both guide and conduit for westbound travelers as early as the Mexican War.

The Mormon Battalion carved out a wagon road west in 1846 and 1847, following the river from Gila Bend to Yuma Crossing, where the river meets the Colorado.

In a wet year, the river below Gila Bend was about 150 yards wide, and the water 4 or 5 feet deep in midstream.

Floating on wagon beds

Col. Philip St. George Cooke, commander of the battalion, decided in December 1846 to float supplies down the Gila. Two wagon beds were lashed together end to end, supported by cottonwood logs on each side.

A member of the battalion, Henry W. Bigler, wrote in his journal on Dec. 31, "This move of the Colonel's we did not like and we had forebodings it would not be a success."

The boat leaked. But when Lt. George Stoneman insisted that he could maneuver the boat down the river to the Colorado, Cooke ordered him to go ahead.

Stoneman departed with about 2,500 pounds of cargo: flour, pork, corn for the mules, tools and some of Cooke's personal baggage.

The contraption made it about 70 miles to the point where the Gila joined the Colorado at Yuma Crossing, but it was not an easy journey. The craft kept getting snagged on sandbars, and Stoneman had to jettison some of the provisions to move the craft through more shallow waters.

Some forty-niners, heading for the California gold fields, also relied on the Gila for water and grass.

Mules in quicksand

Alden M. Woodruff, a gold seeker from California, wrote in his journal:

"We traveled down the river three or four days and found no grass — we had plenty of corn and wheat — but we soon learned how to find grass; we had to swim our stock over to the bars and islands, which were subject to overflow, and on some found plenty of fine grass. It was on this river that my two best mules (Pol and Bill) were ruined, by getting mired in the quicksand. After my mules were broken down, I had to swap off both for (another) one, leave my wagon, and pack (the mule)."

Other forty-niners floated their wagons down the Gila. Elias H. Howard and his wife (we don't know her name) were navigating the river Oct. 21, 1849, when she began labor.

The party poled the rude craft to a sandbar, where Mrs. Howard gave birth to a son. Legend says she got back on the flatboat next morning, took up her pole and continued to help propel the boat toward Yuma.

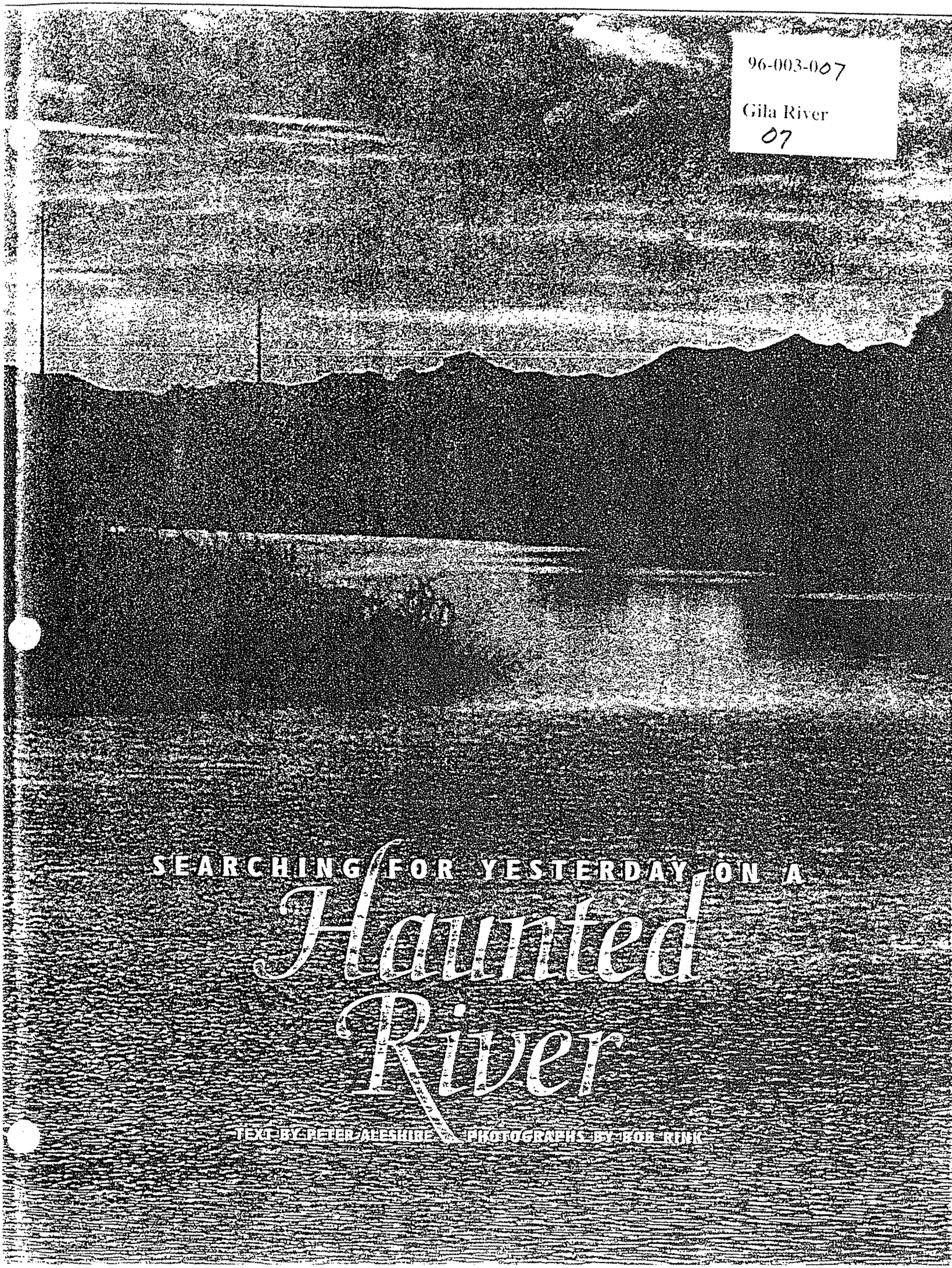
Changing course

Historians used to claim that Gila Howard was the first white child born in what would become Arizona, but that intelligence has since been declared racially "insensitive."

In 1885, Florence asked the Legislature for money to bridge the river north of town. Lawmakers came up with $1,200. Soon, the Gila changed course, cutting a new channel around the end of the bridge and continuing muddily toward Yuma.

No report on the Gila would be complete without this Will Rogers quip. The humorist was on hand March 4, 1930, when Calvin Coolidge, one of Rogers' favorite targets, helped dedicate the dam. Looking over the damp, grassy future bed of San Carlos Lake, Rogers said, "If this was my lake, I'd mow it."

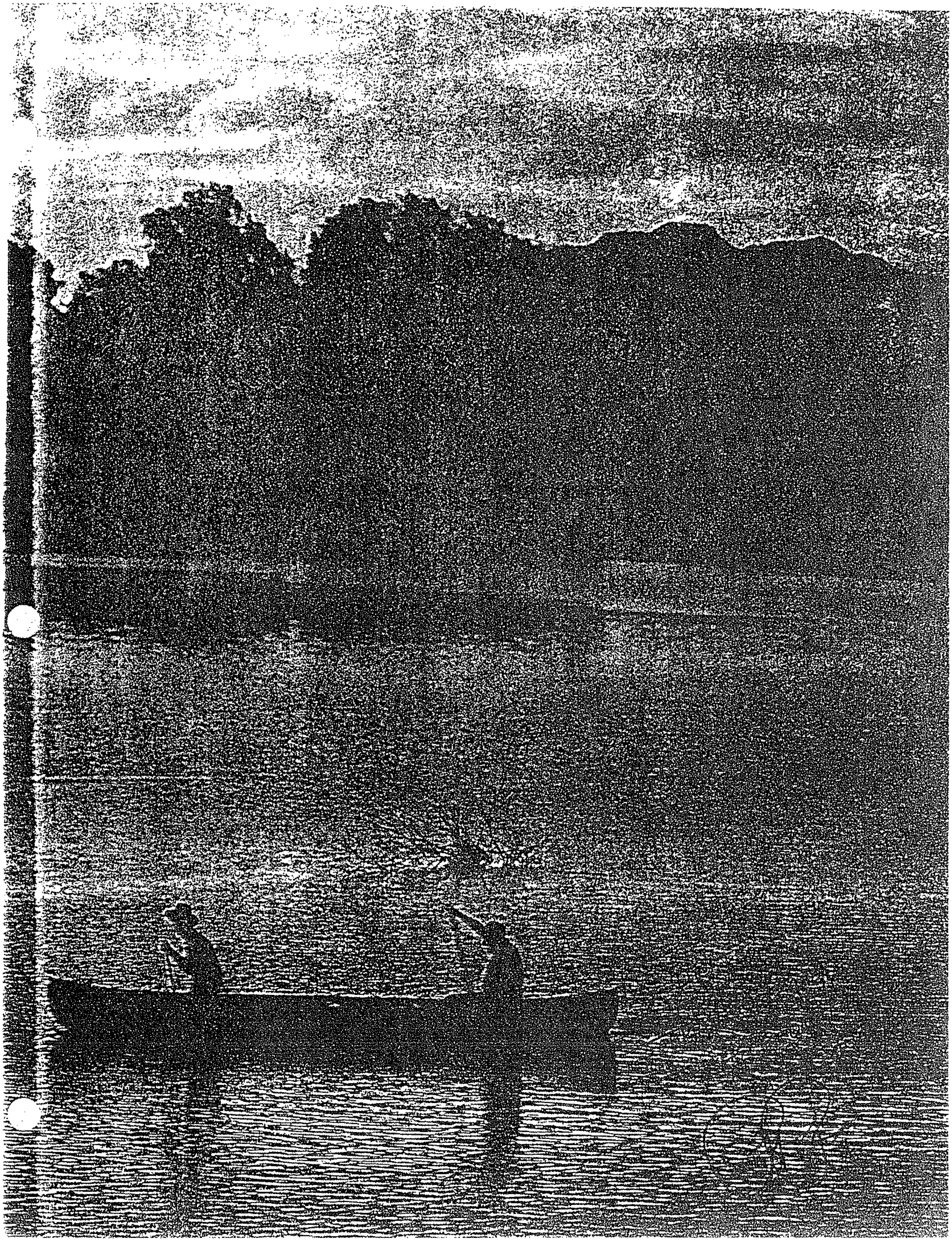
It is the overflow water from Coolidge and Roosevelt dams, of course, which is now sending the Gila well beyond its shallow banks, threatening life and destroying property all the way to Yuma.



SEARCHING FOR YESTERDAY ON A

Haunted River

TEXT BY PETER ALESHIRE / PHOTOGRAPHS BY BOB RINK



the upper Gila, but had dreamed about trying his luck on the historic lower Gila. So he jumped at my invitation.

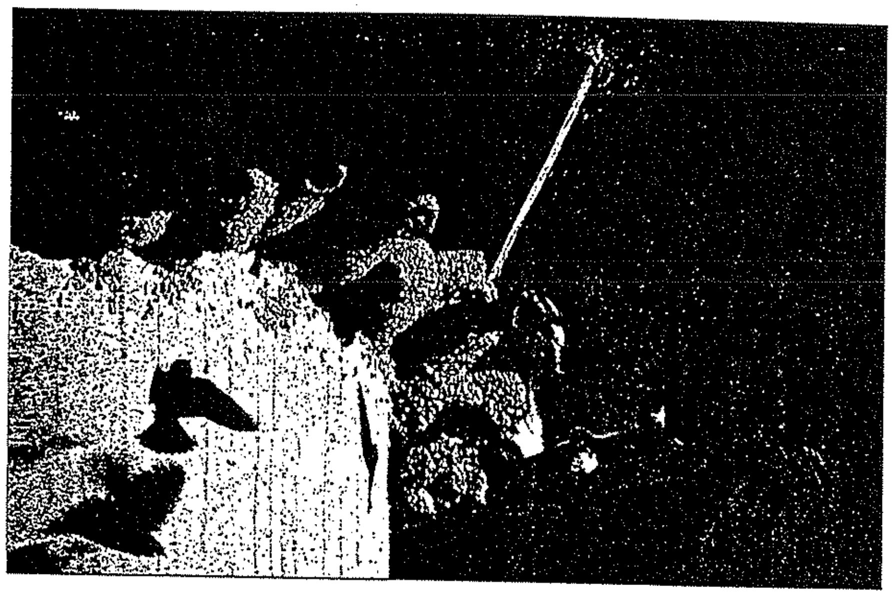
Wading out into the water ahead of the canoe, I guided the bow through the grasping tamarisk branches, inundated by the rise of the river in the great embayment just below Painted Rock Dam. Gil hopped into the stern as the canoe settled into the water, and I clambered, perilously, into my spot in the bow. In a moment, we were through the screen of branches. Several hundred pelicans rose from a sandbar 100 yards to the south and wheeled in a great white-winged mass above our heads. Farther down the sandbar, a huge squadron of gulls regarded us with suspicion but held their ground. Our delight rebounded when a great burst of long-legged, long-necked egrets exploded from a stand of partly submerged tamarisks 100 yards north.

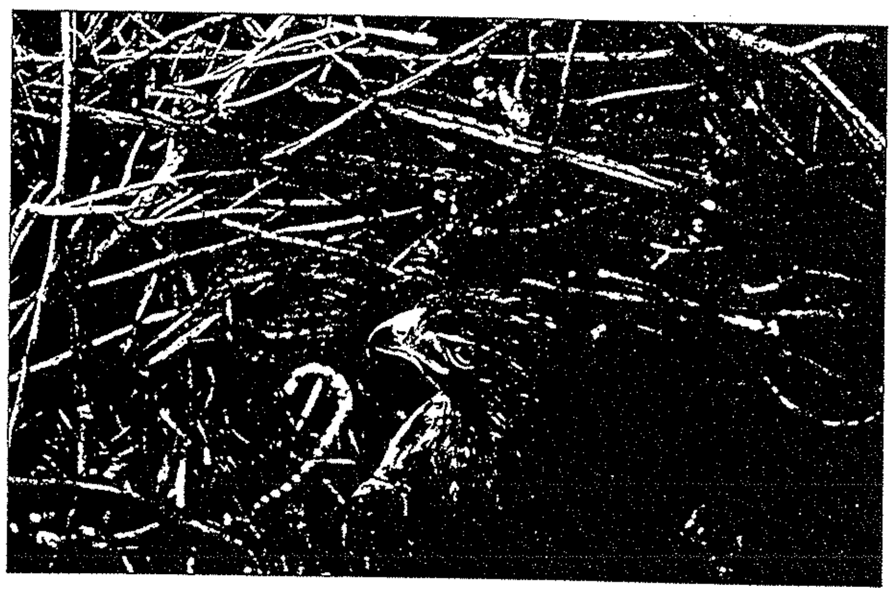
Beavers, otters, and a host of other animals made their living all along the Gila, as did a succession of ancient cultures, which left behind pottery, arrowheads, and strange geometric designs etched into the sun-bronzed surface of rocks.

The first European explorers reported a thriving succession of groups living all along the Gila. Most were farming cultures, who greeted the early Spanish explorers amiably enough. Outriders for Francisco Vasquez de Coronado explored the Gila, searching for the fabled and completely fictitious Seven Cities of Cibola. Spanish explorer-priests such as Father Francisco Hermengildo Garces and Father Eusebio Francisco Kino traveled often along the Gila, for the most part winning the admiration of the Indians.

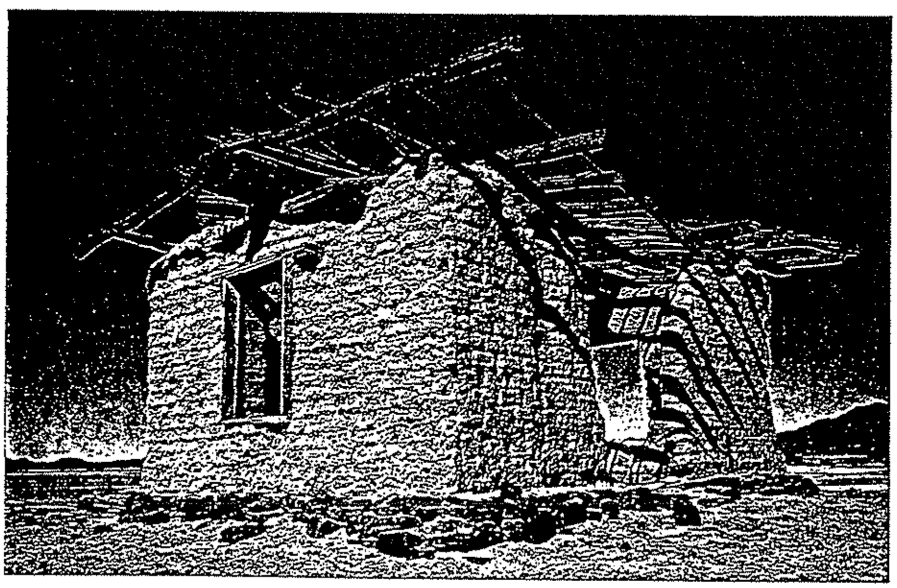
Many of the great names of Western history connect at some point with the Gila River. Early trappers quickly converted the Gila's beavers into hats; mountain men like Jedediah Smith, Kit Carson, Pauline Weaver, and John Walker passed repeatedly along its banks; the famous Mormon Battalion hacked out a wagon road; and Gen. Stephen Kearny's Army of the West lugged cannon along its inhospitable banks in an effort to conquer California during the Mexican-American War. The 49'ers rushed along its length toward the goldfields of California; the fabled Butterfield stage plied its banks until shut down by the Civil War; and assorted detachments of cavalry chased the elusive Apaches up and down its broad valley.

The bluff overlooking the Gila River perhaps 20 miles below Painted Rock Dam also provided the setting for one of the most famous massacres in Western history, when a party of Tonto Apaches killed Royse Oatman, his wife, and four of their children. They left Oatman's eldest son for dead





(PRECEDING PANEL, PAGES 4 AND 5) *Canoeists make their way along the Gila River as a new day dawns, not knowing what adventure lies around the next bend.*
(OPPOSITE PAGE) *Author Peter Aleshire paddles near the eroded banks of the Gila on a trip of discovery that yields insight if not his final destination.*
(TOP AND ABOVE) *Birdlife abounds along the river. Here mud swallows make their home under a bridge that now spans the Gila, and a red-tailed hawk nests in a secluded spot.*



(TOP) *This petroglyph panel may have been left by members of the Archaic, Patayan, and Hohokam Indian cultures who lived along the once well-traveled banks of the Gila between 7000 B.C. and A.D. 1450.*
(ABOVE) *Another of the evocative remnants from the past still visible along the river is this weathered adobe structure.*
OPPOSITE PAGE *Tiny islands jut out of the reservoir behind Painted Rock Dam, swollen with spring run-off from eastern Arizona and western New Mexico.*

and abducted his two young daughters, Olive, 16, and Mary Ann, 10. Mary Ann succumbed to the rigors of captivity, but Olive was recovered five years later, having been sold to a band of Mohaves. The sensational case made national headlines and provoked at least one tabloid-style book, fixing a lurid image of the Gila River in the nation's psyche.

This rich mixture of national and personal history overlay the somnambulant flow of the present-day river, as we paddled down the Gila on our own small journey of discovery. Sometimes we paddled at a brisk pace, savoring the sound of the bow sluicing through the dark waters. More often we ambled, gradually adjusting our internal chronometers to the river's pace.

I'd hoped that the floods and the months of reservoir releases would revive the cottonwoods and willows and bulrushes. It did, to a degree. But mostly the sandbars and shoreline had been claimed by millions of tamarisk seedlings, that bane of Southwestern waterways. Tamarisks grow like weeds, spring back after fires, thrive in soils rendered salty by upstream flood control, drive out competitors, and spread like chicken pox. They've mostly elbowed the native willows and cottonwoods aside, and laid long-term claim to the Gila.

We slept where sunset found us, generally covering 20 to 25 river miles daily. The floods had left the banks littered with uprooted tamarisks, providing plenty of grist for campfires. We developed a certain languid routine, beaching the canoe on a likely sand dune, spreading our gear, gathering up wood, then watching the last light fade from the river's surface. After wolfing down thin soup, hot dogs, or some other campfire concoction, we would wander down to the river and listen to it mumble secrets in the dark. In the blackness, we could imagine the robed Father Garces lying without a blanket, listening to the murmur of the river, and we could almost sense the Apaches somewhere just out of earshot, listening, like us, to the coyotes.

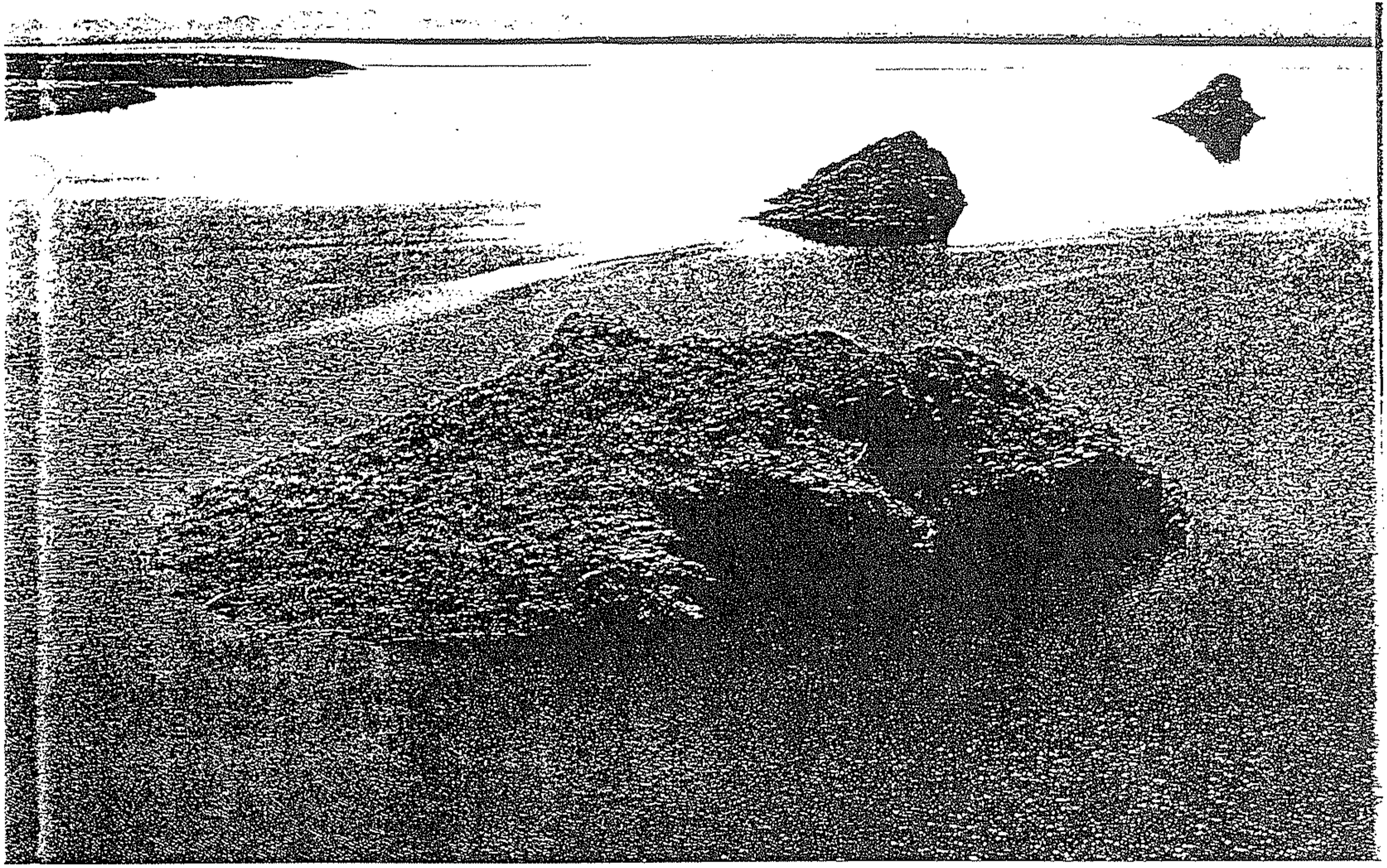
But I didn't come face to face with any ghosts until we wandered off into the tamarisk forest.

It seemed a sensible enough notion at the time.

The river swirled around a bend and entered a narrow pass with rearing black volcanic cliffs on both sides. We decided to hike up to a mesa, hoping to get a glimpse of the river ahead. The base of the cliffs looked to be no more than a quarter-mile from the river's banks.

Dumb idea.

We immediately plunged into a tamarisk



forest, not knowing that the line of trees along the bank extended all the way back to the bottom of the cliff.

Crawling on our hands and knees to get through snarls, we finally reached the base of the cliff, only to find ourselves blocked by a deep, swampy channel filled with fetid water. Turning, we struggled upstream through the undergrowth until we found a place to cross the channel.

"Look at that," Gil said, gesturing through a break in the trees.

I looked up the slope, tumbled with gigantic sun-bronzed boulders. Ancient hands had almost completely covered the surface of a huge boulder with an astonishing assemblage of petroglyphs. The rock contained several enormous hands, a welter of abstract designs, a series of concentric circles, snakes, several seemingly human figures with elongated fingers and enormous sexual organs, several sheeplike animals whose horns curled in the wrong direction, a coyote, and a strange figure that looked like a gigantic ant with antlers. Some of the glyphs appeared relatively fresh, some had nearly faded back to the color of the unmarked rock, suggesting that they could be thousands of years old.

"Wonderful," whispered Gil.

I stared, open-mouthed, for some while before I noticed the initials.

On the uppermost section of the rock, someone had twice etched the initials K.J. To the side, appeared a date. It looked like 1916. But it might have been 1906.

We scrambled up the slope toward the rock, as I calculated the odds. K.J.? Katherine Jennings? A declaration of love, left alongside pleas to the spirits of the bighorns and a lost cosmology?

We reached the base of the rock panel, breathing heavily. Looking upslope, I could see that the rocks along the base of the cliff were covered with petroglyphs.

Then I sat in the sun on a rock and stared out across the Gila River where the Hohokam prayed to forgotten gods; Father Kino sought a treasure in souls; Kearny cursed his ponderous cannon; the Oatmans met their bleak fate; the Butterfield stage outran the Apaches; and two brothers gambled on the next bend of the river.

And all at once, the ghosts thronged about me, whispering my name softly in an unknown tongue.

Afterword: In the end, we duplicated only a small section of my ancestors' journey, partly because of the deadlines and demands of modern life, and partly because of the changes in the river.

We continued on down the river for several days after finding the rock art and the initials carved in stone. The river spreads out once it leaves that canyon, braiding into many small channels. We wandered back and forth across the floodplain, trying to keep to the main channel, but often grounding out and pulling our canoe down shallow inclines. We finally elected to give up the struggle where the road from Dateland crosses the river. We were weary of the shallows — which also exasperated Kearny's column and everyone else who ever tried to move freight up the Gila.

Besides, our brides were waiting back home in Phoenix, not at the end of a long journey toward an unguessed future.

[illegible]

96-003-007

Gila River
08

Salt River at 91st Ave
Jan 1992

8

96-003-008

Gila River

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December 10, 1996

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Jay Brashear, Chair
Earl Eisenhower
Henry Evans
Gail Getzwiller
Cecil Miller
State of Arizona
Navigable Stream Adjudication Commission
1700 West Washington
Phoenix, AZ 85007

Re: Navigability of the Gila River

Dear Messrs. Brashear, Eisenhower, Evans, Miller and Ms. Getzwiller:

This letter is submitted on behalf of ASARCO Incorporated Ray Complex which owns agricultural, mining and other land along the mainstream and tributaries of the Gila River from Hayden to the Mineral Creek confluence. This area is within the area known as the Middle Gila between the San Carlos Reservoir and the Ashurst-Hayden Diversion Dam.

The Commission is instructed by statute that unless the Commission finds clear and convincing evidence to the contrary, a watercourse was non-navigable at the time of statehood if diversions were made from the watercourse to irrigate and reclaim land by persons who made entries under the Desert Land Act of 1877 or any other federal act, or to provide water to lands that are included in a federal reclamation project or Indian reservation, that would have been inconsistent with or impediments to navigation. A.R.S. § 37-1128.D.4.

On June 29, 1935, the Federal District Court for the District of Arizona entered a decree in United States of America v. Gila Valley Irrigation District, Globe Equity 59, confirming and tabulating water rights in the Gila River. It found that valid appropriations for irrigation, industrial, municipal, domestic and related uses with priority dates earlier than 1912 had been made to divert up to 249,746 acre feet annually from locations within the

Middle Gila from below San Carlos Reservoir in Township 18E to the Ashurst-Hayden Diversion Dam. These appropriations were made to provide water to Indian reservations, federal reclamation projects and persons who had made entries under the Desert Land Act and other federal acts.

According to the Arizona Department of Water Resources, Arizona Water Resources Assessment, Vol II (August 1994), the Gila River at Winkleman (just below the San Carlos Reservoir) has a median annual flow of 224,380 acre feet. Table 28 at p. 158. This includes not only natural flow water but water conserved by the San Carlos Reservoir as well as flood waters, which are non-navigable.

Also, the natural flow of the Gila River under natural conditions at the beginning of the Middle Gila reach below the San Carlos Reservoir (without Coolidge Dam) can be closely approximated by adding the natural flow of the Gila above the Reservoir to the natural flow entering the Gila below the Reservoir. This can also be done by reference to the tables in DWR's report referenced above. The natural flow above San Carlos Reservoir consists of the sum of the flow of the Gila River at Calva, 140,060 acre feet median annual flow, and the flow of the San Carlos River at Peridot, 24,540 acre feet per year median annual flow. Table 27, p. 155. The median annual flow of the San Pedro River at Winkleman is reported as 22,180 acre feet. Table 28, p. 158. These three flows total 186,780 acre feet per year and approximate the natural conditions flow of the Gila River at Kelvin upstream of the Middle Gila reach diversions. This figure also includes flood waters, which are non-navigable.

Therefore, the finding by the District Court that valid appropriations of the Middle Gila River made prior to 1912 totaled 249,746 acre feet, and the fact that that amount exceeds the normal flow of the Middle Gila River under natural conditions conclusively demonstrates that appropriations had been made that were inconsistent with and impediments to navigation at the time of statehood.

Accordingly, the Commission should find the Gila River non-navigable as of February 14, 1912, at least from the San Carlos Reservoir to the Ashurst-Hayden Diversion Dam.

Very truly yours,

James W. Johnson

James W. Johnson

JWJ/clj

Arizona

Water Resources Assessment

Volume II

Hydrologic Summary

August 1994

Hydrology Division

Arizona Department of Water Resources

TABLE 27

ANNUAL FLOWS FOR SELECTED USGS STREAMGAGING STATIONS IN THE UPPER GILA RIVER WATERSHED
(SOUTHEASTERN ARIZONA PLANNING AREA)

Station Name	Station Number	Period of Record	Mean Annual Flow (ac-ft)	Median Annual Flow (ac-ft)	Record Annual High Flow (ac-ft)	Record Annual Low Flow (ac-ft)
Gila River near Clifton	9442000	1912-1917 1929-1933 1936-1946 1949-1989	149,100	112,190	673,130	31,120
Blue River near Clifton	9444200	1969-1990	54,290	28,810	175,880	7,240
San Francisco River at Clifton	9444500	1914-1915, 1917 1928-1933 1936-1990	154,170	93,730	678,200	30,400
Eagle Creek above pumping plant near Morenci	9447000	1945-1990	41,260	26,640	172,990	12,300
Bonita Creek near Morenci	9447800	1982-1990	6,730	4,970	15,920	2,970
San Simon River near Solomon	9457000	1932, 1936-1982	8,690	6,400	27,500	1,010
Deadman Creek near Safford	9458200	1968-1976 1987 1989-1990	940	570	2,680	80
Gila River at head of Safford Valley near Solomon	9458500	1941-1946 1957-1965	205,560	126,670	810,660	62,970
Gila River at Calva	9466500	1930-1990	233,790	140,060	1,100,180	20,990
San Carlos River near Peridot	9468500	1930-1990	39,810	24,540	201,220	5,940

Source: U.S. Geological Survey, 1992, National Water Information System

TABLE 28

ANNUAL FLOWS FOR USGS STREAMGAGING STATIONS IN THE MIDDLE GILA RIVER WATERSHED (SOUTHEASTERN ARIZONA PLANNING AREA)

Station Name	Station Number	Period of Record	Mean Annual Flow (ac-ft)	Median Annual Flow (ac-ft)	Record Annual High Flow (ac-ft)	Record Annual Low Flow (ac-ft)
Gila River at Winkelman	9470000	1942-1980 1985-1990	239,580	224,380	810,660	39,090
San Pedro River at Winkelman	9473500	1967-1978	31,850	22,180	75,280	9,410
San Pedro River at Palominas	9470500	1931-1933 1936-1940 1951-1981	23,160	16,940	67,310	5,140
San Pedro River at Charleston	9471000	1905, 1913-1926 1929-1933 1936-1990	42,700	34,160	149,100	9,410
San Pedro River near Tombstone	9471550	1968-1986	40,530	29,970	113,640	9,430
San Pedro River near Benson	9471800	1967-1976	23,160	19,900	44,150	10,860
San Pedro River near Redington	9472000	1944-1947 1951-1990	32,570	20,410	129,560	2,240
Aravaipa Creek near Mammoth	9473000	1932-1940, 1942 1967-1990	23,890	28,880	101,330	6,950
Gila River at Kelvin	9474000	1912-1990	356,830	324,260	2,243,780	56,460
Gila River below Coolidge Dam	9469500	1901, 1904 1916-1990	251,160	223,650	1,346,270	16,650

Source: U.S. Geological Survey, 1992, National Water Information System

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96-003-009

ORIGINAL

RECEIVED 6-10-96

Gila River

Central Arizona Paddlers Club Boating Survey of Arizona Rivers 1992

(Approximately 20% of our membership responded to the survey.)

River	Segments our members have boated
Salt	K&M Mine to Hwy. 60
	Alma School Rd. to Mill Ave. (Mesa/Tempe)
	Hwy. 60 to Roosevelt Lake
	Granite Reef to McKellips Rd. (Past Tri-City Landfill)
	Saguaro Lake to Granite Reef (Tuber's Run)
	Hwy. 60 Bridge to Hwy. 288 Bridge (Bridge to Bridge)
	Upper Salt
	Lower Salt
	Horseshoe Bend
	100% of Salt River including normally dry & lakes
	All Sections
	Country Club Rd. to 35th Ave.
	Source to Phoenix
	Granite Reef to Gilbert Road
	Lower Salt through town
	Upper, Middle, Lower, and In Town
Verde	Perkinsville to Clarkdale
	Camp Verde to Childs
	Beasley Flats to Childs
	Childs to Horseshoe Lake
	Rio Verde to Salt River
	Camp Verde to Sheep Bridge
	Needle Rock to Beeline Hwy.
	Lower Verde
	Upper Verde
	Camp Verde to Beasley
	Needle Rock to Salt River
	Horseshoe Lake to Salt
	All of Verde from Camp Verde down
	All Sections
	Camp Verde to Horseshoe Lake
	Clarkdale to Horseshoe Lake
	Between Horseshoe and Bartlett and below Bartlett
East Verde	Doll Baby to Verde to Horseshoe Lake
San Pedro	Palominas to Hereford Rd.

Agua Fria	Black Canyon/New River Area Black Canyon City to above Lake Pleasant
Gila	Gila Box 115 Ave. in Phoenix to Estrella Parkway 91st Ave. in Phoenix (Salt River) to Estrella Mineral Springs to Ashurst Hayden Dam Old Bridge (near Clifton) to Safford (Gila Box) Confluence of San Francisco to Safford San Carlos Dam to Ashurst Hayden Dam 10 miles above Winkelman to Winkelman Most of the Gila (dry parts too) through Arizona Winkelman to Ashurst Hayden Dam Winkelman to Kearny Gillespie Dam to Painted Rock Dam Below San Carlos Dam Clifton to Solomon, Arizona (Gila Box) Clifton to Safford Christmas to Winkelman
San Francisco	New Mexico to Clifton Clifton to Confluence of Gila
Colorado	Lee's Ferry to Phantom Ranch Diamond Creek to Pierce's Ferry Lee's Ferry to Pierce's Ferry Grand Canyon Below Hoover Dam Through Topock Canyon Hoover Dam to Yuma Parker to Lake Havasu Topock to Lake Havasu Below Hoover Dam (Black Canyon) Parker Dam to Martinez Lake Glen Canyon to Lee's Ferry All Sections
Little Colorado	
Blue	
Black	Bonita Creek to Black River Crossing Point of Pines to Salt River Source to Salt

White	Indian Reservation to K&M Mine Road White River Crossing to Salt River
Sycamore Creek	Hwy. 87 Bridge to Sugarloaf Mountain
Tonto Creek	Gisela to south of Jake's Corner Rye Creek to Roosevelt Lake Gisela to SRP Gauge Gisela to Roosevelt Tonto -Box Rye Creek to Jake's Corner
Bonita Creek	Tonto Creek to Black River
Cherry Creek	
Fish Creek	
Burro Creek	
Indian Bend Wash	

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ORIGINAL RECEIVED 2-18-97 ORIGINAL 96-003-010 GILA RIVER

ORIGINAL TESTIMONY RELEVANT TO ALL WATERCOURSES

Presented by Arizona Center for Law in the Public Interest

96 - 000 - 002
Non-Specific
Evidence

to the

Arizona Navigable Stream Adjudication Commission

February 18, 1997

The Arizona Center for Law in the Public Interest offers the following testimony relevant to all findings and recommendations of the Commission on whether watercourses were navigable as of statehood. We made many of these points in preliminary testimony to the Commission on February 6, 1996.

As amended, the state statute governing Commission proceedings contains grossly illegal and inaccurate standards for the determination of navigability and non-navigability. Federal law, as developed by the federal courts, sets the test for determining title to the beds of watercourses. Arizona Center for Law v. Hassell, 837 P.2d 158, 164-65 (Ariz. App. 1991). That test is a liberal one: Whether the waterway was at statehood susceptible for use as a highway for transporting people or goods. Utah v. United States, 403 U.S. 9, 11 (1971). A river may be found navigable for title purposes despite occasional impediments such as sand or gravel bars, and despite the fact that it is only navigable a few months out of the year. State of Oregon v. Riverfront Protective Association, 672 F.2d 792, 795 (9th Cir. 1982). Actual use for boating, whether commercial or sporting, can demonstrate susceptibility as a highway for public passage. Utah v. United States, 403 U.S. at 11. Although state ownership turns on navigability at the time of statehood, evidence of current recreational use by small craft such as canoes is probative of navigability at statehood. North Dakota v. Andrus, 671 F.2d 271, 277-78 (8th Cir. 1982).

The remoteness of a river and lack of actual use at statehood does not defeat a finding of navigability: The question is whether the river was susceptible of transporting people or goods. United States v. Utah, 283 U.S. 64, 83 (1931). A river is deemed navigable if it could transport people or goods by any conveyance - not merely those in use at the time of statehood. State of Alaska v. Ahtna, Inc. 891 F.2d 1401, 1405 (9th Cir. 1989). In fact, present-day use of a river for guided recreational trips can provide conclusive evidence of navigability at statehood. Id. at 1405. Conversely, the fact that dams or diversions render a waterway non-navigable today does not matter, as long as it was passable in its original condition. See Frank, Forever Free, 16 U.C. Davis L. Rev. 579, 586 (1983).

Under the standards set forth above, the Arizona Court of Appeals concluded in 1991 that there was substantial evidence from which a factfinder might conclude that portions of rivers and streams other than the Colorado met the applicable standard of navigability at the time Arizona became a state. Hassell, 837 P.2d at 165. In reaching that conclusion, the Court had before it much of the same evidence that is now before this Commission. If anything, the Commission has before it even more substantial evidence of navigability than was before the Court, due to extensive studies conducted by the State Land Department since the Court's decision, and other evidence offered by various parties.

Unfortunately, the Legislature has tried to restrict this Commission's ability to find watercourses navigable by imposing a number of tests and presumptions that are flatly contrary to the federal test of navigability. These include the following:

1. A presumption that the entire watercourse was nonnavigable if any determination of nonnavigability in a public proceeding exists for the watercourse or a portion thereof. ARS §37-1128.B. The presumption can be overcome only by "clear and convincing evidence." There is absolutely no such presumption under the Federal test, and the presumption is absurd on its face. The mere fact that a "public proceeding" took place does not mean that the state's title claims were properly adjudicated (or even represented). Moreover, the state does not have the authority to relinquish its public trust ownership where the watercourse was in fact navigable at statehood. Illinois Central RR v. Illinois, 146 U.S. 387 (1892). Further, the mere fact that a small reach of a river was found nonnavigable hardly means that another reach (which could be hundreds of miles away) is presumptively non-navigable. It is also violative of the public trust doctrine for the state to place a higher burden of proof on itself to show navigability than applies in an order civil case.

2. A requirement that the Commission must find and recommend a watercourse was nonnavigable, if as of statehood it either was not used or susceptible of being used for both commercial trade and travel; or flowed only in direct response to precipitation and was dry at all other times. ARS 37-1128.C. There are absolutely no such restrictions on finding navigability under the federal test. As noted above, the federal test merely requires susceptibility for use as a highway for the transportation of people or goods. There is no requirement that such transportation be "commercial." Nor does the federal test in any way prohibit a finding of navigability where a watercourse flows "only in direct response to precipitation." The issue under the federal test is susceptibility for use for transportation -- if that susceptibility is due to rain events, then the test is met.

3. A presumption of non-navigability, defeatable only by clear and convincing evidence, if any of the following applied: i)

no sustained trade and travel occurred both upstream and downstream in the watercourse; ii) no profitable commercial enterprise was conducted; iii) vessels customarily used for commerce in 1912, such as keelboats, steamboats or powered barges, were not used on the watercourse; iv) diversions were made from the watercourse for various purposes that would have been inconsistent with or impediments to navigation; v) any boating or fishing was for recreational and not commercial purposes; vi) any flotation of logs or other material that occurred or was possible on the watercourse was not for commercial purposes; vii) there were structures constructed in or across the watercourse that would have inconsistent with or impediments to navigation; viii) transportation in proximity to the watercourse was customarily accomplished by methods other than by boat; ix) the United States did not regulate the watercourse under the rivers and harbors act of 1899. ARS §37-1128.D.

None of the above create any sort of presumption of non-navigability under the federal test, let alone the kind of presumption against navigability imposed by ARS 37-1128.D. As the above discussion of the federal test shows, the federal test does not require evidence of actual use for travel **at all**, let alone commercial use by large vessels of the period. Moreover, the federal test looks to the watercourse's **ordinary and natural** condition - not its condition when altered by human activity. The fact that floating of logs, boating, and fishing occurred is probative of **navigability** under the federal test: it does not become evidence of **non**-navigability merely because it was not commercial. Nor does the federal test create any presumption of non-navigability merely because a rivers was not regulated under the rivers and harbors act, or because travel near the watercourse was customarily done other than by boat. The test is susceptibility for use in travel, not whether the watercourse was regulated under other laws or whether boats were the preferred mode of travel.

4. A bar on consideration of: a) previously appropriated water as being within the ordinary and natural condition; b) use of ferries; c) fishing from the banks; d) use under flood conditions. ARS §37-1128.E. There is absolutely nothing in the federal test that allows these types of exclusions. Federal law looks to whether the watercourse was navigable in fact - it does not impose artificial restrictions on what can be considered in making that determination. For example, federal courts have explicitly relied on ferry travel as evidence of navigability. City of Centralia v. FERC, 851 F.2d 278 (9th Cir. 1988). They also routinely consider evidence of actual boating and fishing use, and do not bar such evidence based on the conditions or location of use.

5. A requirement to considers dams and diversions and other human uses as part of the ordinary and natural condition of the watercourse. Such a requirements is not a part of the federal test, and conflicts with the plain meaning of the word "natural."

For all the foregoing reasons, any determination of non-navigability by this Commission under the tests set out in ARS §37-1128 will have no legal validity or persuasive value in establishing ownership of streambeds. Accordingly, we urge the Commission to: a) suspend further proceedings to determine navigability or non-navigability of watercourse; b) refrain from making any findings or recommendations on navigability or non-navigability; and c) advise the legislature that there is no point in conducting further proceedings or making findings and recommendations unless and until the standards for determining navigability in ARS 37-1128 are changed to accurately reflect federal law.

DATED this 18th day of February, 1997.

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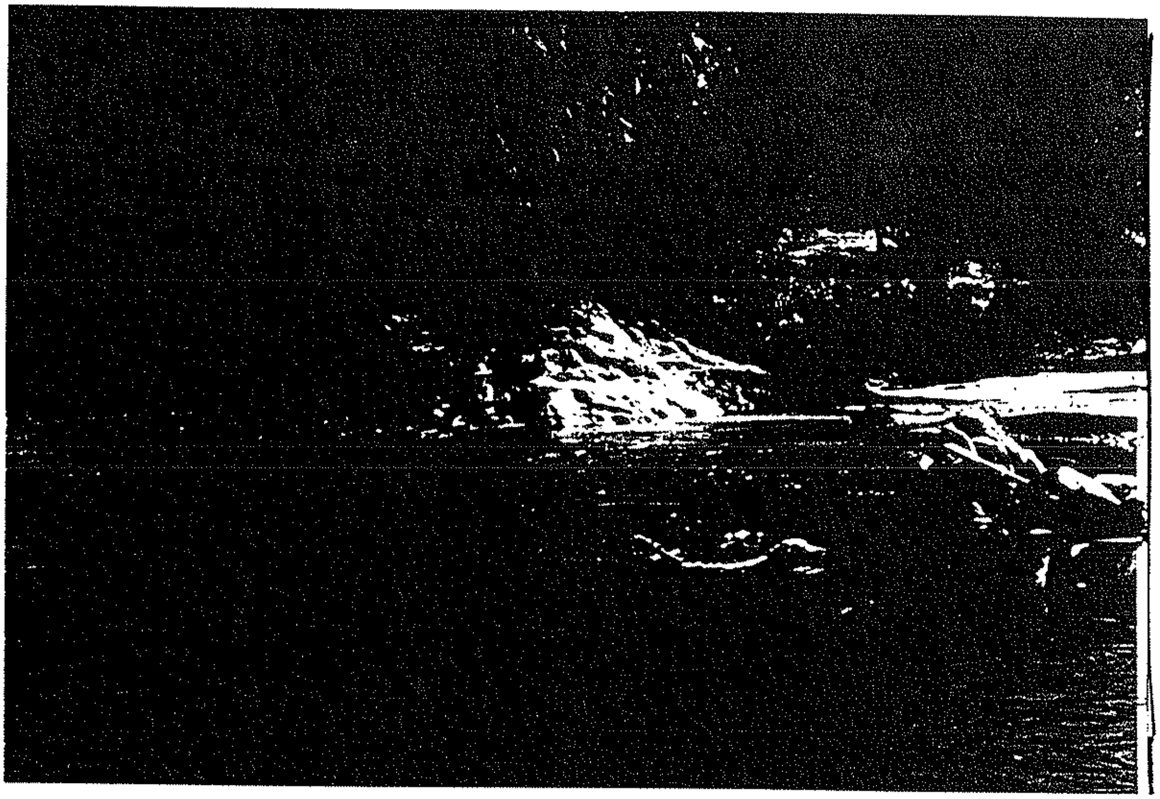
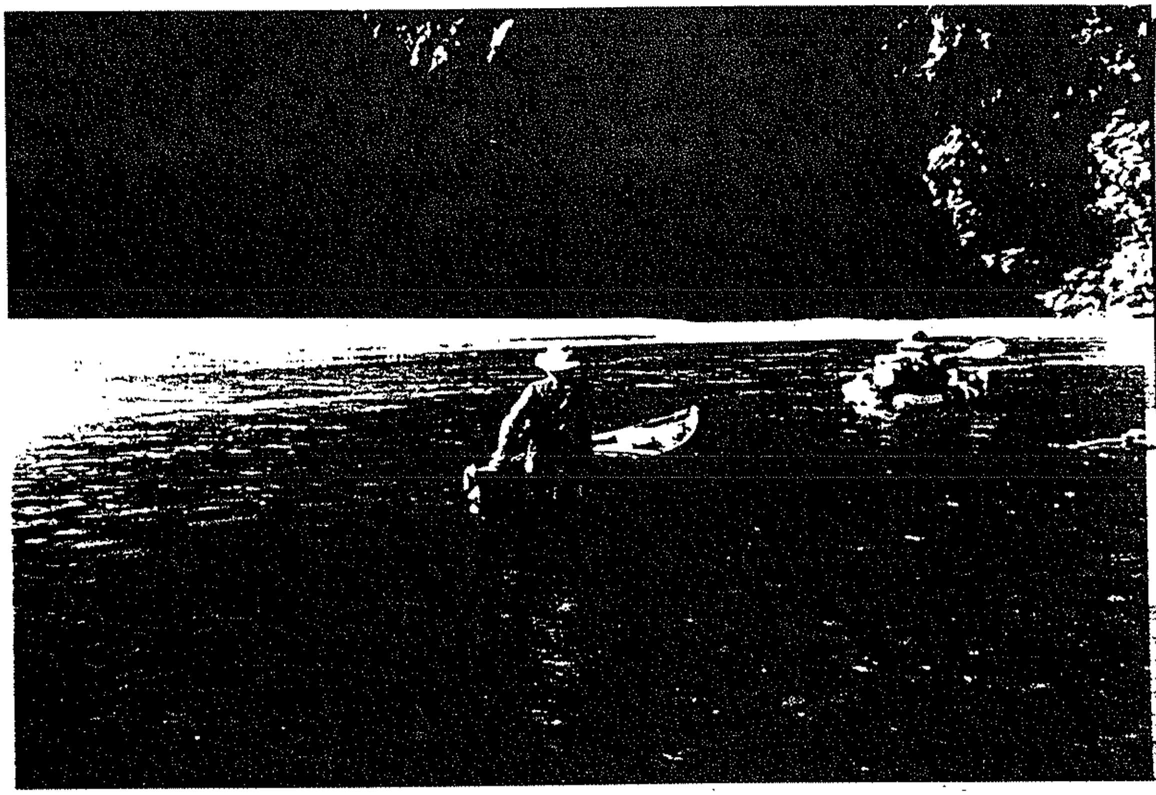


(1) Juncture of San Francisco & Gila Rivers. April Trip down Gila Box. ~~A~~pprox 350 CFS at old Safford Bridge

Jim Slingluff
Estimated 1992



(2) Junction of San Francisco & Gila Rivers. April Trip Down Gila Box. Approx 350 cfs at Old Safford Bridge

96-003-011
Gila River
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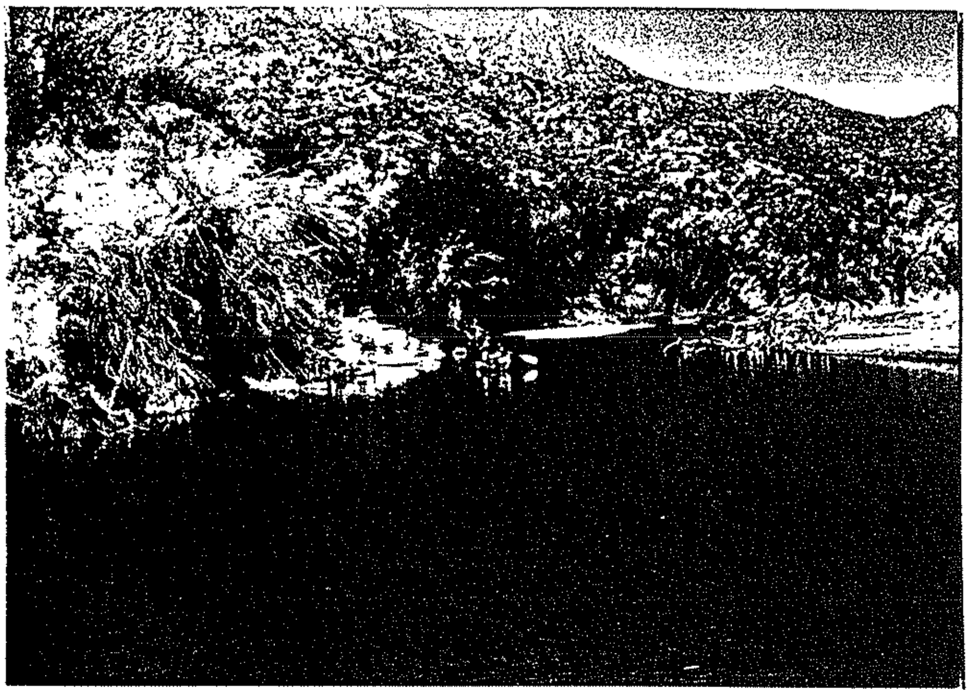
Jim Slingluff
Estimate 1994



③ ThanksGiving Holiday Duck Hunting
TRIP. Gila River ~~R~~ ABOUT
3 RIVER miles ABOVE Winkleman.
At Time of Picture no water
was Being ReLEASED FROM
Coolidge Dam, so All water is
Spring or Ground water, Estimated
CFS is Between 100 & 200
Estimate 1995 Jim Slingluff

96-003-011
Gila River
003

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Forever Free: Navigability, Inland Waterways, and the Expanding Public Interest

BY RICHARD M. FRANK*

First part is mostly Federal

Recent decisions have expanded public rights in waterways to include rights in secondary lakes and rivers once thought to be private. Federal courts have broadened these rights by more liberal interpretation of the "navigability" test traditionally used to determine the scope of the public interest in waterways. California courts have expanded public rights on a different theory, based on the public trust doctrine and the public right of recreational boating. This article concludes that these federal and state decisions are not inconsistent, but provide alternative avenues for protection of the public interest in waterways, including protection of allied ecological and recreational values.

[A]ll the navigable waters within the said State shall be common highways, and forever free . . . . — Act for the Admission of California into the Union.[1]

INTRODUCTION

America's inland lakes and rivers have played a vital role in the nation's exploration, settlement, and continuing prosperity. In the eighteenth and nineteenth centuries, they served as arteries that made possible the country's westward migration. Waterways provided both transportation and sustenance to explorers and trappers, the first arrivals on the American frontier. Later they served as a principal means of establishing permanent settlements, obtaining necessary commodities

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[1] Act of Sept. 9, 1850, ch. 50, 9 Stat. 452, 453.

from eastern cities, and transporting crops and other products to market.

Under these circumstances, our legal system quickly bestowed special status upon this precious natural resource. A society which from its inception cherished the concept of private property rights nevertheless embraced the view that the country's major waterways are open to all and incapable of private ownership, control, or alienation.

This principle is ingrained in American jurisprudence. The original Massachusetts Declaration of Fundamental Liberties of 1641, for example, declared open public access to and use of the great ponds of Massachusetts.[2] The 1787 Northwest Ordinance, which provided for admission of most of the midwestern states and which was the basis for California's Act of Admission, provided that "navigable waters leading into the Mississippi and St. Lawrence, and the carrying places between the same, shall be common highways, and forever free . . . ."[3] Early appellate decisions reflected this view[4] as courts vigorously defended the public's right of access to navigable waters. For example, in an 1862 decision, the Pennsylvania Supreme Court observed: "There is no natural right of the citizen, except the personal rights of life and liberty, which is paramount to his right to navigate freely the navigable streams of the country he inhabits."[5]

California's extensive system of inland waterways facilitated the Gold Rush and determined the subsequent settlement patterns in the nineteenth century. It is therefore not surprising that the same concern for public rights of navigation quickly became rooted in California's Constitution,[6] statutes,[7] and common law.[8]

In recent years, America's lakes and rivers have assumed a somewhat different but no less vital role. Particularly in the west, the importance of many of these waterways for commercial purposes has diminished as modern technology has created new and more efficient means of transporting people and goods. At the same time, population growth, accelerating urbanization, diminishing open space, and concomitant pres-

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[2] *See* Inhabitants of W. Roxbury v. Stoddard, 89 Mass. 158, 166-67, 171 (1863).

[3] Act of Aug. 7, 1789, ch. 8, 1 Stat. 50, 52.

[4] *See, e.g.*, Wright v. Seymour, 69 Cal. 122, 10 P. 323 (1886); Moore v. Sanborne, 7 Mich. 422 (1853); Lamprey v. Metcalf, 52 Minn. 181, 53 N.W. 1139 (1893); Olson v. Merrill, 42 Wis. 203 (1877).

[5] Flanagan v. City of Philadelphia, 42 Pa. 219, 228 (1862).

[6] CAL. CONST. art. X, § 4 (formerly CAL. CONST. art. XV, § 2).

[7] *See, e.g.*, CAL. CIV. CODE § 3749 (West 1970); CAL. HARB. & NAV. CODE § 131 (West 1978); CAL. PENAL CODE § 370 (West 1970).

[8] *See, e.g.*, People v. Gold Run Ditch & Mining Co., 66 Cal. 138, 4 P. 1152 (1884).

sures for expanded recreational opportunities have all combined to create new demands upon waterways. The capacity of these resources to serve as recreational and ecological havens has been recognized by both the legal[9] and scientific[10] communities. As a result, the pressures on our legal system to preserve longstanding public rights to navigable waters continue unabated.

The threshold problem in this controversy is determining which waterways are significant enough to warrant this special legal status. Traditionally stated, which lakes and rivers are "navigable" and therefore open to public access? Until recently, answers to these questions were found by reference to a few court decisions. In the past few years, however, numerous cases have built upon these earlier precedents and broadened traditional notions of "navigability."[11] As a result, the number and type of waterways subject to preeminent public rights of navigation are expanding dramatically. This expansion establishes the public's right of access to waterways once thought to be private and challenges longstanding concepts of private property rights.

These recent developments are taking place concurrently in both the federal and state courts. The analytical means adopted by each judicial system to achieve that end, however, differ substantially.[12]

This article will review these parallel developments in the law of navigability. Section I briefly summarizes the traditional rules of navigability that have evolved over the past century. Section II analyzes recent federal decisions amplifying upon and liberalizing the federal law of navigability. Section III discusses two lines of state court cases, one focusing on the public trust doctrine and the other on public rights

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[9] *See, e.g.*, Marks v. Whitney, 6 Cal. 3d 251, 259-60, 491 P.2d 374, 380-81, 98 Cal. Rptr. 790, 796-97 (1970); People *ex rel.* Baker v. Mack, 19 Cal. App. 3d 1040, 1045, 1050, 97 Cal. Rptr. 448, 451, 454 (3d Dist. 1971); GOVERNOR'S COMMISSION TO REVIEW CALIFORNIA WATER RIGHTS LAW, *Legal Aspects of Instream Use* (1978).

[10] Perhaps one of the most definitive and widely publicized works documenting the environmental values of wetlands is *Our Nation's Wetlands*, published in 1978 by the President's Council on Environmental Quality. Lake Tahoe is a prominent example of an inland waterway with inestimable recreational and ecological values that faces clear and present environmental dangers. Both the resources of Lake Tahoe and the causes of their decline have been extensively documented. *See, e.g.*, TAHOE REGIONAL PLANNING AGENCY, TOWARD A SHORE-ZONE PLAN FOR LAKE TAHOE (1972); U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND TAHOE REGIONAL PLANNING AGENCY, FISHERIES OF LAKE TAHOE AND ITS TRIBUTARY WATERS: A GUIDE FOR PLANNING (1971); CALIFORNIA TAHOE REGIONAL PLANNING AGENCY, REGIONAL PLAN (1980).

[11] *See* sections II-IV *infra*.

[12] *See* sections II-III *infra*.

of navigation to minor waterways, and how they are coalescing to create a California rule that may be greater than the sum of its parts. Finally, Section IV contrasts federal and state approaches and offers some suggestions regarding their future utility and viability.

I. Rules Of The Game: The Schizoid Nature Of The Law Of Navigability

> The legal concept of navigability embraces both public and private interests. It is not to be determined by a formula which fits every type of stream under all circumstances at all times.[13]

Any discussion of the law of navigability necessarily begins with the recognition that the concept is a slippery one, capable of multiple interpretations and definitions. To appreciate this schizoid nature of the law of navigability, one need venture no further than the decisions of the United States Supreme Court.[14] Even a cursory examination of these cases shows that they address such wide ranging subjects as title to the beds of waterways,[15] the scope of federal power under the commerce clause of the United States Constitution,[16] riparian water rights,[17] and

[13] United States v. Appalachian Elec. Power Co., 311 U.S. 377, 404 (1940).

[14] Utah v. United States, 403 U.S. 9 (1971) (title to bed of lake); United States v. Appalachian Elec. Power Co., 311 U.S. 377 (1940) (applicability of Federal Power Act of 1920 and commerce clause); United States v. Oregon, 295 U.S. 1 (1935) (title to bed of lake); United States v. Utah, 283 U.S. 64 (1931) (title to beds of several streams); United States v. Holt State Bank, 270 U.S. 49 (1926) (title to bed of lake); Brewer-Elliott Oil & Gas Co. v. United States, 260 U.S. 77 (1922) (title to bed of river); Oklahoma v. Texas, 258 U.S. 574 (1922) (title to bed of river); Economy Light & Power Co. v. United States, 256 U.S. 113 (1921) (applicability of Rivers and Harbors Act of 1899); United States v. Cress, 243 U.S. 316 (1917) (compensability of property rights taken under navigation servitude); Donnelly v. United States, 228 U.S. 243 (1913), *modified at* 228 U.S. 708 (1913) (navigability for purposes of determining appropriate jurisdiction for criminal prosecution); Leovy v. United States, 177 U.S. 621 (1900) (applicability of 1890 act of Congress dealing with obstructions in navigable waters); United States v. Rio Grande Dam & Irrigation Co., 174 U.S. 690 (1899) (applicability of 1890 act of Congress dealing with obstructions in navigable waters); St. Anthony Falls Water Power Co. v. St. Paul Water Comm'rs, 168 U.S. 349 (1897) (riparian rights under Minnesota law); Egan v. Hart, 165 U.S. 188 (1897) (power of state to construct dam across allegedly navigable stream); Packer v. Bird, 137 U.S. 661 (1891) (title to bed of stream); The Montello, 87 U.S. (20 Wall.) 430 (1874) (admiralty jurisdiction); The Daniel Ball, 77 U.S. (10 Wall.) 557 (1870) (admiralty jurisdiction).

[15] *See* section I(A) *infra*.

[16] *See* section I(B) *infra*.

[17] St. Anthony Falls Water Power Co. v. St. Paul Water Comm'rs, 168 U.S. 349 (1897).

admiralty law.[18]

For purposes of this article, navigability is significant in three principal contexts.[19] The first is the standard by which title to the beds of lakes and rivers is established (the federal title test). The second is the standard of navigability used to establish federal regulatory jurisdiction under the commerce clause. Finally, navigability is a term embraced by various state court systems to define the scope of, for example, public rights of passage and recreational use. These distinct principles of navigability are briefly discussed below.

A. *Federal Title Test*

The ownership of land under navigable waters is a fundamental incident of state sovereignty.[20] Prior to the admission of the several states, the federal government held these lands in trust for the benefit of those states and their citizens. The beds of these navigable waterways automatically vested in the respective states as they entered the Union and assumed sovereignty on an "equal footing" with the original thirteen states.[21] Once a state enters the Union, its power over the beds of navigable waters is subject to a single limitation, the paramount authority of the United States to ensure that such waters remain free to interstate and foreign commerce.[22] Determining which waterways are "naviga-

[18] The Montello, 87 U.S. (20 Wall.) 430 (1874).

[19] A comprehensive survey of all facets and legal interpretations of navigability is beyond the scope of this article. *See generally* Johnson & Austin, *Recreational Rights and Title to Beds of Western Lakes and Streams*, 7 NAT. RESOURCES J. 1 (1967); MacGrady, *The Navigability Concept in the Civil and Common Law: Historical Development, Current Importance, and Some Doctrines That Don't Hold Water*, 3 FLA. ST. U.L. REV. 511 (1975).

[20] Martin v. Waddell, 41 U.S. (16 Pet.) 367 (1842). In *Martin*, a colonial grant of New Jersey tidelands was construed as being for the benefit of the citizenry at large:

> For when the Revolution took place, the people of each state became themselves sovereign; and in that character hold the absolute right to all their navigable waters and the soils under them for their own common use, subject only to the rights since surrendered by the Consitution to the general government.

Id. at 410.

[21] Montana v. United States, 450 U.S. 544, 551-52 (1981), *reh'g denied*, 452 U.S. 911 (1981); Oregon v. Corvallis Sand & Gravel Co., 429 U.S. 363, 375-81 (1977). Under the equal footing doctrine, the new states "have the same rights, sovereignty and jurisdiction . . . as the original states possess within their respective borders." Mumford v. Wardell, 73 U.S. (6 Wall.) 423, 436 (1867). These rights include ownership of the lands underlying the navigable waters within the state's boundaries. Pollard's Lessee v. Hagan, 44 U.S. (3 How.) 212, 229 (1845).

[22] Montana v. United States, 450 U.S. 544, 551 (1981); United States v. Oregon,

ble" for purposes of this title test is indisputably a matter of federal rather than state law.[23] Nonetheless, state courts have concurrent jurisdiction to apply the federal test in disputes over title to navigable waters.[24]

The criteria embodied in the federal title test were originally articulated by the Supreme Court over a century ago in *The Daniel Ball*:

> Those rivers must be regarded as public navigable rivers in law which are navigable in fact. And they are navigable in fact when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water.[25]

Over a century later, that statement remains the most oft-quoted articulation of the rule. Ironically, *The Daniel Ball* did not involve the issue of title to the bed of inland waterways; it concerned the parameters of admiralty jurisdiction. Yet the seven subsequent Supreme Court cases that dealt directly with "navigability for title" adopted the *Daniel Ball* definition as the basic federal test for identifying submerged beds to which the state holds title.[26]

The Supreme Court expanded upon the *Daniel Ball* rule in *United States v. Holt State Bank*,[27] stating that "navigability does not depend on the particular mode in which such use is or may be had . . . nor on an absence of occasional difficulties in navigation, but on the fact, . . . that the stream in its natural and ordinary condition affords a channel for useful commerce."[28]

The federal test of navigability for title purposes can be distilled into

295 U.S. 1, 14 (1935).

[23] United States v. Utah, 283 U.S. 64, 75 (1931); United States v. Holt State Bank, 270 U.S. 49, 55-56 (1926). Significantly, this was not considered the rule in the 19th century. Early decisions took the view that the question of title to the beds and shores of navigable waters was one purely of state law. *See, e.g.*, Railroad Co. v. Schurmeir, 74 U.S. (7 Wall.) 272 (1868).

[24] State *ex rel.* Burnquist v. Bollenbach, 241 Minn. 103, 63 N.W.2d 278 (1954); State v. Bunkowski, 88 Nev. 623, 632, 503 P.2d 1231, 1236 (1972). In California, the Attorney General has occasionally been called upon to give advisory opinions on the matter. *See, e.g.*, 55 Op. Cal. Att'y Gen. 293 (1972) (Tuolumne River); 36 Op. Cal. Att'y Gen. 20 (1960) (Salton Sea).

[25] 77 U.S. (10 Wall.) 557, 563 (1870).

[26] Utah v. United States, 403 U.S. 9 (1971); United States v. Oregon, 295 U.S. 1 (1935); United States v. Utah, 283 U.S. 64 (1931); United States v. Holt State Bank, 270 U.S. 49 (1926); Brewer-Elliott Oil & Gas Co. v. United States, 260 U.S. 77 (1922); Oklahoma v. Texas, 258 U.S. 574 (1922); and, arguably, Packer v. Bird, 137 U.S. 661 (1891).

[27] 270 U.S. 49 (1926).

[28] *Id.* at 56.

seven distinct elements:

1. Navigability Is a Question of Fact

Navigability is to be determined by reviewing the applicable facts in each case.[29] Accordingly, analogies to other waterways or a legislative declaration regarding navigability are neither controlling nor particularly helpful.[30]

2. Susceptibility for Navigation

Although actual use of a river or lake is relevant to the determination of whether a particular waterway is navigable, such evidence is not essential.[31] The rationale underlying this principle is obvious: many waterways are located in regions, particularly the American West, which were sparsely populated at the time of statehood. Navigabililty depends on the waterway's natural features, not on actual historical use, which is often determined by population trends.[32]

3. The Waterway Must be Susceptible to Navigation as a Highway

[29] The Daniel Ball, 77 U.S. (10 Wall.) 557, 563 (1870).

[30] United States v. Utah, 283 U.S. 64, 75 (1931) (Utah statute declaring rivers navigable not determinative in federal litigation over title to beds of waterways); Newcomb v. City of Newport Beach, 7 Cal. 2d 393, 399, 60 P.2d 825, 828 (1936) (fact that Newport Bay not declared navigable by Legislature until 1909 does not mean that it was not navigable in fact before that date).

[31] The Montello, 87 U.S. (20 Wall.) 430, 441 (1874); The Daniel Ball, 77 U.S. (10 Wall.) 557, 563 (1870).

[32] The Supreme Court stressed this point in United States v. Utah, 283 U.S. 64 (1931), when it rejected the argument posed by the federal government that evidence of actual past use is required:

> In view of past conditions, the Government urges that the consideration of future commerce is too speculative to be entertained. Rather it is true that, as the title of a State depends upon the issue, the possibilities for growth and future profitable use are not to be ignored. *Utah*, with its equality of right as a State of the Union, *is not to be denied title* to the beds of such of its rivers as were navigable in fact at the time of the admission of the State either *because the location* of the rivers and the circumstances of the exploration and settlement of the country through which they flowed *had made recourse to navigation a late adventure, or because commercial utilization on a large scale awaits future demands. The question remains one of fact as to the capacity of the rivers in their ordinary condition to meet the needs of commerce as these may arise in connection with the growth of the population, the multiplication of activities and the developments of natural resources. And this capacity may be shown by physical characteristics and experimentation* as well as by the uses to which the streams have been put.

for Public Passage

Several early cases held that a waterway must be susceptible to navigation for commerce.[33] Recent decisions have simply required a waterway's use as a highway for transporting people or goods.[34] The fact that the body of water is wholly within one state or is geographically isolated does not adversely affect navigability for title purposes. Moreover, actual private, recreational, or experimental use can demonstrate susceptibility as a highway for public passage or even for commerce.[35]

4. A Waterway Must be Navigable in its "Natural and Ordinary Condition"

In determining navigability for title purposes, the court must determine a waterway's capacity for navigation in its natural and ordinary condition.[36] Thus, artificial changes such as dams and fills should be ignored.[37]

5. Navigability is Established at the Time of Statehood

Navigability for title purposes is determined as of the date the particular state was admitted to the Union.[38] Thus, substantial historical investigation is often necessary. However, post-statehood history is relevant to the inquiry if the waterway retains its natural or near natural condition.[39] Conversely, intervening events that render a waterway non-navigable do not make it non-navigable in law if it was susceptible of trade and travel in its original condition.[40]

6. Navigability Need Not be Continuous

A particular waterway may be navigable for title purposes despite occasional impediments such as sand or gravel bars, riffles, or occasional log jams.[41] Nor is it determinative that a lake or river is not

Id. at 83 (emphasis added). *See also* United States v. Appalachian Elec. Power Co., 311 U.S. 377, 405-10 (1940); The Montello, 87 U.S. (20 Wall.) 430, 441 (1874).

[33] *See, e.g.*, Packer v. Bird, 137 U.S. 661, 667 (1891); The Daniel Ball, 77 U.S. (10 Wall.) 557, 563 (1870).

[34] Utah v. United States, 403 U.S. 9, 11 (1971).

[35] *Id.*; United States v. Utah, 283 U.S. 64, 83 (1931).

[36] United States v. Holt State Bank, 270 U.S. 49, 56 (1926).

[37] *Id.*; United States v. Utah, 283 U.S. 64, 75-79 (1931).

[38] Utah v. United States, 403 U.S. 9, 9-10 (1971). California, for example, became a state on Sept. 9, 1850.

[39] *Id.*; United States v. Utah, 283 U.S. 64, 82 (1931).

[40] *Cf.* Economy Light & Power Co. v. United States, 256 U.S. 113 (1921).

[41] United States v. Utah, 283 U.S. 64, 86-87 (1931). *See also* The Montello, 87 U.S.

navigable year round.[42]

7. Navigability May be Based on Capacity to Support Relatively Small Craft

The requisite navigation may be by any "customary method of trade or travel."[43] Early cases quickly found that navigability should not depend solely upon evidence of large watercraft such as steamers or sailing ships. Over a century ago, the Supreme Court observed that "[i]t would be a narrow rule to hold that in this country, unless a river was capable of being navigated by steam or sail vessels, it could not be treated as a public highway."[44] Over the years, a variety of moderately sized craft have passed legal muster as adequate proof of navigability.[45]

B. Federal Commerce Clause Test

A second relevant standard of navigability arises under the United States Constitution,[46] most importantly the commerce clause.[47] In the landmark case of *Gibbons v. Ogden*,[48] the Supreme Court first held that navigation was an implicit concern of the commerce clause. The Court subsequently held that the power to regulate navigation necessarily carried with it control over navigable waters.[49] Federal regulatory jurisdiction over navigable waterways has manifested itself in several congressional enactments.[50]

As in questions of title to waterways, commerce clause jurisdiction over navigable waters raises the issue of determining navigability. Congress and various administrative agencies have struggled to fashion defi-

(20 Wall.) 430, 441-42 (1874).

[42] United States v. Utah, 283 U.S. 64, 87 (1931); Economy Light & Power Co. v. United States, 256 U.S. 113, 122 (1921).

[43] The Daniel Ball, 77 U.S. (10 Wall.) 557, 563 (1870). *See also* United States v. Appalachian Elec. Power Co., 311 U.S. 377, 405-06 (1940).

[44] The Montello, 87 U.S. (20 Wall.) 430, 441 (1874).

[45] *See, e.g.*, Utah v. United States, 403 U.S. 9 (1971) (livestock barges and tourist excursion craft); United States v. Holt State Bank, 270 U.S. 49 (1926) (variety of small craft and flatboats).

[46] *See, e.g.*, U.S. CONST. art. I, § 8 (war powers clause); U.S. CONST. art. IV, § 3 (public property clause).

[47] U.S. CONST. art. I, § 8, cl. 3: "[Congress shall have the power] to regulate commerce with foreign Nations, and among the several States, and with the Indian Tribes."

[48] 22 U.S. (9 Wheat.) 1 (1824).

[49] *See, e.g.*, Gilman v. City of Philadelphia, 70 U.S. (3 Wall.) 713 (1865).

[50] *See, e.g.*, Rivers and Harbors Act of 1899, 33 U.S.C. §§ 401-406 (1976); Federal Power Act, 16 U.S.C. §§ 791a-828c (1976 & Supp. V 1981).

nitions of navigability,[51] but the question ultimately remains a matter for judicial resolution.

The principal case defining navigability for commerce clause purposes is *United States v. Appalachian Electric Power Company.*[52] Under *Appalachian Power* and its progeny,[53] the commerce clause test of navigability closely tracks the federal title test. Indeed, they are identical, with three notable exceptions. First, navigability for commerce clause purposes can arise after statehood.[54] Second, unlike the title test, reasonable improvements in enhancing navigation may be considered in determining a waterway's navigability under the commerce clause. Stated another way, the "natural and ordinary condition" prong of the title test is inapplicable.[55] These two variations might lead one to conclude that the commerce clause test of navigability is more liberal than the title test. However, this conclusion is substantially tempered by the third distinction between the two standards. To be navigable for commerce clause purposes, a waterway must serve as a link in interstate or foreign commerce. The title test contains no such requirement.[56]

Although this article does not focus on federal regulatory control over lakes and rivers, many cases arising under the commerce clause address public rights to navigable waterways.[57] This is particularly true concerning sovereign title questions. Many commerce clause decisions contain a searching inquiry of aspects of the two coextensive standards.[58] To the extent that the commerce clause cases analyze such navigability

[51] *See, e.g.*, 16 U.S.C. § 796(8) (1976), defining "navigable waters" under the Federal Power Act; and 33 C.F.R., § 329 (1981), defining navigable waters for purposes of United States Army Corps of Engineers' jurisdiction under the Rivers and Harbors Act of 1899.

[52] 311 U.S. 377 (1940) (finding New River a navigable waterway for purposes of Federal Power Commission jurisdiction, thereby requiring FPC license prior to construction of hydroelectric dams on river).

[53] *See, e.g.*, Miami Valley Conservancy Dist. v. Alexander, 692 F.2d 447 (6th Cir. 1982); Puget Sound Power & Light Co. v. Federal Energy Regulatory Comm'n, 644 F.2d 785 (9th Cir. 1981); Connecticut Light & Power Co. v. Federal Power Comm'n, 557 F.2d 349 (2d Cir. 1977).

[54] United States v. Appalachian Elec. Power Co., 311 U.S. 377, 408 (1940).

[55] *Id.*

[56] Utah v. United States, 403 U.S. 9, 10 (1971); Oregon v. Riverfront Protective Ass'n, 672 F.2d 792, 794 n.1 (9th Cir. 1982); Sierra Pacific Power Co. v. Federal Energy Regulatory Comm'n, 681 F.2d 1134, 1137-39 (9th Cir. 1982). *See also* notes 30-34, 36-38 and accompanying text *supra*.

[57] *See, e.g.*, United States v. Appalachian Elec. Power Co., 311 U.S. 377 (1940); Puget Sound Power & Light Co. v. Federal Energy Regulatory Comm'n, 644 F.2d 785 (9th Cir. 1981); Loving v. Alexander, 548 F. Supp. 1079 (W.D. Va. 1982).

[58] *See* note 57 *supra*.

concepts, they are directly applicable to title test concerns.[59]

C. State Tests of Navigability

Individual states are free to establish their own rules of navigability for purposes other than determining title and defining the limits of federal regulatory power.[60] Many states have formulated their own stan-

[59] In recent years, certain cases purporting to define navigability in the commerce clause context have extended the notion of navigability far beyond the bounds of either federal title test or traditional commerce clause precedents. Among the most notable is N.R.D.C. v. Callaway, 392 F. Supp. 685 (D.D.C. 1975). In *Callaway*, the district court interpreted "navigable waters" as that term is found in Section 404 of the Clean Water Act, 33 U.S.C. § 1344 (1976 & Supp. V 1981). Section 404 prohibits the discharge of dredged or fill materials into "navigable waters" without a federal permit. The court found that in Section 404 Congress had "asserted federal jurisdiction over the nation's waters to the maximum extent permissible under the Commerce Clause of the Constitution. Accordingly, as used in the Water Act, the term is not limited to the traditional tests of navigability." 392 F. Supp. at 686. The *Callaway* decision forced the United States Army Corps of Engineers to expand broadly its permit authority over dredging and filling activities, and provoked a controversy that continues to this day. *See, e.g.*, 40 Fed. Reg. 31,322-43 (1975); 47 Fed. Reg. 31,793 (1982).

This expansive view of navigability has triggered new legal questions. In Kaiser Aetna v. United States, 444 U.S. 164 (1979), for example, the Supreme Court focused on the Corps of Engineers' assertion of jurisdiction over a shallow lagoon in Hawaii. The Court found that the claim of jurisdiction, based on the Rivers and Harbors Act, constituted a taking of property in violation of the fifth amendment to the United States Constitution under the rather unique facts of the case.

One significant way in which such cases differ from the traditional line of title and commerce clause navigability decisions lies in the governmental objective sought to be enforced. In the latter type of cases, the focus is on the waterway's susceptibility for navigation. Jurisdiction in both *Callaway* and *Kaiser Aetna* was predicated on quite different concerns: protection against deleterious water quality in *Callaway*, and promotion of public land and water access to what originally had clearly been private property in *Kaiser Aetna*. For this reason, the line of decisions represented by these two cases may well constitute a distinct and separate set of principles rather than a substantive modification to more traditional notions of navigability and navigable waters. *See* Oregon v. Riverfront Protective Ass'n, 672 F.2d 792, 795 n.2 (9th Cir. 1982); Loving v. Alexander, 548 F. Supp. 1079, 1090-91 (W.D. Va. 1982).

[60] This principle was cogently summarized in a recent California decision, Hitchings v. Del Rio Recreation & Park Dist., 55 Cal. App. 3d 560, 567, 127 Cal. Rptr. 830, 834 (1st Dist. 1976):

> These federal definitions [for title test and commerce clause purposes] are controlling when applicable to the context of the problem at hand, and the federal government retains paramount control over waters navigable under the commerce clause definition. However, in all other respects, the states are free to prescribe their own definitions of navigability, and, when not in conflict with federal dominion, "the exclusive control of waters is vested in

dards to establish a right of public passage along lakes and rivers[41] and to promote expanded recreational opportunities to these inland waterways.[42] State rules of navigability for these purposes have tended to be far more liberal than traditional formulations of either of the federal tests.[43] The result has been to make available for public use lakes and rivers considered too modest to constitute state sovereign lands under the federal title test or to subject them to federal regulatory power under the commerce clause, at least under early federal decisions.

California has been at the forefront of this trend, providing that the public may use for boating and related recreational purposes any body of water that may be navigated using a small oar or motor propelled craft.[44] This standard has been characterized as "a recreational boating

> the state, whether the waters are deemed navigable in the Federal sense or in any other sense."

(Citations omitted.) The power of the states to establish their own rules of navigability has been expressly recognized by the United States Supreme Court. Brewer-Elliott Oil & Gas Co. v. United States, 260 U.S. 77, 89 (1922); Donnelly v. United States, 228 U.S. 243, 262 (1913).

[41] *See, e.g.*, Forestier v. Johnson, 164 Cal. 24, 127 P. 156 (1912); Elder v. Delcour, 364 Mo. 835, 269 S.W.2d 17 (1954); Luscher v. Reynolds, 153 Or. 625, 56 P.2d 1158 (1936).

[42] *See, e.g.*, People *ex rel.* Baker v. Mack, 19 Cal. App. 3d 1040, 97 Cal. Rptr. 448 (3d Dist. 1971); Diana Shooting Club v. Husting, 156 Wis. 261, 145 N.W. 816 (1914).

[43] By using criteria far less imposing than those applied under the federal tests summarized above, these state standards of navigability embrace a broader scope of waterways, including minor lakes and streams as well as artificially created waterways. *See, e.g.*, Hitchings v. Del Rio Woods Recreation & Park Dist., 55 Cal. App. 3d 560, 568, 127 Cal. Rptr. 830, 834 (1st Dist. 1976); Bohn v. Albertson, 107 Cal. App. 2d 738, 238 P.2d 128 (1st Dist. 1951); Wilbour v. Gallagher, 462 P.2d 232 (Wash. 1969). *See also* Johnson & Austin, *Rights and Titles to Beds on Western Lakes and Streams*, 7 NAT. RESOURCES J. 1 (1967); Annot., 6 A.L.R. 4th 1030 (1981).

[44] The California test of navigability was articulated in People *ex rel.* Baker v. Mack, 19 Cal. App. 3d 1040, 1050, 97 Cal. Rptr. 448, 454 (3d Dist. 1971):

> The modern determinations of the California courts, as well as those of several of the states, as to the test of the navigability can well be restated as follows: members of the public have the right to navigate and to exercise the incidents of navigation in a lawful manner at any point below high water mark on waters of this state which are capable of being navigated by oar or motor-propelled small craft.

Numerous other states have fashioned their own standards of navigability and concomitant public rights to inland lakes and rivers. *See, e.g.*, Muench v. Public Service Comm'n, 261 Wis. 492, 53 N.W.2d 514 (1952); Day v. Armstrong, 362 P.2d 187 (Wyo. 1961). *Cf.* People v. Emmert, 597 P.2d 1025 (Colo. 1979). For a comprehensive review of these sometimes disparate state approaches, see Hitchings v. Del Rio Woods Recreation & Park Dist., 55 Cal. App. 3d 560, 568-70, 127 Cal. Rptr. 830, 834-37

test of navigability."[45] The rights conferred upon the public to navigable waterways are in the nature of a public recreational easement, existing irrespective of private ownership claims to the river or lake bed.[46]

II. Expanding State Sovereign Interests in Waterways: The Federal Title Test of Navigability Receives a Liberal Application

> [N]avigable waters, in contrast with non-navigable waters, is but one way of expressing the idea of public waters, in contrast with private waters.[47]

The standards of navigability under both federal and California law have been the subject of considerable judicial scrutiny in recent years. Building upon precedents, the courts have broadly construed the definition of navigable waterways.

This trend is seen most clearly in the context of the federal test of navigability for title purposes. Until recently, the federal title test was considered settled, due largely to the infrequent appellate decisions addressing the question of navigability and sovereign title.

The federal title test was traditionally considered the most "stringent" iteration of navigability in the legal system.[48] Early decisions of

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(1st Dist. 1976); People *ex rel.* Baker v. Mack, 19 Cal. App. 3d at 1045-48, 97 Cal. Rptr. at 450-53; Johnson & Austin, *Recreational Rights and Titles to Beds on Western Lakes and Streams*, 7 NAT. RESOURCES J. 1 (1967); Annot., 6 A.L.R. 4th 1030 (1981).

[45] Hitchings v. Del Rio Woods Recreation & Park Dist., 55 Cal. App. 3d 560, 568, 127 Cal. Rptr. 830, 835 (1st Dist. 1976).

[46] *Id.* at 571, 127 Cal. Rptr. at 837. While these public rights of navigation find strong support in California common law, they are also embodied in the state Constitution and statutes. *See, e.g.*, CAL. CONST. art. XV, § 4:

> No individual, partnership or corporation claiming or possessing the frontage of title lands in a harbor, bay, inlet, estuary, or other navigable water in this State, shall be permitted to exclude the right-of-way to such water whenever it is required for any public purpose, nor to destroy or obstruct the free navigation of such water; and the Legislature shall enact such laws as will give the most liberal construction to this provision, so that access to the navigable waters of this State shall be always attainable for the people thereof.

See also CAL. CIV. CODE § 3479 (West 1980) (unlawful obstruction to free public use of navigable waterways constitutes a nuisance); CAL. HARB. & NAV. CODE § 131 (West 1978) (obstruction of navigable waterways a misdemeanor); CAL. PENAL CODE § 370 (West 1970) (same).

[47] Nekoosa Edwards Paper Co. v. Railroad Comm'n, 201 Wis. 40, 47, 228 N.W. 144, 147 (1929).

[48] This perception is actually somewhat misguided, as explained in notes 54-56 and accompanying text *supra*. *See also* United States v. Oregon, 295 U.S. 1, 14 (1935); United States v. Utah, 283 U.S. 64, 75 (1931).

the Supreme Court, lower federal courts, and state tribunals reflected a relatively strict reading of the federal test of navigability.[69]

However, recent federal court opinions, and certain federal administrative decisions signal a broader formulation of the concept of navigability. Virtually without exception, these decisions reflect a more liberal view of the federal title test. In part, this trend can be attributed to the recent increase in litigation over title to the beds of inland waterways. The courts have resolved these cases by broadly reading the earlier precedents. The decisions have embraced the smallest watercraft imaginable, along with mere timber products, as proper evidence of historic use under the federal standard. Additionally, the decisions have found insignificant the fact that the waterways in question are often seasonal in nature or possess formidable obstructions to navigation. Finally, the *degree* of proof required to support a finding of navigability appears to be far less substantial than it once was.

The result of these developments is twofold. First, there is an increase in state sovereign claims to inland lakes and rivers once thought to be owned by the federal government or private parties. Second, much new litigation testing the limits of this suddenly dynamic area of the law has arisen. Several of the most important new decisions are summarized below.

A. *The Decisions*

1. The Little Missouri River Case

In *North Dakota v. Andrus*,[70] the Eighth Circuit Court of Appeals applied the title test of navigability in a dispute between North Dakota

[69] *See, e.g.*, United States v. Oregon, 295 U.S. 1 (several lakes in Oregon found non-navigable despite documented use by trappers in variety of small craft); Oklahoma v. Texas, 258 U.S. 574 (1922) (portions of Red River forming common boundary between Texas and Oklahoma determined non-navigable for title purposes); North American Dredging Co. of Nev. v. Mintzer, 245 F. 297, 300 (9th Cir. 1917) (San Pablo Canal near Richmond, California non-navigable despite evidence "that occasionally power boats and scows of light draft have been taken up through San Pablo Creek into the channel involved"); Harrison v. Fite, 148 F. 781 (8th Cir. 1906) (Arkansas waterways susceptible of navigation in some seasons of year by canoes, skiffs, and dugouts, are nonetheless non-navigable for title purposes, since deemed not to be useful highways of commerce); State *ex rel.* Burnquist v. Bollenbach, 241 Minn. 103, 63 N.W.2d 278 (1954) (Minnesota rivers found non-navigable by state court applying federal test of navigability).

[70] North Dakota *ex rel.* Bd. of Univ. & School Lands v. Andrus, 671 F.2d 271 (8th Cir. 1982), *cert. granted on other grounds sub nom.* Block v. North Dakota *ex rel.* Bd. of Univ. & School Lands, 103 S. Ct. 48 (1982) (mem.).

and the federal government over title to the bed of the Little Missouri River. The state argued that the river was navigable under the federal standard and therefore owned by North Dakota in its sovereign capacity. The federal government, on the other hand, claimed that the Little Missouri was non-navigable. Accordingly, it claimed title to its bed as an incident of federal upland ownership.[71] The lawsuit had been precipitated by the federal government's issuance of mineral leases to the bed of the waterway.

North Dakota filed suit in federal district court to stop these leasing efforts and to obtain a declaration of the river's navigability. The state prevailed at the district court level,[72] and the United States appealed.

The court of appeals sustained the district court decision, holding that the river was navigable for title purposes and the riverbed was therefore sovereign land owned by North Dakota in trust for its citizens. The court relied exclusively on evidence of isolated cases of historic use by small craft such as canoes, some brief and unsuccessful efforts to float logs downstream, and current use annually by hundreds of recreational canoes.[73] The court was not dissuaded by the fact that the river was impassable at certain times of the year due to winter freezes, high flood levels during spring runoff periods, and low summer flows. Moreover, the opinion recounts facts showing that the waterway's maximum depth was two and one-half feet.[74]

Although the *North Dakota* court cited and relied on the Supreme Court's decisions in *The Daniel Ball*, *The Montello*, and especially *Utah v. United States*,[75] it nonetheless recognized that its decision was not based on particularly strong evidence.[76]

The Little Missouri River decision constitutes a major precedent in the law of navigability for title purposes for several reasons. First, the case demonstrates that the capability of a waterway to support only the

[71] *See, e.g.*, Packer v. Bird, 137 U.S. 661, 672-73 (1891).

[72] North Dakota *ex rel.* Bd. of Univ. & School Lands v. Andrus, 506 F. Supp. 619 (N.D. 1981).

[73] North Dakota *ex rel.* Bd. Of Univ. & School Lands v. Andrus, 671 F.2d 271, 277-78 (8th Cir. 1982).

[74] *Id.*

[75] *Id.* at 277.

[76] The court wrote.

> Although we feel that the evidence in the record concerning navigability is rather thin, we still affirm the district court. The legal standards on navigability are liberal, and we must bear in mind that the issue is one of potential commercial use and hence navigability at the time of statehood, not in the present day.

Id. at 278.

smallest of craft, such as a canoe, is a proper touchstone of title test navigability.[illegible] Second, the case constitutes perhaps the most liberal application of the principle that a waterway need not be navigable year round.[illegible] Third, the case suggests that the modest physical characteristics of a waterway are not determinative. The court found the river navigable despite its shallow bottom, substantial rapids, swift moving current, and other obstructions. Fourth, the decision explicitly relies on the modern private recreational use of the water to demonstrate navigability under the federal test, that is, as a highway for public passage, trade, or commerce. Finally, the court found evidence of logging to be a proper indication of navigability for title purposes.[illegible]

2. The White River Case: Logging and Navigability

Another recent federal court decision also found that logging is an adequate basis for navigability. In *Puget Sound Power & Light Co. v. Federal Energy Regulatory Commission,*[illegible] the Ninth Circuit Court of Appeals considered the navigability of the White River in the State of Washington. The case arose under the commerce clause with the Federal Energy Regulatory Commission (F.E.R.C.) asserting licensing jurisdiction over the river under the Federal Power Act.[illegible] Rejecting an

[illegible] *Cf.* United States v. Oregon, 295 U.S. 1 (1935).

[illegible] Indeed, from the language of the decision, it appeared that on an annual basis the Little Missouri is more often impassible than not. North Dakota *ex rel.* Bd. of Univ. & School Lands v. Andrus, 671 F.2d 271, 277-78 (8th Cir.), *cert. granted on other grounds sub nom.* Block v. North Dakota *ex rel.* Bd. of Univ. & School Lands, 103 S. Ct. 48 (1982) (mem.).

[illegible] The Little Missouri River case contains another legal issue unrelated to the present inquiry but nonetheless of substantial proportions. The Eighth Circuit also ruled that the 12 year statute of limitations contained in the federal quiet title statute, 28 U.S.C. § 2409a(f) (1976), does not apply in an action brought by a state to quiet its claim to sovereign lands. This latter issue was appealed to the United States Supreme Court which granted a writ of certiorari. 671 F.2d 271, 273-76 (8th Cir. 1982), *cert. granted sub nom.* Block v. North Dakota *ex rel.* Bd. of Univ. & School Lands, 103 S. Ct. 48 (1982) (mem.). As this article went to press, the case was still pending before the Supreme Court. The federal government chose not to appeal that portion of the Eighth Circuit's decision dealing with the navigability of the Little Missouri River. Accordingly, that portion of the court of appeal's ruling is final. *Cf.* STERN & GROSSMAN, SUPREME COURT PRACTICE 361 (B.N.A. 1978).

[illegible] 644 F.2d 785 (9th Cir. 1981).

[illegible] The federal government often finds itself in a somewhat novel position in litigating navigability issues. On the one hand, the federal government owns millions of acres of land in the Western United States, both in a proprietary capacity and as trustee for numerous Indian tribes. Accordingly, in cases involving navigability for title test purposes, the federal government generally is in the position of arguing that various waterways are non-navigable. The result, assuming this contention is correct, is that the federal upland property interests would extend into and include the bed of the waterway in question. On the other hand, the federal government often takes an expansive view of its jurisdiction for commerce clause purposes and thus argues for a broad interpretation of navigability in the commerce clause context. Given the similarities between the two legal standards, the potential for legal inconsistencies in the government's far-flung litigation efforts becomes apparent.

earlier decision of the Washington Supreme Court holding the identical reach of the White River non-navigable,[illegible] the Ninth Circuit ruled the waterway navigable for commerce clause purposes.

The court premised its finding exclusively on evidence of use by Indian canoes and the flotation of "shingle bolts" downstream,[illegible] noting however, that "[s]hingle bolts were not driven on the White River without difficulty. Nor was the use of the river extensive, or long and continuous."[illegible] The upland owners had argued that mere evidence of a commercial timber drive was insufficient to establish navigability. Echoing the Eighth Circuit in *North Dakota*, the court rejected this contention, stating that navigability does not depend upon the size of articles transported in commerce, but upon the stream's usefulness as a transportation mechanism for commerce. The court added that the tests for navigability must consider the wide variations of a waterway's uses.[illegible]

Puget Sound is particularly significant because it based navigability almost *exclusively* on river transportation of timber supplies. Moreover, the shingle bolts involved were so moderately sized that they could be transported on comparatively small waterways. Thus, *Puget Sound* represents a further liberalization of the navigability standard for commerce clause purposes and, by inference, for title test purposes as

[illegible] Sumner Lumber & Shingle Co. v. Pacific Coast Power Co., 72 Wash. 631, 131 P. 220 (1913), *discussed in* Puget Sound Power & Light Co. v. Federal Energy Regulatory Comm'n, 644 F.2d 785, 787-88 (9th Cir. 1981).

[illegible] The decision defines shingle bolts as being "a quartered section of log, normally cedar, and . . . about four feet six inches in length." Puget Sound Power & Light v. Federal Energy Regulatory Comm'n, 644 F.2d 785, 788 n.3 (9th Cir. 1981).

[illegible] *Id.* at 789.

[illegible] *Id.*, relying in part on United States v. Appalachian Elec. Power Co., 311 U.S. 377, 405-06 (1940). The *Puget Sound* decision brings the Ninth Circuit into conformance with the views of several other federal courts that have relied upon historic evidence of logging to find inland waterways navigable for commerce clause purposes. *See, e.g., Appalachian Elec. Power Co.*, 311 U.S. at 405, St. Anthony Falls Water Power Co. v. St. Paul Water Comm'n, 168 U.S. 349, 359 (1897); Connecticut Light & Power Co. v. Federal Power Comm'n, 557 F.2d 349, 357 (2d Cir. 1977); Wisconsin v. Federal Power Comm'n, 214 F.2d 334, 336 (7th Cir.), *cert. denied*, 348 U.S. 883 (1954).

well.[66]

3. The McKenzie River Case: Logging and Title Test Navigability

As discussed above, the tests of navigability for title and commerce clause purposes are quite similar.[67] The holding in *Puget Sound*, a commerce clause case, was extended by the Ninth Circuit to a sovereign title case in *State of Oregon v. Riverfront Protective Association*.[68]

In *Riverfront*, the bed of the McKenzie River in Oregon was the subject of a title dispute. The state claimed that the bed of the river constituted state sovereign trust lands. Defendants, riparian landowners claiming title derived from federal upland land grants, asserted that the bed of the McKenzie River was privately owned. The issue was whether the river had been navigable for title purposes upon Oregon's admission to the Union in 1859.

The sole evidence of navigability posited by Oregon was the fact that the McKenzie River had been used for log drives for several years in the late 1800s. The district court held this evidence insufficient as a matter of law to demonstrate navigability for title purposes,[69] and the Ninth Circuit Court of Appeals reversed.

In so doing, the court predictably relied on *Puget Sound*. Recognizing the distinctions between title and commerce clause navigability,[70] the court nonetheless found the earlier case controlling. It did so even in the face of facts arguably less compelling than those in *Puget Sound*. Driving logs on the McKenzie, the court observed, required constant attention to avoid such difficulties as logjams, flooding, and low

[66] The extent to which this position represents a pronounced change from earlier legal views is illustrated by reference to the California Supreme Court's decision in the early case of American Water Co. v. Amsden, 6 Cal. 443, 446 (1856):

> To . . . attribute navigable properties to a stream which can only float a log, is carrying the doctrine entirely too far, and is turning a rule which was intended to protect the public, into an instrument of serious detriment to individuals, if not of actual private oppression. The important uses to which the waters of non-navigable streams are constantly applied, would have no security or certainty under such a stretch of construction. Dams for the erection of mills, manufactories, canals, for the purpose of irrigation, supplying mines, or even to subserve navigation itself, would have to give way to the mere claim of the right to float a saw-log, and if a log, why not a plank, or a fishing rod? The idea of navigation certainly never contemplated such a definition or such results.

[67] *See* notes 52-56 and accompanying text *supra*.

[68] 672 F.2d 792 (9th Cir. 1982).

[69] The district court opinion is unreported.

[70] 672 F.2d at 794 n.1.

seasonal flows. Still, the river was successfully used to transport logs.[71]

The court noted in *Riverfront* that although log drives regularly occurred on the McKenzie in the late 1800s and early 1900s, they were not a year round activity. It observed that log drives generally occurred over a two and one-half month period in late spring. The court found that the river was never utilized during high water periods from November through March due to unsafe conditions, and that insufficient water levels prevented logging during the low water period from July through October.[72]

Finally, the *Riverfront* court focused on the title test requirement that a river must be navigable in its natural condition for purposes of determining title. It noted the lower court finding that the McKenzie had sometimes been temporarily deepened for logdriving through the construction of "wing dams." The court held that such minor alterations facilitated the log drives but did not "improve" the river significantly.[73]

[71] The court wrote:

> Like the logs transported down the McKenzie, the shingle bolts in *Puget Sound* "required nearly constant handling by the drivers to break up jams, free those bolts that were lodged on the banks and shallow areas, and direct them down the main channel of the river." . . .
>
> Transportation on the McKenzie may have been somewhat more difficult. In *Puget Sound* drivers found the work "not difficult," 644 F.2d at 788, whereas on the McKenzie it took substantial logging crews an average of from thirty to fifty days to complete a log drive down the 32-mile reach at issue. Unfavorable circumstances could increase this time to over ninety days. Intractable log jams had to be broken up with dynamite. Too much rain caused uncontrollable flooding; too little exposed gravel bars, boulders, and shoals. Crews might spend three or four days moving logs across a single gravel bar. But notwithstanding such difficulties, thousands of logs and millions of board feet of timber were driven down the river. Significantly, the evidence shows that the logs floated on the McKenzie were much larger than shingle bolts floated on the White River in *Puget Sound* and, apparently, the entire volume of traffic also was larger.

Id. at 795 (footnote omitted).

[72] 672 F.2d at 795.

[73] The court observed:

> [T]hese crude dams cannot reasonably be deemed to have altered the natural condition of the river. The same is true of all the other artificial aids to logdriving — log booms, peaveys, "dogs," two-horse teams, and dynamite — with which log drivers on the McKenzie plied their laborious trade. These rough means facilitated the transport of logs on the McKenzie, but they did not improve the river. Certainly they bear little resemblance to the planned civil engineering projects considered to be reasonable improvements in *United States v. Appalachian Elec. Power Co.*, 311 U.S. 377,

Thus, *Riverfront* is important for several reasons. First, it expressly found that evidence of logging activity, standing alone, is adequate to prove navigability for title purposes. Stated another way, navigation solely *downstream* suffices as a matter of law for title test navigability purposes.[94] Second, the case shows that hazards and obstructions in the river that made log drives difficult and required extensive human acts to overcome do not preclude a finding of navigability. Finally, *Riverfront* demonstrates that the capability of a waterway to support navigation for as little as two and one-half months per year constitutes an adequate capacity for navigation under the title test. Each of these principles reflects a major development in the law of navigability.

4. The Kankakee River Decision: Support From The East

Navigability questions usually arise in litigation over waterways located in the western United States.[95] This can be attributed to the following factors that make these lands increasingly valuable: shifting population patterns; increased interest in mineral exploration and development activities; and heightened activism of Native American tribes asserting their property interests.

Occasionally, however, eastern jurisdictions have left their mark in this area of the law. In a recent case, *Illinois v. Corps of Engineers*,[96] the Corps of Engineers determined that a seventy-mile stretch of the Kankakee River in Illinois was non-navigable under the Rivers and Harbors Act of 1899. Illinois challenged the Corps' ruling. The district court held for the state, finding the Kankakee to be navigable. As in the cases discussed above,[97] historical evidence of actual use was sparse.

> 418-18 (1940) (improvements for keelboat and steamboat use). Thus, the McKenzie was used in its ordinary condition as a highway for useful commerce.

Id. at 796 (footnotes and citations omitted).

[94] The decision follows an earlier Nevada decision taking the same position in a case involving logging and sovereign title questions. State v. Bunkowski, 88 Nev. 623, 503 P.2d 1231 (1972).

[95] All of the seven previously cited title test navigability cases decided by the Supreme Court, for example, involve waterways located west of the Mississippi. *See* note 26 *supra*. Virtually all of the recent decisions analyzed in this article also concern lakes and rivers in the western states.

[96] 17 Env't Rep. Cas. (BNA) 2214 (Jan. 9, 1981).

[97] Oregon v. Riverfront Protective Ass'n, 672 F.2d 792 (9th Cir. 1982); North Dakota *ex rel.* Bd. of Univ. & School Lands v. Andrus, 671 F.2d 271 (9th Cir. 1982), *cert. granted on other grounds sub nom.* Block v. North Dakota *ex rel.* Bd. of Univ. & School Lands, 103 S. Ct. 48 (1982) (mem.); Puget Sound Power & Light Co. v. Federal Energy Regulatory Comm'n, 644 F.2d 785 (9th Cir. 1981).

The court recounted random trips in small craft by explorers, trappers, fur traders, and Indians in the eighteenth and nineteenth centuries. It was unimpressed with the federal government's argument that the river was shallow, long and sinuous, and passed through a large swamp area. The court noted that even a single trip by a supply boat could raise an inference of navigability. Past use, even though sporadic, was held sufficient for a finding of navigability.[98]

Illinois arises under the commerce clause,[99] but nonetheless bears on the general question of title test navigability because the pertinent distinctions between the two tests are inapplicable.[100] Like the *North Dakota* case,[101] *Illinois* illustrates the increased tendency of the federal courts to premise a finding of navigability on sporadic evidence of small craft similar to recreational boats.[102]

5. The Truckee River Opinion: Sierra Whitewater

The most recent statement by the Ninth Circuit Court of Appeals on

[98] The court stated that:

> This evidence is clearly sufficient to establish navigability even if the defendants' contentions were accurate. Acknowledging that "use of a stream long abandoned by water commerce is difficult to prove by abundant evidence," 311 U.S. at 416, the Supreme Court in *Appalachian Electric* noted that an inference of navigability could arise even by a single trip of a government supply boat despite the need of the crew to get out and push or even through testimony of "sporadic" use.
>
> The most the federal defendants could hope to establish at trial would be the fact that transportation on the River was difficult and sporadic. Yet the conclusions of the District Counsel regarding these supposed difficulties are legally irrelevant since, given the undisputed documentary evidence of *some* past use, neither the frequency of such use nor its cause are necessary conditions for establishing navigability and the lack thereof does not negate navigability.

Illinois v. Corps of Engineers, 17 Env't Rep. Cas. (BNA) 2214, 2216 (N.D. Ill. 1981) (emphasis in original).

[99] Due to the cryptic nature of the opinion, the context in which the court considered navigability in *Illinois* is unclear. Communications with trial counsel, however, reveal that the case involved regulatory jurisdiction under the Rivers and Harbors Act (telephone conversation with Judith S. Goodie, Asst. Attorney General, State of Illinois, counsel for plaintiff, Dec. 9, 1982).

[100] *See* notes 53-56 and accompanying text *supra*.

[101] North Dakota *ex rel.* Bd. of Univ. & School Lands v. Andrus, 671 F.2d 271 (8th Cir. 1982), *cert. granted on other grounds sub nom.* Block v. North Dakota *ex rel.* Bd. of Univ. & School Lands, 103 S. Ct. 48 (1982) (mem.).

[102] Other recent cases from the eastern United States involving commerce clause jurisdiction similarly illustrate a liberal application of navigability principles. *See, e.g.*, Miami Valley Conservancy Dist. v. Alexander, 692 F.2d 447 (6th Cir. 1982) (portions

the law of navigability involved a dispute over the Truckee River. The Truckee begins at the northwest shore of Lake Tahoe, California, and flows northeasterly down the eastern slope of the Sierra Nevada, terminating 100 miles away at Pyramid Lake, Nevada. The F.E.R.C. claimed that the river was navigable, and that it therefore had jurisdiction to license hydroelectric power operations under the Federal Power Act. The Sierra Pacific Power Company, which operates several such projects on the Truckee, protested the government's assertion of jurisdiction. In a lengthy administrative decision, the F.E.R.C. found the Truckee navigable for commerce clause purposes, and therefore under the Federal Power Act.[103] Sierra Pacific appealed the ruling to the Ninth Circuit, which reversed in *Sierra Pacific Power Company v. Federal Energy Regulatory Commission.*[104]

The opinion recounts in considerable detail the physical characteristics of the Truckee. Of particular significance are the court's observations that the gradient (rate of vertical fall) of the Truckee ranges from negligible levels to 100 feet per mile. Most of the river has a gradient of twenty-five to forty feet per mile.[105] The only evidence of historical navigation cited by the court was the use of segments of the river for logging.[106]

No clear evidence was presented to show that the portion of the river straddling the California/Nevada border had ever been used for logging or had the physical capacity for such use. Because there was no effective interstate link, the Truckee was held to be non-navigable for commerce clause purposes.[107]

Although *Sierra Pacific* held the Truckee River to be non-navigable, it is nonetheless instructive to analyze the decision for title test purposes. In dicta, the court appeared to find major stretches of the river in both California and Nevada navigable for intrastate title purposes.

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of Great Miami River navigable under Rivers & Harbors Act and therefore subject to federal regulatory jurisdiction; upriver portion and certain tributaries of Great Miami River non-navigable); Loving v. Alexander, 548 F. Supp. 1079 (W.D. Va. 1982) (Jackson River is a navigable water of the United States based on minimal evidence, but not subject to United States Army Corps of Engineers' jurisdiction under Rivers & Harbors Act because waterway located entirely within Virginia).

[103] Pyramid Lake Paiute Tribe of Indians v. Sierra Pacific Power Co., Env't Rep. Cas. (BNA) 61 (Aug. 10, 1979).

[104] 681 F.2d 1134 (9th Cir. 1982).

[105] *Id.* at 1136.

[106] *Id.* at 1136-39.

[107] It was this portion of the river that contained a gradient of 100 feet per mile and a "possibly significant obstruction to navigation" consisting of "two long boulder-filled drops." *Id.* at 1138-39.

These "findings" appeared to be based on prior state determinations and the fact that those intrastate portions of the Truckee were shown by documented historic logging operations to be more susceptible to navigation than the segment transsecting the state border.[108]

Sierra Pacific is also significant because it reaffirms the Ninth Circuit's previously stated view in *Puget Sound* and *Riverfront* that logging represents a sufficient form of navigation for title and commerce clause navigation. Moreover, the gradients of those portions of the Truckee wholly within California and Nevada that the court appeared to find navigable for intrastate purposes are far more pronounced than those of other rivers previously considered navigable for title purposes by the federal appellate courts.[109]

6. The Alaskan Experience: Special Circumstances and Expanding Principles

Since Alaska was admitted to the Union in 1959, considerable controversy has existed over property rights to its waterways. Administrative decisions of the federal government have embraced the expansive view of navigability typified in the judicial decision of the Alaska Native Claims Appeal Board (Board) in *Appeal of Doyon, Ltd.*[110]

The Board, a part of the United States Department of the Interior, was established to administer the Alaska Native Claims Settlement Act.[111] Title to the Kandik and Nation Rivers, which are tributaries to the Yukon, was contested. The issue was whether these rivers were navigable. If so, they passed as sovereign lands to Alaska upon its admission to the Union. If non-navigable, the beds of these rivers would remain available for federal conveyance to Native tribes or private interests.

In a unanimous decision, the Board reversed the prior decision of the Bureau of Land Management, another branch of the Department of the Interior. The Board held that the Kandik and Nation Rivers in Alaska are navigable for title purposes and therefore held in trust by the state. The Board prefaced its lengthy opinion by asking whether use of a river by trappers employing such small craft as pole, tunnel,

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[108] *Id.* at 1137 n.4, 1138-39.

[109] *Cf.* discussion of river gradients contained in United States v. Utah, 283 U.S. 64, 77-81 (1931) (finding navigable portions of several rivers in Utah containing gradients ranging from 1 to 11 feet per mile).

[110] 86 Interior Dec. 692 (1979).

[111] 43 U.S.C. §§ 1601-1628 (1976 & Supp. IV 1980) as implemented in 43 C.F.R. §§ 2650.0-.8 (1981), and 43 C.F.R. §§ 4.900-.913 (1981).

and river boats is sufficient evidence to sustain a finding of navigability.[111]

The Board based its findings of navigability solely on the fact that the rivers historically had been used in connection with trapping, trading, and the transport of supplies and furs by trappers.[112] The administrative decision went on to find that small craft such as pole boats, tunnel boats, and outboard river boats constituted the customary modes of trade on those waterways, thus supporting a finding of state sovereign ownership.[113] The Board also based its ruling on the presently widespread recreational use of the rivers.[114] Relying on recent judicial decisions on navigability,[115] the Board rejected the Bureau of Land Management's arguments that the rivers should be declared non-navigable because of their sparse use, physical impediments in the waterways, and frozen consistency for approximately seven months each year.[116]

In *Doyon*, an administrative agency of the federal government adopted the broad view of navigability recently espoused by the federal courts. Like *North Dakota* and *Illinois*, *Doyon* relies exclusively on evidence of navigation by very small craft. In *Doyon*, sparse level of historic use was not significant; instead, physical susceptibility of the rivers for navigation was the key. The administrative decision also shows that a waterway may be navigable despite significant physical obstructions and the fact that, on the average, they are passable for only five months of the year. In this regard, the Board's ruling mirrors the decisions in *Riverfront* and *North Dakota*. Finally, *Doyon* lends fur-

[111] Appeal of Doyon, Ltd., 86 Interior Dec. 692, 694 (1979).

[112] *Id.* at 703.

[113] *Id.* at 705.

[114] The Board observed:

> In the present case, historical use by trappers was within the living memory of some of the witnesses, and use of the rivers continues, although the purpose is increasingly for recreation rather than trapping . . . [R]ecreation [sic] use of itself, may not suffice the susceptibility test for purposes of navigation for title. Present use of recreation [sic] purposes may be properly considered as a corroborating factor in determining susceptibility for uses of highway of commerce. The Board notes that if the type of watercraft used for recreation is capable of carrying a commercial load, and is commonly used to do so, then use of such watercraft offers some indication that the waterway is capable of being used for the purpose of useful commerce.

Id. at 706. *Cf.* United States v. Utah, 283 U.S. 64, 82 (1931).

[115] Utah v. United States, 403 U.S. 9 (1971); United States v. Holt State Bank, 270 U.S. 49 (1926).

[116] Appeal of Doyon, Ltd., 86 Interior Dec. 692, 697-98 (1979).

ther credence to recreational use as valid evidence of historic navigability. The federal government's decision in *Doyon* thus represents an administrative counterpart to a long line of judicial decisions enunciating a liberal test of navigability for title purposes.

B. *The Evolving Federal Law of Navigability: New and Liberal Application of the Doctrine*

Together, the decisions analyzed above demonstrate the broadening of the federal title test of navigability. These developments affect property rights to many western lakes and rivers. Cases have arisen in both federal courts and administrative tribunals, and involve disputes arising directly under the title test and under the closely related commerce clause standard.

This change has altered several of the elements comprising the federal title test.[117] First, several decisions attach little significance to the documented use of the contested waterway. The mere *susceptibility* of a lake or river for use is increasingly stressed. Second, recent decisions deemphasize commercial navigation of these waterways, relying instead on isolated instances of navigation, experimental efforts, and even purely recreational use. Subtly modifying the venerable *Daniel Ball* standard, the cases find navigability based on public passage alone without sustained commercial utility. Third, the decisions evince a liberalized view toward obstructions to navigation. The fact that waterways are shallow, frozen, or otherwise impassable for most of the year, or subject to pronounced gradients, does not compel the conclusion that they are non-navigable, and may even support a finding of navigability. Finally, the smallest type of craft or object such as canoes, skiffs, logs, and even pieces of timber may constitute the "customary method of trade or travel."

These cases suggest a clear trend favoring a finding of navigability. As a result, increasing numbers of lakes and rivers are viewed as being navigable under federal law. Assuming that claims are vigorously pursued, the beds of these waterways — together with their important recreational, ecological, and economic values — are likely to be found sovereign assets of the several states rather than incidental appendages of private upland ownership or, alternatively, part of the vast federal domain.

Neither these developments nor the consequences have been lost on the states. Currently pending are many cases in which states seek to

[117] *See* notes 29-45 and accompanying text *supra*.

quiet title to the beds of inland lakes and rivers. Virtually all of these cases deal with waterways in the Western United States, and most involve litigation between individual states and the federal government.[119] The decisions summarized above will bear heavily in the resolution of those pending sovereign claims. Not since 1971 has the United States Supreme Court dealt with the issue of navigability for purposes of establishing state sovereign title.[120] Given the plethora of pending and anticipated litigation on the subject, the Supreme Court may soon have occasion to speak again. At least until it decides to do so, however, liberal application of the title test of navigability will continue.

III. The California Alternative: The Public Trust Doctrine

In the courts of the Western States, there is much conflict of opinion . . . .[121]

Although federal courts have promoted public rights to waterways by broadly interpreting the established federal title test of navigability, the

[119] A partial listing of these cases includes the following: Alaska v. United States, No A81-265CIV (D. Alaska) (state quiet title action to bed of Slopbucket Lake); Alaska v. United States, No. A80-359CIV (D. Alaska) (quiet title action concerning navigability of Gulkana River); Alaska v. United States, No. A81-483CIV (D. Alaska) (state ownership of submerged lands in Alaska being litigated in connection with Alaska Native Claims Settlement Act of 1971); Alaska v. Warner, No. A-78-69 (D. Alaska) (quiet title action to bed of Colville River, involving boundary dispute between State of Alaska and United States Navy involving former Naval Petroleum Reserve No. 4); State v. Yuba Goldfields, Inc., et al., No. S-79-733-RAR (E.D. Cal.) (quiet title action brought by California against federal government and private mining corporation concerning title to bed of Yuba River); Nevada v. United States, et al., No. R-78-015 (D. Nev.) (state title claim to bed of Ruby Lake, contained within Ruby Lake National Wildlife Refuge); 101 Ranch v. United States, No. CIV 82k-81-89 (D. N.D.) (quiet title action brought against federal government to determine ownership to portion of Devil's Lake; state has intervened); Utah v. United States, No. 79-0302 (C.D. Utah) (quiet title action brought by Utah against United States to quiet state's title to bed of Utah Lake); Brandenberger v. State of California, Nevada County Superior Court, No. 21947 (quiet title action brought by private upland owners against California concerning title to Donner Lake).

[120] Utah v. United States, 403 U.S. 9 (1971). In *Utah*, the Court held the Great Salt Lake to be navigable. Accordingly, the Court found its bed to be owned in trust by Utah. The Court relied on limited evidence of navigation on the Lake in connection with riparian agricultural operations and a short lived excursion craft. In many ways, *Utah* is the most liberal of the Supreme Court's seven rulings on navigability for title purposes. Accordingly, it perhaps can be viewed as the case precipitating the current development in federal title test navigability.

[121] Packer v. Bird, 137 U.S. 661, 669 (1891) (discussing law of navigability).

individual states have followed a somewhat different course. California appears to rely upon the public trust doctrine to expand public access to its system of lakes and waterways. In so doing, the California courts, already known for their broad interpretation of the public trust doctrine, are extending the limits of trust principles into previously uncharted areas. To fully understand this development, a brief discussion is necessary of California's development of the public trust doctrine and its rules establishing public access to and passage upon lakes and rivers.

A. *The Public Trust Doctrine in California*

The public trust doctrine has recently been the subject of renewed interest in California law. It has evolved into a basic element of modern environmental law.

Although the public trust concept was developed under the English common law, it actually dates back to Roman civil law.[122] Simply stated, the doctrine provides that certain resources are held by the sovereign in special status. Government may not alienate these resources; nor may it permit their injury or destruction by private parties. Instead, governmental officials have an affirmative duty to safeguard the long term preservation of these resources for the general public.[123]

The public trust doctrine first achieved prominence in American jurisprudence in the United States Supreme Court's decision, *Illinois Central Railroad v. Illinois*.[124] In *Illinois*, the Court invalidated the Illinois Legislature's earlier grant of Chicago's waterfront because it impermissibly alienated a public resource that was incapable of private ownership.

California law early embraced the public trust doctrine[125] and the California Supreme Court incorporated the *Illinois Central* doctrine into California law in *Oakland v. Oakland Water Front Co.*[126] The

[122] For a discussion of the historic underpinnings of the public trust doctrine, see Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 475-84 (1970).

[123] For a detailed analysis of the public trust doctrine, see Althaus, PUBLIC TRUST RIGHTS (U.S. Fish & Wildlife Service 1978); Dunning, *The Significance of California's Public Trust Easement for California's Water Rights Law*, 14 U.C. DAVIS L. REV. 357, 367-78 (1980); Sax, note 122 *supra*; Stevens, *The Public Trust: A Sovereign's Ancient Prerogative Becomes the People's Environmental Right*, 14 U.C. DAVIS L. REV. 195 (1980).

[124] 146 U.S. 387 (1892).

[125] *See, e.g.*, People v. Gold Run Ditch & Mining Co., 66 Cal. 138, 4 P. 1152 (1884); Ward v. Mulford, 32 Cal. 365 (1867).

[126] 118 Cal. 160, 50 P. 277 (1897).

13

Read carefully to note that much of
It is Federal law — applies in Arizona too

Who Owns the Waterways?

Information About Public Ownership of Oregon's Waterways

96-003-013
Gila River

ORIGINAL

OREGON DIVISION OF STATE LANDS

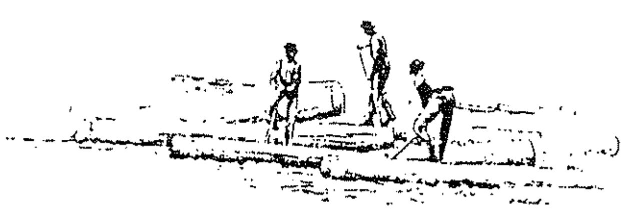
RECEIVED 6-10-97

INTRODUCTION

Waterways--lakes, rivers, and streams--are vital to our Oregon quality of life. Historically, they were trade routes for Native Americans; pathways for explorers and pioneers; and highways of commerce for timbermen and steamboats. Great runs of salmon and steelhead populated our rivers. Beavers were abundant and created complex wetland systems in the river valleys. With plenty of space and abundant resources, knowing who owned our waterways did not seem important.

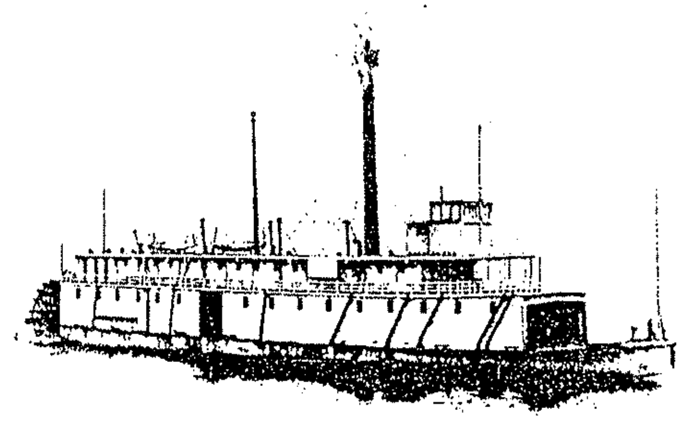
Today, our waterways continue to "work" for us by providing sand and gravel, hydroelectricity, storage, surface space, water quality treatment, and transportation routes. They provide "play" places for us, too, as we swim, fish, hunt, camp, picnic, and boat. In some cases, our waterways are our "boundaries" separating states, counties, cities, and neighbors. With increasing population demands, limited natural resources, and differing values, we now require answers to the question, "Who owns the waterways?"

This brochure, prepared by the Oregon Division of State Lands with assistance from the Oregon Department of Justice, attempts to give clear answers to some of the complex and perplexing questions of waterway ownership. *If you have questions about this publication or seek additional information about state ownership of Oregon's waterways, contact the Oregon Division of State Lands at 378-3805.*



Q. Which waterways do the people of Oregon own?

A. With few exceptions, the people of Oregon own the bed and banks under all navigable streams, rivers, and lakes (commonly referred to as submerged and submersible land) up to the ordinary high water line. Navigable waterways include all tidelands.



Q. How did the people come to own these submerged and submersible lands?

A. Under the Equal Footing Doctrine, federal courts have held that states entering the Union have the same rights as the original thirteen states. When the original thirteen states took sovereignty of their land from the British after the American Revolution, those states became owners of the land underlying navigable waters. Therefore, when Oregon was admitted to the Union in 1859, it became the owner of all land underlying navigable waterways within its borders as a part of its sovereignty.

Q. What does the term "navigable" mean?

A. Federal courts have developed the following test to determine whether a waterway is "navigable":

1) The waterway must be capable of or susceptible to use as a highway for the transportation of people or goods;

2) Transportation must be conducted in customary modes of trade and travel on water;

3) Waters must be navigable in their natural and ordinary condition; and

4) Navigability is determined as of the date of statehood (February 14, 1859).

The courts have determined that the use or potential for use of almost any type of watercraft is sufficient to determine navigability. The use did not have to occur in 1859; it is enough that it could have occurred (i.e., susceptability). Historical uses that no longer exist can also help prove a waterway is navigable (e.g., log drives, steamboats, ferries).

For example, the McKenzie River case, decided by the U.S. Court of Appeals in 1982, confirmed that log drives and commercial tourism (i.e., drift boat fishing guides) were sufficient evidence to prove navigability and, therefore, state ownership to the river's bed and banks. The State of Oregon uses all of these criteria to support the public's claim of waterway ownership.

Q. How does the state determine which waterbodies are "navigable" and, therefore, publicly owned?

A. The Division determines the public's ownership claim to each waterway on a case by case basis. The determination is made by applying the federal court standards within the funding constraints of the agency. The opportunity to make a determination may happen as a result of such activities as a bridge project, a marina, a gravel mining operation, or conflicts between recreationists and upland land owners.

Q. Who makes the final decision on whether or not a waterway is "navigable?"

A. The Division makes the initial factual determination based on the weight of the evidence. Ultimately though, only the courts can make the final determination. As a result of a Division of State Lands' (DSL) decision, a lawsuit was filed and, in 1982 the McKenzie River case was decided by the U.S. Court of Appeals.

Q. Can a person navigate over the surface of water where the underlying lake or streambed is privately owned?

A. Yes. According to Oregon court cases, the public has the right to navigate on waters where the bed is privately owned. This may not, however, include the right to wade or otherwise use the beds and banks, or to trespass on privately-owned uplands.

Q. Do other government agencies use the term "navigable?"

A. Yes. Even though the term is the same, the meaning and usage are not. Navigability relating to state ownership of the beds and banks of waterways is sometimes called "title navigability."

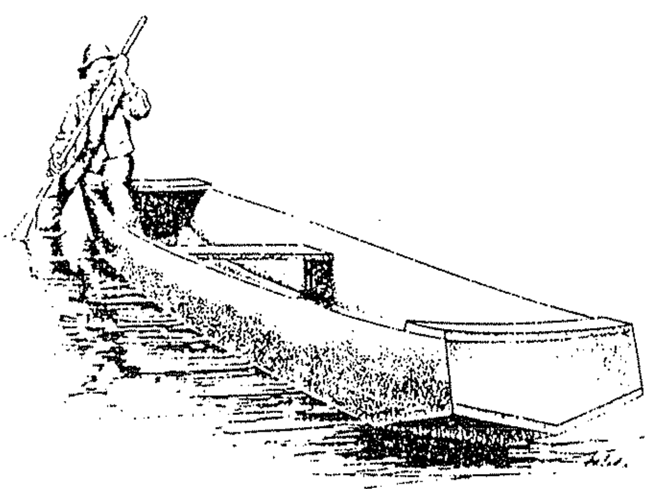
The Oregon State Marine Board uses the term "navigable waters" in order to determine its jurisdiction to regulate the operation of boats and to promote boating safety.

The U.S. Army Corps of Engineers also uses the term "navigable waters" which stems from the federal Rivers and Harbors Act of 1899. This Act, along with associated federal regulations, determines the Corps' jurisdiction over the alteration of waterways. Similar regulations direct the U.S. Coast Guard. "Navigable waters" are also defined in the Clean Water Act as areas subject to the Corps' regulatory authority over filling in waterways.

None of these definitions are the same as the definition federal courts have used to determine "title navigability" or ownership of beds and banks of waterways.

Q. How do the Land Board and DSL manage these public lands?

A. The Land Board and DSL hold these lands in trust for the public (under the "Public Trust Doctrine"). DSL administers the program to clarify title and manage uses of these lands for the Land Board. These lands are managed in the public interest to assure that any authorized private uses (e.g., marinas, docks, log rafts, gravel mining) pay their fair share as compensation for the use of public land. All income from the use of these lands is deposited into the Common School Fund.



Q. What is the Public Trust Doctrine?

A. This doctrine of law provides that the State of Oregon holds public land (i.e., submerged and submersible land) in trust for the benefit of all the people. The general public has a right to fully enjoy these resources for a wide variety of public uses including navigation, recreation, and fisheries.

Q. Did the state ever grant any of its submerged and submersible land to private owners?

A. Yes. In the late 1870's, the Oregon State Legislature granted certain submersible lands (between ordinary low and high water) to the upland owners along several major Oregon rivers--the Willamette, Umpqua, Coquille, and Coos Rivers. This program was repealed in 1878. As a result of the grants, some present upland owners along these particular rivers do have ownership down to ordinary low water. In addition, along some other rivers, the state sold tidelands and other submersible land to private owners. Even where the state granted title to its submerged and submersible land to private individuals, the lands are still subject to some public use under the Public Trust Doctrine.

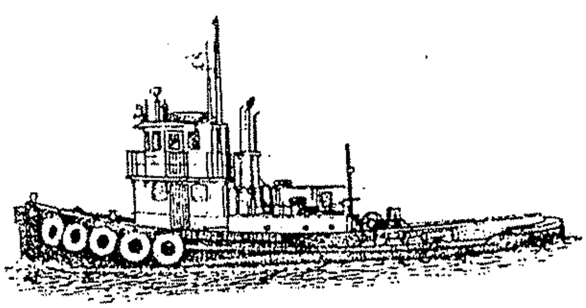
Q. Is there any other way a private individual could have ownership of the bed of a navigable river?

A. No. Even a grant from the federal government purporting to convey title to a private individual prior to Oregon's statehood may not have conveyed ownership. Rivers sometimes change course suddenly due to floods or other natural events, however, and this may affect ownership of the riverbed.

Q. What if the current property owner's deed reads to the middle of the river?

A. Since a deed can only convey interests actually owned by the seller, and since the beds and banks of all navigable rivers were given to the state at statehood in 1859, it is likely that the state is the only true owner. The state's right to ownership is a "prior existing right" and is frequently mentioned as such on the deeds. Somewhere along the chain of property transactions, a deed may have been changed to include the riverbed from ordinary high water to the middle of the river. Unfortunately, if this happened it was likely done incorrectly.

Q. Is it possible that a waterfront property owner could be paying taxes on submerged or submersible land under navigable waters?



A. Yes. It is possible—but shouldn't be so. Carefully check your current property tax report from your county assessor. It may show that you are being taxed only on the upland (i.e., land above ordinary high water) and the remainder, though within your tax lot, is not taxed at all.

If you still have questions, contact your assessor or an attorney. In the event you have been taxed for property not owned by you, it is possible to recover past taxes paid on that area (see ORS 311.206). The Division of State Lands can also provide written determination of the state's ownership claim to the waterway.

Keep in mind that if a waterway is navigable, state ownership would normally extend to the ordinary high water line.

Q. Do private upland property owners along navigable rivers have any special rights?

A. Yes. In addition to the rights of ordinary property owners, ORS 274.040 grants owners whose land abuts or fronts state-owned submersible land, a preference right to lease the adjacent state-owned land, should the state decide to lease the public land.

A waterfront owner may also construct a small, flat personal-use dock or float (of 200 square feet or less) without having to obtain a lease from DSL. The dock or float must be registered (at no cost) with DSL. In addition, any facility that meets the legal definition of a "wharf" is also exempt from leasing. Beyond the preference, wharf and dock rights, the riparian owner does not have any greater rights to use state-owned land than any other member of the public.

ALSO, NO PERSON HAS THE RIGHT TO USE YOUR LAND WITHOUT YOUR PERMISSION (e.g., fishing, camping).

Q. Does the state's ownership of land underlying navigable water affect water rights?

A. No. There is no effect on valid water rights. Navigability is a land ownership issue: it does not affect the water itself. If a water right is obtained from the Oregon Water Resources Department, an easement must also be obtained from DSL for placement of the water diversion facility if it is located in a navigable waterway. In addition, a state removal/fill permit may be required.

Q. What can be done if someone is abusing the public's land within a navigable waterway?

A. Littering, illegal fires, offensive behavior, and other such abuses of public land need to be controlled or prevented. Contact your local police, sheriff's office or State Police for assistance. Because DSL has limited resources, public education and cooperation are stressed to resolve problems.

14

Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

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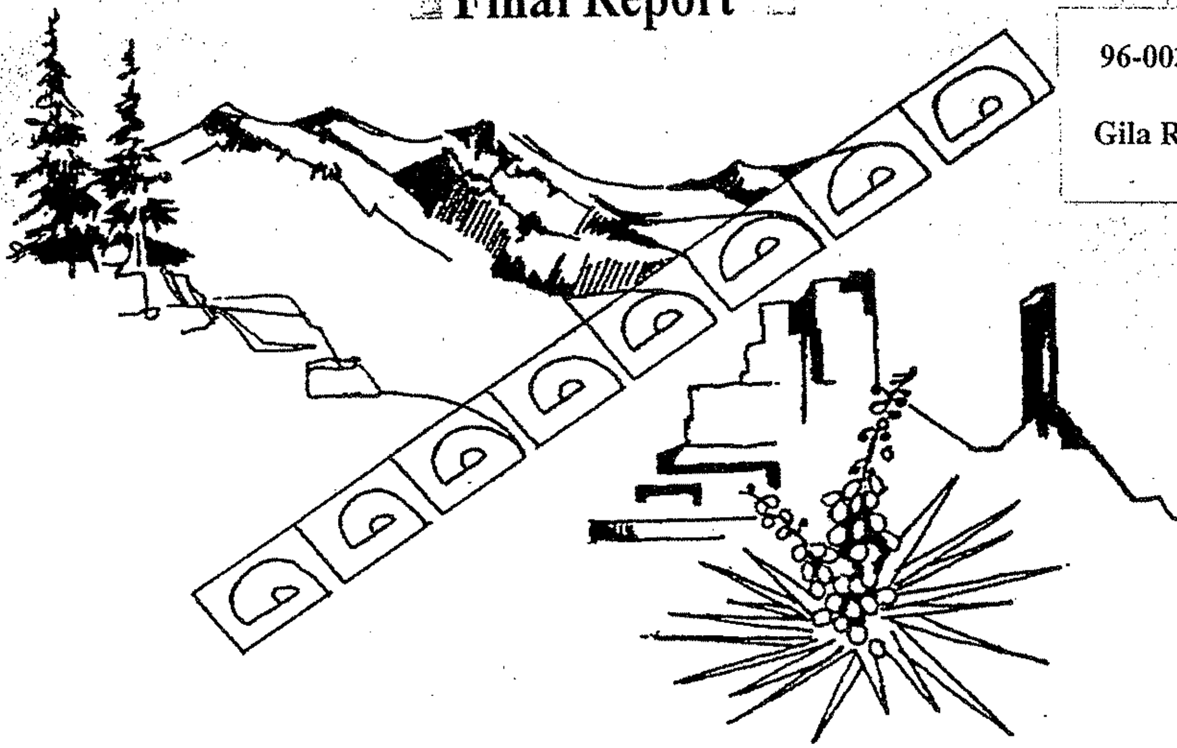
San Francisco
River

ORIGINAL

Final Report

96-003-014

Gila River



Prepared by

SFC Engineering Company

In Association With

George V. Sabol Consulting Engineers, Inc.

JE Fuller/Hydrology & Geomorphology, Inc.,

and

SWCA, Inc. Environmental Consultants

August 1997

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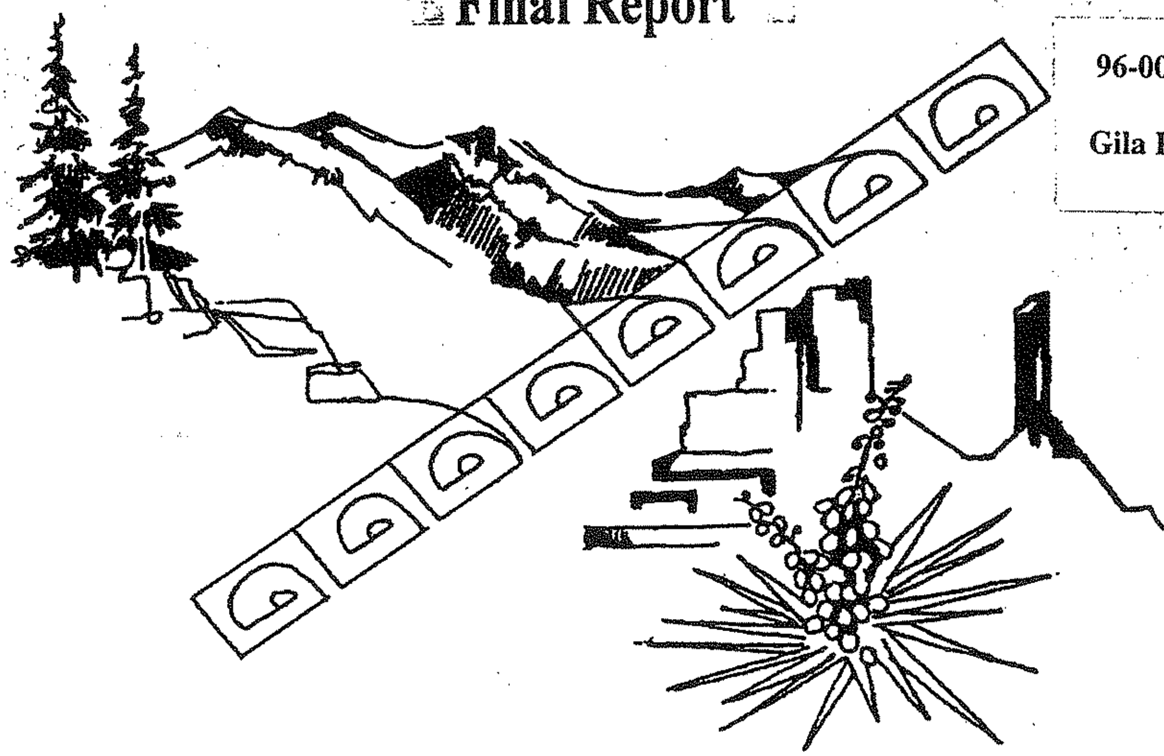

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UPPER GILA RIVER & SAN FRANCISCO RIVER FINAL REPORT

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PREFACE

This report was prepared under contract to the Arizona State Land Department (ASLD) Drainage & Engineering Section. The report summarizes information relating to the navigability or non-navigability of the Upper Gila River and San Francisco River as of the time of Arizona statehood on February 14, 1912. This report documents information for two river reaches: (1) the Upper Gila River from Safford to the Arizona/New Mexico border and (2) the San Francisco River from its confluence with the Gila River to the Arizona/New Mexico border. The information presented in this report is intended to provide data and evidence to the Arizona Navigable Stream Adjudication Commission (ANSAC). ANSAC will use these data to make findings and recommendations to the Arizona Legislature as to the navigability or non-navigability of the Upper Gila and San Francisco Rivers. This report does not make a recommendation or draw any conclusions regarding title navigability of the Upper Gila and San Francisco Rivers.

The report consists of several related sections. First, an archaeological overview of the Upper Gila and San Francisco Rivers relating to river uses is presented to set the long-term context of river conditions and river uses. Second, a historical study of the periods prior to and including statehood are discussed with respect to documented uses of the rivers, typical modes of transportation, and descriptions of river conditions. Third, the historical geomorphology and hydrology of the Upper Gila and San Francisco Rivers are summarized to illustrate past and potential flow conditions in the river. Finally, land use information is described and presented in a GIS format.

The Upper Gila River Navigability Study was performed by a project team consisting of SFC Engineering Company (SFC) in association with JE Fuller/ Hydrology & Geomorphology, Inc. (JEF), and SWCA, Inc., Environmental Consultants (SWCA). This study was completed on behalf of the ASLD (Contract #A5-0092) as directed by Arizona Revised Statutes 37-1124. Project staff included V. Ottozawa-Chatupron, ASLD, Project Manager; George V. Sabol, SFC, Project Principal; P. Deschamps, SFC, Project Co-Manager; J. Fuller, JEF, Project Co-Manager and hydrologist/geomorphologist; D. Gilpin, SWCA, historian; M. Cederholm, SWCA, GIS specialist.

A glossary and list of acronyms are provided at the end of this report.

Executive Summary

SFC Engineering Company, in cooperation with JEFuller/ Hydrology & Geomorphology, Inc., SWCA Environmental Consultants and the Arizona Geological Survey (AZGS), was retained by the Arizona State Land Department (ASLD) to provide information to the Arizona Stream Navigability Adjudication Commission (ANSAC). ANSAC will use information provided by the project team to help make recommendations of navigability or non-navigability for the Upper Gila and San Francisco Rivers to the Arizona Legislature. This report provides information on the Upper Gila River between Safford and the Arizona/New Mexico border, and the San Francisco River from its confluence with the Gila River to the Arizona/New Mexico border.

The basic approach to this study was to develop a database of information to be used by ANSAC in making their recommendation of navigability or non-navigability to the Arizona State Legislature. Because the State's definition of navigability includes both actual navigation and susceptibility to navigation, the data collection effort was directed at two areas:

- Historical Uses of the River. Data describing actual uses of the river as of the time of statehood were collected to help answer the question, "Was the river used for navigation?"

- Potential Uses of the River. Data describing river conditions as of the time of statehood were collected to help answer the question, "Could the river have been used for navigation?"

Specific tasks for the study included agency contact, a literature search, summary of data collected from agencies and literature, and preparation of a summary report. The objectives of the agency contact task were to inform community officials of the studies, to obtain information on historical and potential river uses, and to obtain access to data collected by agency personnel on the Gila River. For the latter task, public officials from communities located within the study reach were contacted. The objective of the literature search was to obtain published and unpublished documentation of historical river uses and river conditions. Information collected from agency contacts was supplemented by published information from public and private collections.

The literature search focused on five subject areas: (1) Archaeology, (2) History, (3) Hydrology, (4) Hydraulics, and (5) Geomorphology. Archaeological data augment the historical record of potential river uses at statehood by providing an extended record of river conditions, use of river water, climatic variability, and cultural history along the rivers. Historical data provide information on actual river uses as of the time of statehood, but also provide anecdotal information on whether river conditions could have supported certain types of navigation. SWCA historians prepared a report summarizing use of the river and adjacent area in historic times, with special emphasis on the establishment, growth, and development of towns, irrigation systems, commercial activities, and developments. The hydrologic/hydraulic data are the primary source of information regarding susceptibility to navigation. These data include estimates of flow depths, width, velocity, and average flow conditions at statehood, based on the historical streamflow estimates, and records of natural stream conditions at statehood, and records of existing stream conditions. Geomorphic data provide information relating to river stability, river conditions at statehood, and the nature of changes to the river since the time of statehood. Another element of the study was collection of land use information. Land use data were compiled for the Gila and San Francisco Rivers and were entered in a GIS database. Land use data included existing title records from county assessors offices, FEMA floodplain delineations, and state and federal land leasing records from ASLD.

The data collected was organized into six main subject areas: archaeology, history, geology, hydrology, and land use. Archaeological studies of the Upper Gila and San Francisco Rivers in Arizona have been fairly limited, although it is known that the Gila River played a major role in the human settlement patterns and occupational success of prehistoric development within the study area. The rivers provided a permanent water source, fish that were used as a protein source, and a riparian corridor that was rich in building materials, wildlife and vegetation. Therefore, most prehistoric habitations in the study area were close to the rivers. Although archaeologists have documented some 11,000 years of human use in southeastern Arizona, most of the archaeological sites in the study area date to the period from about 50 BC to AD 1200 when farmers of the Mogollon archaeological culture lived in the area. The Mogollon farmers lived in farmsteads and hamlets of as many as 20 rooms scattered along the Gila River and in the vicinity of Clifton, on the San Francisco River. In addition to the riverside farming communities, campsites and specialized activity sites have been identified throughout the uplands adjacent to the rivers. In the early historic period (circa AD 1540-1870) the area was occupied by the Yavapai and Apache, who lived primarily by hunting wild animals and gathering wild plants. Their sites consist primarily of rock overhangs, agave-roasting features, and campsites.

Except for the lower portion of the Upper Gila River near Safford, there is no evidence of extensive prehistoric irrigation agriculture on the Upper Gila and San Francisco Rivers, as was documented for the Lower Gila River, probably due to the lack of a wide floodplain and arable land area along the rivers. Given that the water supply in the Upper Gila and San Francisco River study area was sufficient to support an extensive canal system and agricultural economy near, and downstream of, Safford, lack of water probably cannot explain the lack of archaeological evidence of prehistoric irrigation agriculture. Archaeological reconstructions suggest that streamflow rates changed little from the AD 740 -1370 period to the AD 1800-1979 period. Archaeological research has not documented any use of the river for commercial trade and travel or any regular flotation of logs.

Historical records of the Upper Gila and San Francisco Rivers extend back to the Spanish explorations of the Southwest during the 1500's. The Spanish are thought to have named the Gila River the "Rio de Los Balsas" (River of Rafts), either because their army was forced to cross the river in rafts, or because of the Indians' use of wicker baskets to cross the river. By the 1820's, Mexico had won its independence from Spain, and American fur trappers such as James Ohio Pattie, Ewing Young, and Kit Carson explored the Upper Gila and San Francisco Rivers, trapping beaver along the rivers, and establishing a travel route into Arizona. These early trappers traveled primarily on horseback or on foot in the study area, although their records indicate that they built and used canoes and rafts when they reached the Colorado River downstream of the study area. The American military expedition of Stephen Watts Kearny and William Emory in 1846, and Bartlett's boundary survey of 1850-1853 of the Gadsden Purchase, included explorations of the Upper Gila and San Francisco Rivers. Later expeditions through Arizona abandoned the Gila River route of the trappers and the military for Cooke's less difficult route located to the south of the study area.

Discovery of copper deposits by Cavalry troops along the San Francisco River during the Apache wars of the 1870's led to establishment of the Clifton-Morenci mining district. With the Apache threat subdued, and the economic incentive for development provided by copper mining, Euro-American settlement of the Upper Gila River occurred, and with it development of farms and ranches to supply the mines, roads and railroads, and a number of small towns. A Bureau of Census map from 1901 shows most of the Gila Valley was irrigated above the confluence with the San Francisco River, but only a small portion of the San Francisco River near Potter's Ranch above Clifton was irrigated. By 1922, there were about 54 miles of main irrigation canals watering about 4,500 acres of farmland along the Upper Gila River.

Although there is some historical evidence that small boats were used on both the Upper Gila and San Francisco Rivers, transportation in the region was typically by horse, mule, wagon, stagecoach, or rail. A railroad spur was constructed to Clifton by 1883 to transport copper ore, which had previously been shipped by oxen and mule teams. A cattle trail from New Mexico followed the channel of the San Francisco River to the Gila River, and then downstream along the Gila River to other parts of Arizona. This trail remained a popular jeep and four-wheel drive route during low flow months, until the route was recently closed by the U.S. Forest Service to protect the habitat of the endangered Loach Minnow. During the period around statehood, river crossings near Clifton were accomplished by means of swinging bridges (foot bridges) or railroad. Horses, wagons and others had to ford the river.

Several episodes of boating the Upper Gila and San Francisco Rivers were documented during the historical period, in additional to the possible Indian boating noted by the Spanish explorers. The Chiricahua Apaches of the region were known to construct boats made of bull hides stretched over wooden frames for crossing streams, although no instances are specifically recorded for the Upper Gila and San Francisco Rivers. Several persons used canoes or unspecified small boats to float down the entire length of both rivers around the time of statehood. G.W. Evans and Amos Adams floated from Clifton to Riverside (near Florence) in January-February of 1895 in an unspecified type of small boat, and did not report any difficulties until well downstream of Safford. Stanley Sykes used a canoe to float the entire length of the Gila River in Arizona in 1909. Early residents of Clifton reported that building rafts for use on the San Francisco River was a popular pastime for children during the period immediately following Arizona statehood. During recent years, recreational boating has become a popular pastime on both the Upper Gila and San Francisco Rivers, especially during the winter and late spring. No evidence of boating in the upstream direction, sustained commercial boating operations, ferries, or use of keel boats or other powered boats was identified.

Early descriptions of the Upper Gila and San Francisco Rivers do not differ significantly from contemporary descriptions of the rivers. Bartlett (1854) believed that Gila River was not navigable, except during irregular floods. During these "floods" Bartlett felt that flat bottom boats could pass to the Salt River confluence near Phoenix. Whipple (part of the Bartlett survey) felt that the Gila River was an impracticable route for a wagon or railroad route due to its narrow canyons in some reaches. The San Francisco River was described as usually "relatively shallow" flowing over a wide expanse of white sand and reeds. It has steep-walled canyons with a relatively flat floodplain averaging 300-600 feet wide. The permanent stream width was generally less than 30 feet, which meanders across the floodplain. The low flow channel position changes during each flood, creating cut banks and leaving gravel bars. Floods fill the canyon from wall to wall. The Upper Gila was described as a perennial stream, often narrow and shallow enough to travel down the riverbed, except in the impassable (to vehicles) canyons. The river corridor supported a variety of species including beaver, quail, geese, ducks, deer, wolves, coyotes, and fish.

The study area was sparsely populated throughout the historical period, much as it is today. Clifton, at its peak of mining activity in 1910, had a population of about 5,000 (1993 pop. = 3,000). Several small farming and ranching communities grew up along the Upper Gila River to serve the mining community at Clifton. Much of the study is now located within the Apache-Sitgreaves National Forest or is managed by the Bureau of Land Management. Historical uses of the Upper Gila and San Francisco Rivers included limited agriculture supported by irrigation diversions from the rivers, municipal and industrial consumptive uses, recreation, and hunting, gathering, and fishing by Indians prior to the Apache wars.

The geomorphology of the Upper Gila and San Francisco Rivers is substantially unchanged from its condition at or before statehood in most of the study area upstream of the Safford Valley. Most of the Upper Gila and San Francisco Rivers are formed within bedrock canyons. Bedrock along the channel margins in these canyons precludes significant movement of the river channel or other channel changes. In addition, the bedrock geology of the Upper Gila and San Francisco Rivers area made access to the river difficult during the period around statehood, prevented development of extensive irrigation systems, and prevented the development of large population centers near the river. The reach of the Gila River located downstream of the Gila Box widened significantly around the time of statehood in response to large floods, and changed from a narrower, tree-lined river to a wide braided floodplain. Ordinary high and low watermarks may be defined based on existing topographic, vegetative, and soil characteristics.

The Upper Gila and San Francisco Rivers are perennial streams which, except for numerous irrigation diversions, have remained free-flowing since they were first settled in the 1870's. Flow rates within the study reaches probably have not changed significantly since the time of statehood. River flows have been reliable enough over the past 120 years to support irrigation-based agriculture in the Duncan Valley at the upstream end of the Upper Gila River reach, as well as a more extensive irrigation-based farm economy in the Safford Valley downstream of the study area.

As early as 1899, there were 45 diversions in the Duncan and Safford Valleys. The combined capacity of the early diversion canals and ditches was enough to divert all the flow from the Gila River during the peak irrigation season in reaches with irrigated agriculture. Available diversion data for the San Francisco River are sparse; however, even small diversions from the San Francisco River could have had a measurable impact, given the typical low average flow rates during seasons when high irrigation demand coincides with seasonal low flow. Under natural conditions, the Upper Gila River would rarely have had no-flow days, but could have experienced annual periods of low flow during June and July.

Streamflow data gathered for the Upper Gila and San Francisco River study indicate that:

- The Upper Gila River is a naturally perennial stream. The average annual discharge for the Upper Gila River varies from about 200 cfs to 430 cfs in the study reach. The minimum monthly average flow ranges from about 15 cfs to 100 cfs within the study reach, and typically occurs during the month of June.

- The San Francisco River is a naturally perennial stream. The average annual discharge for the San Francisco River varies from about 90 cfs to 215 cfs. The minimum monthly average flow ranges from about 13 cfs to 53 cfs, and typically occurs in the month of June.

- The long-term flow record demonstrates that the Upper Gila River and the San Francisco Rivers are susceptible to wide seasonal and annual variations in discharge rates.

The average annual discharge rates are only equaled or exceeded 20% of the time on the Upper Gila and the San Francisco Rivers. Therefore, the average annual discharge rate may not be as representative of "typical" flow conditions as the median (50%) flow rate or the 90% flow rate, which may give a better indication of their susceptibility to navigation. Long-term median flow rates for the Upper Gila River vary from about 66 cfs to 174 cfs between the Arizona/ New Mexico border and Safford. The long-term median flow rate for the San Francisco River varies from about 32 cfs to 76 cfs between the Arizona/ New Mexico border and the Gila River confluence. Flow depths and widths for the Upper Gila and San Francisco Rivers are shown in Table E-1.

Table E-1
Upper Gila River and San Francisco River Flow Characteristics

Frequency	Discharge (cfs)	Hydraulic Depth (ft)	Average Velocity (ft/sec)	Top Width (ft)
Gila River Near Virden, NM - Upstream End of Study Reach (Duncan Valley)				
90 % Flow	21	0.6	1.3	27
Median (50%) Flow	91	0.9	2.2	45
Mean Annual Flow	190	1.2	1.6	100
2-Year Flood	4,980	5.5	8.5	107
5-Year Flood	10,400	7.5	12.6	110
Gila River Near Clifton/Guthrie, AZ - Midpoint of Study Reach (Gila Box)				
90 % Flow	18	0.7	1.0	26
Median (50%) Flow	80	1	1.7	47
Mean Annual Flow	206	1.3	2.5	64
2-Year Flood	5,940	3.7	11.5	140
5-Year Flood	11,500	5.5	14	150
Gila River at Safford Valley, Near Solomon, AZ - Downstream End of Study Reach (Safford Valley)				
90 % Flow	62	0.8	0.5	144
Median (50%) Flow	174	1.3	0.9	146
Mean Annual Flow	433	1.9	1.5	150
2-Year Flood	9,400	6.7	8.8	160
5-Year Flood	22,900	11	11.6	180
San Francisco River at Clifton - Entire Study Reach				
90 % Flow	34	0.9	1.4	28
Median (50%) Flow	76	1.0	1.6	49
Mean Annual Flow	215	1.2	2.5	72
2-Year Flood	6,800	4.5	10.1	150
5-Year Flood	17,800	8.5	13.7	153

According to various federal agency criteria for recreational use of water crafts, and according to long-term gauge records, which demonstrate highly variable flow rates on an annual basis, the Upper Gila River and the San Francisco River would have been susceptible to navigation by low-draft boats on an annual and seasonal basis, respectively. Nevertheless, canoes, small rafts, and kayaks could have navigated some portions of the Upper Gila River and the San Francisco River during the lowest flow months, as well as during flows up to and exceeding the 5-year recurrence interval. Neither the Upper Gila River, nor the San Francisco River would have been susceptible to reliable navigation by larger boats such as powered barges, steamboats, keel boats, etc., due to the occurrence of rapids, high velocities, low flow depths, long narrow canyons with no access to safe landings, natural and man-made obstructions such as riffles and irrigation diversion structures.

The Upper Gila and San Francisco Rivers were used for recreational boating as of the time of statehood. Historical hydrologic conditions in the Upper Gila and San Francisco Rivers probably would have met current federal criteria for some types of recreational boating, for most of the year. No evidence of boating in the upstream direction along the Upper Gila and San Francisco Rivers, or use of large machine-powered boats was found. No evidence of any commercial boating industries developed on the Upper Gila and San Francisco Rivers as of 1912 was uncovered. Both rivers are currently boated for recreational purposes, primarily during the winter and spring months, with limited commercial river running operations in the Gila Box Reach. Current river running guidebooks describe the Upper Gila and San Francisco Rivers as boatable at flow rates from 150 cfs (canoes and inflatables) to 10,000 cfs (large rafts).

Under HB 2589, the Arizona Legislature defined navigability criteria that established a presumption of non-navigability to be used by ANSAC when considering evidence for specific streams. For the Upper Gila and San Francisco Rivers, the following data described in this report relate to the State's navigability criteria:

- **Commercial Trade and Travel**. As of the time of statehood, the Upper Gila and San Francisco Rivers were susceptible to limited forms of commercial trade and travel, although no evidence of such use was identified during that period by this study. The hydrologic and historical record shows that there was sufficient water in the river that would allow use of shallow water boats during regularly occurring portions of the year. Shallow water boating in the downstream direction was most feasible, given the normal conditions of the two rivers.

- **Flow Regime**. As of the time of statehood, the hydrologic record shows that the Upper Gila and San Francisco Rivers were perennial streams. That is, they flow at times other than in direct response to precipitation. Like all rivers, the Upper Gila and San Francisco Rivers respond to excess precipitation with increased flow rates, or to periods of drought with reduced flow rates. However, even during the driest portions of non-drought years, the entire Upper Gila River remains perennial despite diversion of flow by numerous irrigation diversions. The San Francisco River is perennial, but generally has lower flow rates than the Upper Gila River, and occasionally becomes dry during some years.

- **Sustained Trade and Travel Upstream and Downstream**. There was no evidence identified for this study that sustained trade and travel in boats ever occurred on the Upper Gila and San Francisco Rivers, nor is there evidence that trade or travel in boats in the upstream direction ever occurred. However, the hydraulic rating curves indicate that some types of boat traffic could have occurred both upstream and downstream during regularly occurring portions of the year, although upstream travel would have been more difficult than downstream travel. The channel and canyon of the San Francisco River were used a travel route by land vehicles, cattle and horses in both directions throughout the historical period. Portions of the Upper Gila River were used as an overland travel route by the early explorers of Arizona.

- **Profitable Commercial Enterprise**. There was no historical evidence identified for this study that any profitable commercial enterprises were conducted on water using the Upper Gila or San Francisco Rivers for trade and travel as of the time of statehood. Recently, several commercial rafting and floating outfitters have operated seasonal trips in the Arizona/Gila Box of the Upper Gila River downstream of the State Route 191 crossing.

- **Types of Vessels**. The historical record indicates that canoes, rafts, and unspecified floating boats were the only vessels to be used on the Upper Gila and San Francisco Rivers. Keelboats and other powered barges apparently were not used on these rivers, nor is it likely that river conditions would have supported such use. The hydraulic rating curves prepared for the study reach indicate that large keelboats, steamboats or powered barges could not have been used during the low flow conditions on the river as it existed in 1912. During high flows, high velocities and river conditions may have made use of these types of high-draft boats hazardous or impractical.

- **Diversions**. Small irrigation diversions occur throughout the Upper Gila River, and were begun prior to statehood. Several small irrigation dams are found along the Upper Gila River in the study reach. It is not known whether the irrigated lands along the Upper Gila and San Francisco Rivers were covered under the Desert Land Act of 1877. None of the irrigated lands are within Indian Reservations.

- **Recreational Boating**. All of the historical accounts of boating on the Upper Gila and San Francisco Rivers indicate that boating was conducted for recreational purposes. Today, recreational boating on the Upper Gila and San Francisco Rivers is popular, particularly during higher flow periods in the winter and late spring.

- **Regular Flotation of Logs**. Floating of logs may have been possible during portions of most years on the Upper Gila and San Francisco Rivers as of the time of statehood, although irrigation diversions and narrow canyons may have created obstacles to continuous transport. There is no evidence that logs were floated on either river during any period before or after statehood.

- **Impediments to Navigation.** Small irrigation dams were the only known non-natural impediment to navigation in the Upper Gila and San Francisco Rivers that existed in 1912. Rapids in the Upper Gila and San Francisco Rivers are not considered challenging obstacles at flow rates less than 500 cfs, although some Class III rapids (boatable with maneuvering) occur in the Gila Box reach at flow rates over 3,500 cfs.

- **Customary Modes of Transportation**. The customary mode of transportation in the region near the Upper Gila and San Francisco Rivers was not by boat. By 1912, alternatives to boat travel included foot, horse, mule train, wagon, and train.

- **Rivers and Harbors Act of 1899.** The Upper Gila and San Francisco Rivers are not listed under the Rivers and Harbors Act of 1899.

Section 1

Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

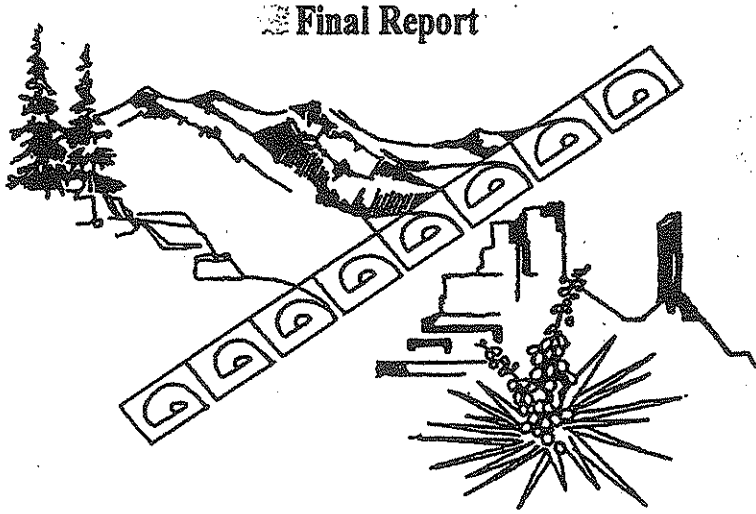
Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

Final Report



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UPPER GILA AND SAN FRANCISCO RIVERS FINAL REPORT
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INTRODUCTION

SFC Engineering Company (SFC), in association with JE Fuller/ Hydrology & Geomorphology, Inc. (JEF), and SWCA, Inc., Environmental Consultants (SWCA) was retained by the Arizona State Land Department (ASLD) to provide information to the Arizona Navigable Stream Adjudication Commission (ANSAC). ANSAC will use the data and evidence provided by the SFC project team to assist their effort toward making findings and recommendations to the Arizona Legislature as to the navigability or non-navigability of the Upper Gila and San Francisco Rivers as of the time of statehood.

This report provides information on the Upper Gila River between Safford and the Arizona/New Mexico border, and the San Francisco River from its confluence with the Gila River to the Arizona/New Mexico border. No recommendation or conclusion regarding title navigability of the Upper Gila or San Francisco Rivers is made in this report. The report consists of several related sections:

Section 1 - General information is provided by the study team regarding the project background, the definition of navigability, the study reach limits, the objectives of the project, and the method of approach;

Section 2 - An archaeological overview of the Upper Gila River valley prepared by SWCA relates to river uses and sets the long-term context of river conditions;

Section 3 - A historical review by SWCA addresses the periods prior to and including statehood with respect to river uses, modes of transportation, and river conditions;

Section 4 - The historical geomorphology of the Upper Gila River evaluated by JEF estimates river conditions and changes since statehood;

Section 5 - The hydrology of the Upper Gila River evaluated by JEF estimates flow rates and conditions at statehood and for existing conditions;

Section 6 - A review of information on boating criteria and use of the river for various types of boating was summarized by JEF;

Section 7 - Historical and current land use information compiled by SWCA is described and presented in a GIS format;

Section 8 - The results of the Upper Gila River study most pertinent to the legislatively mandated criteria of navigability or non-navigability are summarized.

A list of references cited, as well as an extended bibliography where appropriate, is included in each section. Appendices contain supporting documentation and the GIS work products. A glossary of terms and a list of acronyms used in the report are provided.

Project Background

Public Trust principles date back to English Common Law when the King held the beds of rivers affected by tides in Trust for the general public and for the public good. This provision was founded on the principle that there is a public need to use navigable waterways for commerce. When the United States gained independence from the British Crown, Public Trust principles were recognized so that the lands beneath navigable waters within the original thirteen states became the sovereign property of those states. The Equal Footing Doctrine provided that future states were entitled to sovereign ownership of riverbeds located within those new states on an "equal footing" with the original thirteen states.

At the time of statehood on February 14, 1912, the State of Arizona received sovereign title to the beds of navigable rivers located within state boundaries. Under the Equal Footing Doctrine, the United States government previously held these lands in Trust pending the creation and admission of the State of Arizona to the Union. Although the State owned the land, in order to perfect title to the navigable streambeds, the State was required to make its claim of ownership. From statehood until the mid-1980's, Arizona claimed only the bed of the east half of the Colorado River. The State failed to act on any other claims of streambed ownership, and other parties asserted title to certain streambeds lands. In assuming ownership of lands located in or near these streambeds, many of the current record title holders constructed projects and improvements to the land, paid property taxes, and altered the stream ecosystems and riparian habitat.

During recent years, the State, as well as a number of private and public entities, asserted claims of ownership of streambeds throughout Arizona. These claims may or may not be valid, depending in part on whether or not the streams were navigable or susceptible to being navigable as of the time of statehood. As a result, the titles held by land owners whose property includes all or a portion of the streambed of potentially navigable streams are clouded. As a result of litigation addressing in-stream sand and gravel mining activities in the Verde River, the Arizona Legislature recognized the economic hardships created by the uncertainty of the State's potential future claims on streambed lands. In 1987, House Bill (HB) 2017 was passed outlining a procedure by which the State could quit claim any interest in the beds of the Gila, Salt, and Verde Rivers for a nominal fee. HB 2017 also reaffirmed the State's claim to the Colorado River, and waived any claim to all of the other streambeds in the State. The Center for Law in the Public Interest filed suit and challenged the constitutionality of HB 2017. The State Supreme Court upheld the suit in 1991 and found that HB 2017, among other things, did not provide for an evaluation of the validity and value of the State's Public Trust interest in streambed lands along the individual watercourses.

In 1992, the Governor signed HB 2594 which repealed HB 2017 and established a systematic administrative procedure for gathering information and determining the extent of the State's ownership of streambeds. The main purpose of the legislation was to confirm State ownership in Public Trust lands located in the beds of streams determined to have been navigable as of the time of statehood. HB 2594 also created the Arizona Navigable Stream Adjudication Commission (ANSAC), a five member board appointed by the Governor. ANSAC was directed to establish administrative procedures, hold public hearings, and make determinations of navigability or non-navigability for specific watercourses. The legislation also directed the Arizona State Land Department (ASLD) to facilitate determination of navigability and to act as support staff for the ANSAC.

In early 1994, HB 2589, which amended Arizona Revised Statutes (A.R.S.) §§37-1101 through 37-1156, was adopted. HB 2589 set the criteria to be used for determination of navigability and non-navigability and established an ombudsman office to represent the interests of private property owners in proceedings involving governmental action. HB 2589 requires the ANSAC to set priorities for investigating and conducting hearings on watercourses within this state, and then to report its recommendation to the Legislature as to which watercourses or reaches of watercourses were navigable or non-navigable as of the time of statehood. Upon consideration of the ANSAC recommendation, the Legislature then makes a finding and enacts appropriate legislation in response to the determination. HB 2589 was codified as A.R.S. §§37-1101 through 37-1156, and is included in Appendix A of this section of the report.

Definition of Navigability

A.R.S. §37-1101 (6) sets out the definition of "navigable" or "navigable watercourse" to be used to address the ownership of streambeds. That definition is:

> *"Navigable" or "navigable watercourse" means a watercourse, or a portion or reach of a watercourse, that was in existence on February 14, 1912, and at that time was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in the customary modes of trade and travel on water.*

The data collection effort for this study provides information that will assist ANSAC in determining if a given river meets the criteria of the statutory definition of navigability.

A.R.S. §37-1128, C. and D. itemize criteria to be considered by ANSAC in making a finding and recommendation of non-navigability:

C. The Commission shall find and recommend that a watercourse was non-navigable if, as of February 14, 1912, the watercourse either:

1) was not used or susceptible of being used for both commercial trade and travel;

2) flowed only in direct response to precipitation and was dry at all other times.

D. Unless there is clear and convincing evidence that a watercourse was navigable, it is presumed, and the Commission shall find and recommend, that the watercourse was non-navigable if, with respect to the watercourse as of February 14, 1912, any of the following applied:

1) no sustained trade and travel occurred both upstream and downstream in the watercourse;

2) no profitable commercial enterprise was conducted by using the watercourse for trade and travel;

3) vessels customarily used for commerce on navigable watercourses in 1912, such as keelboats, steamboats or powered barges, were not used on the watercourse;

4) diversions were made from the watercourse to irrigate and reclaim land by persons who made entries under the Desert Land Act of 1877, as amended (43 United States Code Sections 321 through 339), any other Federal act or to provide water to lands that are included in a Federal reclamation project or an Indian reservation that would have been inconsistent with, or impediments to, navigation;

5) any boating or fishing was for recreational and not commercial purposes;

6) any flotation of logs or other material that occurred or was possible on the watercourse was not and could not have been regularly conducted for commercial purposes;

7) there were bridges, fords, dikes, manmade water conveyance systems or other structures constructed in or across the watercourse that would have been inconsistent with or impediments to navigation;

8) transportation in proximity to the watercourse was customarily accomplished by methods other than by boat;

9) the United States did not regulate the watercourse under the Rivers and Harbors Act of 1899 (33 United States Code Sections 401 through 467e).

A.R.S. §37-1128, E. and F. itemizes criteria to be, and not to be, considered by the ANSAC in making a finding whether a watercourse was navigable:

E. In finding whether a watercourse was navigable, the Commission shall not consider:

1) waters that had been appropriated for beneficial uses on or before February 14, 1912 as being within the ordinary and natural condition of the watercourse;

2) the use of ferries to cross a watercourse;

3) fishing from the banks of a watercourse;

4) uses of the watercourse under flood conditions.

F. In finding whether a watercourse was navigable, the Commission shall consider the existence of dams and diversions of water and the impact of other human uses that existed or occurred as of the time of statehood as part of the ordinary and natural condition of the watercourse.

Project Limits

The project team collected data and information relevant to the navigability or non-navigability of the Upper Gila River from Safford to the Arizona/New Mexico border, and the San Francisco River from its confluence with the Gila River to the Arizona/New Mexico border, as shown in Figure 1.

Study Reach Lengths

The lengths of the study reaches were estimated using data reduced from the Arizona Land Information System (ALRIS) GIS database. Those data were converted to an AutoCAD drawing file and the lengths of the subreaches determined using that software program. The resulting total lengths of the study reaches are shown in Table 1.

Table 1. Study Reach Lengths

River Study Reach	Length (miles)	Length (kilometers)
Upper Gila River	73	118
San Francisco River	45	72

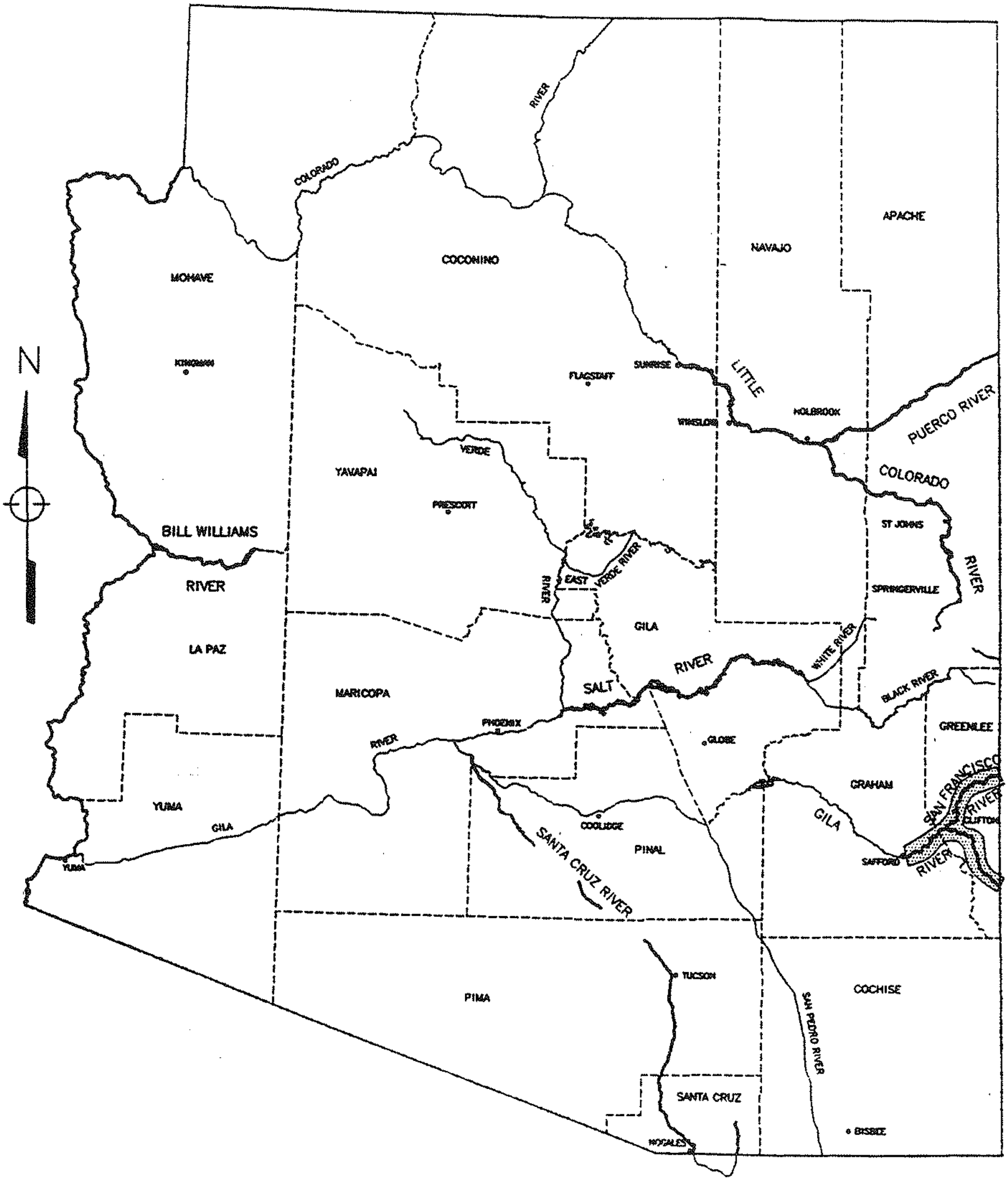

FIGURE 1

General Location Map for Arizona Stream Navigability Studies

Lateral Study Limits

The maximum lateral extent of the study limits for each study reach is the 100-year floodplain boundary. The identification of the lateral limits of the study reaches was conducted in two steps. First, a set of key maps was developed for all study reaches indicating sources of floodplain maps, topographic information, aerial coverage, and other pertinent information. The primary source of floodplain boundary delineations was the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM). Then, a GIS map layer was developed for each study reach showing the 100-year floodplain to establish the maximum lateral extent of the study limits for the purpose of information and data collection in subsequent work tasks. For those subreaches mapped by FEMA, the 100-year floodplain boundary was digitized in GIS format directly from the FIRM maps. No FEMA maps are available for those portions of the study reaches which are on Federally-owned or Indian reservation lands; therefore, no floodplain boundary delineations were generated or mapped for those subreaches due to budget limitations.

Study Objectives

The primary objective of this project is to provide information concerning the factors addressing navigability set forth in A.R.S. §37-1101 *et seq.* to assist in the determination of navigability or susceptibility to being navigable as of statehood. Specific technical goals include the following:

- Perform a literature search to identify and catalog existing historical, archaeological, hydrologic, hydraulic, geomorphic, and land use information.

- Review existing historical, archaeological, and land use information to identify and evaluate evidence of navigable uses of the study areas.

- Review existing hydrologic, hydraulic, and geomorphic materials to identify and evaluate discharge characteristics of the study reaches.

- Identify title owners, lease holders, improvements, and current uses of land located in or near the study reaches using existing information.

- Prepare reports, maps, and other information describing the results of the archaeological, historical, hydrologic, hydraulic, geomorphic, and land use investigations.

- Participate at public hearings and other public forums, as required.

In addition to the goals stated above, other identified goals that are important to the success of the streambed program include the following:

- Establish a cost-effective, streamlined procedure for data collection which can be used for future analyses of other Arizona streams.

- Implement quality control procedures.

- Develop data to a level sufficient to support legal surveys of the boundaries of navigable streams.

PROJECT METHODOLOGY

The basic approach to the stream navigability studies is to develop a database of information to be used by ANSAC in making navigability determinations. To that end, the scope of services for this study includes five main tasks:

- Agency Contact
- Literature Search
- Data Summaries
- Land Use
- Final Report

Because the legislative definition of a navigable watercourse includes both actual navigation and susceptibility to navigation, the data collection effort was focused on two areas:

Historical Uses of the River - Data describing actual uses of the river as of the time of statehood were collected. Specific tasks included agency contact and literature search.

Potential Uses of the River - Data describing river conditions as of the time of statehood were collected. Specific tasks included agency contact, literature search, and hydrologic, hydraulic and geomorphologic assessments.

Agency Contact

The objectives of the agency contact task were to inform community officials of the studies, to obtain information on historical and potential river uses, and to obtain access to data collected by agency personnel in regard to the five study reaches. For the latter task, public officials from communities, towns, cities, and counties located along the Upper Gila and San Francisco Rivers study area were contacted. Contact consisted of an initial letter describing the stream navigability study, its potential impacts on the community, and requesting information to be used in the study. Community officials were then contacted by telephone to answer questions about the study and to provide a second opportunity to provide information for the study. In addition, officials from most local, state, and federal agencies with jurisdiction or interest in the river study areas were contacted by letter or telephone.

Historians, librarians, and archivists from public and private museums, libraries, and other collections were also contacted. Letters requesting summaries of information pertaining to historical stream uses or conditions were sent to each institution, with follow-up telephone contact. Other contacts included letter and telephone requests for information from clubs, professional organizations, special interest groups, and environmental groups. In most cases, contacts led to other persons thought to have information pertinent to the study.

Literature Search

The objective of the literature search was to obtain published and unpublished documentation of historical river uses and river conditions. Information collected from agency contact was supplemented by published information from public and private collections. The literature search focused on the following main categories:

- Archaeology
- History
- Hydrology
- Hydraulics
- Geomorphology

Historical literature searches were conducted to obtain information on the historical uses of the rivers and adjacent lands. Library research identified books, professional journals, magazine and newspaper articles, and unpublished materials that provide information on the history of the use of the rivers. City directories, Sanborne fire insurance maps, and General Land Office maps were also consulted to identify businesses located near the rivers. Literature searches in archaeology provided data on prehistoric and historic settlement patterns along the river, including evidence on paleo-environment and irrigation agriculture. This research included published books and articles and "gray literature" or technical reports. Hydrologic, hydraulic, and geomorphic studies relating to historic navigability of each stream reach were also collected from city, county, state, and federal agencies. Published journal articles, books, and reports available from public library collections were also consulted. Bibliographies of documents and resources for each area of expertise are included in the corresponding report sections.

Data Summaries

Data collected from the agency contact and literature search tasks was organized and synthesized by these subject areas: archaeology, history, hydrology, hydraulics, geomorphology, and land use.

Archaeology

Archaeological data augment the historical record of potential river uses at statehood by providing an extended record of river conditions, use of river water, climatic variability, and cultural history along the rivers. SWCA archaeologists reviewed literature and other information collected during the literature search and agency contact tasks. An overview summarizing previous archaeological work in the area, paleo-environment, the culture history, settlement patterns, and evidence relevant to navigability of the river is presented in Section 2.

History

Historical data provide information on actual river uses as of the time of statehood, and also provide information on whether river conditions would have supported navigation. SWCA historians prepared a report summarizing use of the river and adjacent area in historic times, with special emphasis on the establishment, growth, and development of towns, irrigation systems, commercial activities, and developments. The historical overview is presented in Section 3.

Hydrology/Hydraulics

Hydrologic/hydraulic information is a key source of information regarding susceptibility to navigation. These data include estimates of flow depths, width, velocity, and average flow conditions at statehood, based on the available records. JEF evaluated information collected during the agency contact and literature search tasks. Literature, stream gauge records, topographic maps, aerial photographs, and other data were used to develop an estimate of natural stream conditions at statehood, as well as for existing stream conditions. Depth, velocity, and topwidth rating curves for existing and (circa) statehood channel conditions were developed from historical gauging records. Estimates of 2-year, 5-year, and average annual flow rates were obtained from gauge data or other sources. Flow duration curves and average monthly flow rates were also summarized.

Geomorphology

Geomorphic data provide information on river stability, river conditions at statehood, and the nature of river changes since statehood. A summary of the geology and geomorphology of the Upper Gila and San Francisco Rivers was prepared by JEF. These summaries were based on literature and other information collected during agency contact and the literature search. The objectives of these summaries were to estimate channel positions as of the time of statehood, assess the possibility of and mechanism for historical channel movement from its current position, provide evidence of geologic control of flow rates, and to estimate the location of the ordinary high and low watermarks. The hydrologic, hydraulic, and geomorphologic summaries are presented in Section 5.

Land Use

Land use data were compiled for the Upper Gila San Francisco Rivers and entered in a GIS database. Land use data included existing title owner records from county assessors offices, state and federal land leasing records from ASLD, the Bureau of Land Management, and the U.S. Forest Service. Existing improvements, commercial activities, and present use of lands were identified from land use mapping and reports, aerial photographs, and in some cases, by field visits. Other data collected for the Upper Gila San Francisco Rivers, such as floodplain limits, were also entered in the GIS. The land use data summary description is presented in Section 7; the GIS work product was provided separately.

SUMMARY

A comprehensive summary is presented in Section 8 of this report which itemizes the key findings of the preceding archaeological, historical, hydrologic, hydraulic, geomorphologic and land use sections. The most pertinent findings relative to evidence of navigability or non-navigability, or evidence of susceptibility to navigation, are summarized to provide information to support a determination by others of navigability or non-navigability for each study reach. This report does not make a recommendation or conclusion regarding title navigability of the Upper Gila River.

APPENDIX A

Arizona Revised Statutes §37-1101 through §37-1156

CHAPTER 7

STATE CLAIMS TO STREAMBEDS

ARTICLE 2. DETERMINING NAVIGABILITY

The heading of Chapter 7 was changed from "Ownership of Streambeds" to "State Claims to Streambeds" by Laws 1994, Ch. 277, § 26, effective April 25, 1994.

Cross References

Ombudsman for private property rights, see § 41-1311 et seq.

ARTICLE 1. GENERAL PROVISIONS

§ 37-1101. Definitions

In this chapter, unless the context otherwise requires:

1. "Arizona navigable stream adjudication commission" or "commission" means the Arizona navigable stream adjudication commission established by § 37-1121.

2. "Bed" means the land lying between the ordinary low watermarks of a watercourse.

3. "Determination of nonnavigability in a public proceeding" means a determination that a particular watercourse was not navigable before, or as of, February 14, 1912 by a final, unappealable decision of a judicial or administrative body, including any determination of nonnavigability of:

(a) Any portion of the Salt river lying between granite reef dam and its confluence with the Gila river.

(b) The Agua Fria river.

4. "Highway for commerce" means a corridor or conduit within which the exchange of goods, commodities or property or the transportation of persons may be conducted.

5. "Man-made water conveyance system" means:

(a) An irrigation or drainage canal, lateral canal, ditch or flume.

(b) A municipal, industrial, domestic, irrigation or drainage water system, including dams, reservoirs and diversion facilities.

(c) A channel or dike that is designed, dedicated and constructed solely for flood control purposes.

(d) A hydropower inlet and discharge facility.

(e) A canal, lateral canal, ditch or channel for transporting central Arizona project water.

6. "Navigable" or "navigable watercourse" means a watercourse, or a portion or reach of a watercourse, that was in existence on February 14, 1912, and at that time was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in the customary modes of trade and travel on water.

7. "Ordinary low watermark" means the line on the banks of a watercourse created when the water recedes at its regularly recurring lowest stage in normal years without reference to unusual droughts.

8. "Public entity" means the United States and its agents, this state, a county, city or town, a county flood control district or any other entity established under title 48.[1]

9. "Public trust land" means the portion of the bed of a watercourse that is located in this state and that is determined to have been a navigable watercourse as of February 14, 1912. Public trust land does not include land held by this state pursuant to any other trust.

10. "Public trust purposes" or "public trust values" means commerce, navigation and fishing.

11. "Riparian area" means a geographically delineated area with distinct resource values, that is characterized by deep-rooted plant species that depend on having roots in the water table or its capillary zone and that occurs within or adjacent to a natural perennial or intermittent stream channel or within or adjacent to a lake, pond or marsh bed maintained primarily by natural water sources. Riparian area does not include areas in or adjacent to ephemeral stream channels, artificially created stockponds, man-made storage reservoirs constructed primarily for conservation or regulatory storage, municipal and industrial ponds or man-made water or effluent transportation, distribution, off-stream storage and collection systems.

12. "Watercourse" means the main body or a portion or reach of any lake, river, creek, stream, wash, arroyo, channel or other body of water. Watercourse does not include a man-made conveyance system described in paragraph 5 of this section, except to the extent that the system encompasses lands that were part of a natural watercourse as of February 14, 1912.

Amended by Laws 1994, Ch. 277, § 1, eff. April 25, 1994.

[1] Section 48-101 et seq.

Historical and Statutory Notes

The 1994 amendment deleted the definition of "groundwater"; inserted the definition of "determination of nonnavigability in a public proceeding"; in the definition of "navigable", substituted "and at that time" for "and that"; deleted the definition of "ordinary high watermark"; inserted definitions of "ordinary low watermark" and of "public trust purposes" or "public trust values"; inserted "or effluent" in the definition of "riparian area"; deleted the definition of "surface water"; and renumbered paragraphs accordingly.

Laws 1994, Ch. 277, § 27, provides:

"Sec. 27. Severability

"If a provision of this act or its application to any person or circumstance is held invalid, the invalidity does not affect other provisions or applications of the act that can be given effect without the invalid provision or application, and to this end the provisions of this act are severable."

ARTICLE 2. DETERMINING NAVIGABILITY

§ 37-1121. Arizona navigable stream adjudication commission

A. The Arizona navigable stream adjudication commission is established through July 1, 2000 as a separate agency and independent of the state land department. The commission consists of five persons, not more than three of whom shall be of the same political party, appointed by the governor pursuant to § 38-211. Persons who are appointed to the commission must be well-informed on issues relating to rivers and streams in this state. The commission shall select a presiding officer from among its members.

B. Members of the commission are public officers for purposes of title 38, chapter 3, article 8 and title 38, chapter 3.1.[1] A person who has advocated for or expressed a desire that a watercourse in this state be determined to have been navigable or nonnavigable may not serve as a commission member. A commission member who is a witness, gives evidence or makes statements of personal knowledge of the characteristics of navigability of a watercourse for the commission's consideration shall not participate as a commission member in proceedings relating to that watercourse. A commission member shall not:

1. Have any bias regarding the possible navigability of any watercourse or a portion or reach of a watercourse.

2. Own, obtain a significant portion of income from or claim any ownership or possessory interest in lands affected by this chapter.

3. Directly or indirectly receive a significant portion of income from a person who claims an ownership or possessory interest in lands affected by this chapter or from a person who obtains a significant portion of income from such lands nor have been employed by such persons within two years before, or be employed by such persons within two years after, the commission member's term of office.

C. Funding for the commission and its necessary and reasonable expenses, including contracting for private services, shall be provided from such legislative appropriations as may be necessary to permit the commission to fulfill its responsibilities.

D. The governor, on good cause shown, may remove a member for neglect of duty or misconduct or malfeasance in office. On removal, the governor shall file with the secretary of state a complete statement of all charges made against the member, the governor's findings and a complete record of the disciplinary proceedings conducted with respect to the removal.

E. Members are eligible to receive compensation pursuant to § 38-611 for service on the commission, unless a member who is otherwise employed as a public officer is prohibited from receiving additional compensation.

F. The commission shall maintain its principal office at the state capital but may hold meetings or hearings any place in this state. The commission shall meet at least once each calendar quarter, except that if the commission has completed all inquiries and hearings required under this chapter, the commission shall not be required to meet. The presiding officer or a majority of the members may call additional meetings. On termination, the commission shall transmit all of its records to the secretary of state.

G. In the event of a vacancy on the commission, the governor may appoint a replacement member pursuant to § 38-211.

H. Notwithstanding § 41-192, the attorney general shall not advise or represent the commission.

I. For purposes of subsection B of this section, "significant portion of income" means ten per cent or more of gross personal income for a calendar year.

Amended by Laws 1994, Ch. 277, § 2, eff. April 25, 1994.

[1] Sections 38-501 et seq., and 38-541 et seq.

Historical and Statutory Notes

The 1994 amendment inserted "as a separate agency and independent of the state land department" in subsec. A; inserted the second sentence in the introductory paragraph of subsec. B; deleted "from the sale and use of public trust lands and" preceding "from such legislative appropriations" in subsec. C; in subsec. F, deleted "investigations," preceding "inquiries and hearings required under this chapter", and substituted "secretary of state" for "department"; inserted a new subsec. H; and redesignated existing subsec. H as subsec. I.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1122. General powers and duties of the commission

A. The commission shall:

1. Adopt rules and establish procedures and services that are necessary or desirable to carry out the provisions and purposes of this chapter.

2. Assemble and distribute information to the public relating to the commission's finding and recommendation of navigability of any watercourse and the commission's other activities.

3. Conduct inquiries or hearings in performing the commission's powers and duties. The commission shall conduct its proceedings informally without adherence to judicial rules of procedure or evidence. The commission shall facilitate participation by persons who are not represented by legal counsel and shall not require a person to file documents or notices in order to be heard and participate in proceedings before the commission.

4. Exercise such other powers as may be necessary to fully carry out its responsibilities imposed by this chapter.

B. The commission may employ or contract for legal counsel, independent from the attorney general, and other professional and administrative services. Contracts for legal and professional services are exempt from § 41-192 and title 41, chapter 23.[1]

Amended by Laws 1994, Ch. 277, § 3, eff. April 25, 1994.

[1] Section 41-2501 et seq.

Historical and Statutory Notes

The 1994 amendment designated the existing provisions as subsec. A; substituted "finding and recommendation" for "determination" in par. 2 of subsec. A; rewrote par. 3 of subsec. A; and added subsec. B.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1123. Receiving and compiling evidence and records

A. The commission shall receive, review and consider all relevant historical and other evidence presented to the commission by the state land department and by other persons, regarding the navigability or nonnavigability of watercourses in this state as of February 14, 1912, together with associated public trust values, except for evidence with respect to the Colorado river, and, after public hearings conducted pursuant to § 37-1126:

1. Based only on evidence of navigability or nonnavigability, make findings and recommendations to the legislature pursuant to § 37-1128 as to which watercourses and portions and reaches of watercourses were not navigable as of February 14, 1912.

2. Based only on evidence of navigability or nonnavigability, make findings and recommendations to the legislature pursuant to § 37-1128 as to which watercourses and portions and reaches of watercourses were navigable as of February 14, 1912.

3. In a separate, subsequent proceeding pursuant to § 37-1128, subsection H, consider evidence of public trust values and then identify and make a public report of any public trust values that are now associated with the navigable watercourses.

B. Before receiving, reviewing or considering any evidence pursuant to subsection A of this section for a particular watercourse, the commission shall publish notice once each week for three consecutive weeks in a newspaper of general circulation in each county in which the watercourse is located. The notice shall include:

1. A statement of the intent to receive, review and consider evidence.

2. An address to which interested parties may submit evidence for the commission's review.

3. A date by which evidence must be submitted.

4. A general description of the procedures the commission will use to review the evidence.

C. Private citizens, clubs, organizations, corporations, partnerships, unincorporated associations, municipal corporations and public entities may present evidence to the commission at a hearing according to commission rules. The submission of evidence by any party pursuant to the commission's notice under subsection B of this section does not preclude that party from submitting additional evidence at any hearing before the commission.

D. The state land department shall consult and coordinate its efforts to gather evidence of navigability and public trust values with the department of water resources, the game and fish department, the state parks board and other interested persons and public and private entities. The commission shall consider the information that those persons and entities have compiled regarding the navigability of watercourses.

E. After public notice, the commission shall set priorities for investigating and conduct hearings on the navigability of the watercourses in this state. In setting the priorities, the commission shall consider:

1. The number and value of parcels of real property that are affected by a state claim of sovereign ownership to the bed of the watercourse.

2. The degree of hardship to private parties and political subdivisions due to title uncertainties relating to the bed of the watercourse.

3. The significance of the public trust values associated with the watercourse and the degree to which those values are threatened.

4. The potential viability of this state's sovereign claims to the watercourse, giving higher priority consideration to more viable claims.

F. A person who is aggrieved by the undetermined navigability status of a watercourse may petition the commission to modify the priority set under subsection E of this section and grant expedited consideration for a particular watercourse or portion or reach of a watercourse. The commission shall grant the petition if justified by the factors listed in subsection E of this section.

G. No judicial action seeking a determination of navigability of a watercourse, to establish or obtain ownership of land within the bed and banks of a watercourse or to determine any public trust values associated with a watercourse may be commenced, continued or completed unless the legislature has found that the watercourse was navigable or nonnavigable pursuant to § 37-1128. This subsection does not preclude the department from seeking a temporary restraining order or injunctive relief at any time to prevent loss or damage to public trust resources.

H. Notwithstanding subsection G of this section, any condemnation action by this state or a political subdivision of this state may proceed to trial and conclusion, including the payment of compensation, regardless of the potential claim of title by this state based on the navigability of the watercourse. In any action commenced or continued pursuant to this subsection, the court shall not consider or decide the navigability of the watercourse. Any judgment in any action commenced or continued pursuant to this subsection shall be subject to a potential claim of title by this state based on the navigability of the watercourse.
Amended by Laws 1994, Ch. 277, § 4, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment rewrote the section.

Laws 1994, Ch. 277, § 25, provides:

"Sec. 25. Effect on prior proceedings

"This act does not affect proceedings taken by the state land department and the Arizona navigable stream adjudication commission before the effective date of this act to collect, assemble, compile, receive and review relevant historical and other evidence available or presented to the Arizona navigable stream adjudication commission."

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1124. Compiling evidence and records by department

A. Beginning on or about the date that the commission establishes priorities pursuant to § 37-1123, subsection E, but in no event later than January 2, 1993, the department shall begin the necessary investigation and inquiries to assemble the evidence relevant to finding navigability with respect to those watercourses given the highest priority by the commission. The department shall continue the investigations and inquiries as resources permit, in the order of priority set by the commission.

B. After collecting and documenting all reasonably available evidence regarding the condition and usage of a watercourse as of February 14, 1912, the present uses of the underlying land and the public trust values associated with the watercourse, if any, the department shall promptly transmit all of the evidence to the commission.

C. The department shall maintain a permanent record of the material assembled and transmitted to the commission.

Amended by Laws 1994, Ch. 277, § 5, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment in subsec. A substituted "finding" for "determining", and made a conforming change in statutory citation.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1125. Initial classification of watercourses

A. After the commission receives and reviews sufficient information to permit a preliminary finding with regard to possible navigability of any reach or portion of a watercourse, the commission shall initially classify the watercourse or portion or reach of the watercourse into one of the following categories:

1. The watercourse has characteristics of possible navigability as of February 14, 1912.
2. The watercourse has no such characteristics of navigability.

B. The commission shall make its preliminary finding under this section in an expeditious manner.

C. The commission shall maintain a permanent public record of the classifications of watercourses and portions and reaches of watercourses made under this section.

Amended by Laws 1994, Ch. 277, § 6, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment substituted "a preliminary finding" for "an initial determination" in the introductory paragraph of subsec. A; and substituted "a preliminary finding" for "determination" in subsec. B.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1126. Hearings; notice

A. After the commission completes the initial classification of any watercourse or portion or reach of a watercourse under § 37-1125, the commission shall schedule public hearings to receive additional evidence and testimony relating to navigability or nonnavigability of any such reach or portion, and, after the commission finds a watercourse is navigable, the commission shall schedule public hearings to identify and make a public report of any public trust values associated with the watercourse. The hearings shall be held at the commission's office or, in the case of a hearing concerning a watercourse located principally outside of Maricopa county, at the county seat of the county in which the predominant portion of the particular watercourse is located. The commission may schedule additional hearings at other locations at the commission's discretion.

B. At least thirty days before any public hearing under this section, the commission shall cause notice of the hearing to be published in two newspapers, one of statewide circulation and another of general circulation in the county where the hearing is to be held. In addition, the commission shall mail notice of the hearing to any person who has previously requested notice of hearings in writing from the commission.

Amended by Laws 1994, Ch. 277, § 7, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment substituted "after the commission finds a watercourse is navigable, the commission shall schedule public hearings to identify and make a public report of" for "if potentially navigable," in subsec. A.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1127. Boundary agreements; negotiations; recording; effect

A. At any time before a final judicial determination as to whether a watercourse or a portion or reach of a watercourse was navigable as of February 14, 1912, the commissioner may negotiate with any person or public entity having or claiming an interest in any land affected by this state's claim of sovereign ownership due to navigability for the purpose of reaching a boundary or exchange agreement.

B. At least thirty days before submitting a proposed boundary or exchange agreement to the board of appeals for approval under subsection C of this section, the commissioner shall provide written notice of the proposed action and an opportunity to comment to any person who has previously requested written notice of actions under this section. The commissioner shall provide contemporaneous written notice of the final decision to any person who filed a comment.

C. The board of appeals established under § 37-213 must approve each boundary or exchange agreement. In considering whether to approve a boundary or exchange agreement, the board shall consider whether the agreement is prudent and consistent with the public trust and the Constitution of Arizona.

D. The board of appeals may allow an exchange only if both of the following conditions are met:

1. The land being transferred by the state is not of material use for trust purposes.

2. The land being acquired by the state is of material use for trust purposes and has an appraised value equal to or greater than the value of the land being transferred by the state.

E. Lands that are transferred to this state in an approved boundary or exchange agreement become public trust lands.

F. An approved boundary or exchange agreement is binding on this state and other parties to the agreement but is not admissible as evidence and may not be cited as precedent in any judicial or administrative proceeding involving the navigability of any watercourse, portion or reach.

G. A boundary or exchange agreement shall be recorded in the office of the county recorder of each county in which all or part of the affected land is located.

Amended by Laws 1994, Ch. 277, § 8, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment substituted "judicial determination" for "determination under § 37-1128" in subsec. A; and deleted "determination of" preceding "navigability of any watercourse" in subsec. F.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1128. Determination of navigability; quiet title action

A. After the commission completes the public hearing with respect to a watercourse, the commission shall again review all available evidence and render its finding and recommendation as to whether the particular watercourse, or any portion or reach of the watercourse, was navigable as of February 14, 1912.

B. If any determination of nonnavigability in a public proceeding exists for a watercourse or a portion or reach of a watercourse, it is presumed that the entire watercourse was nonnavigable as of February 14, 1912, and the commission shall find and recommend that it was nonnavigable unless there is clear and convincing evidence that the watercourse was navigable.

C. The commission shall find and recommend that a watercourse was nonnavigable ~~if~~, as of February 14, 1912, the watercourse either:

1. Was not used or susceptible of being used for both commercial trade and travel.

2. Flowed only in direct response to precipitation and was dry at all other times.

D. Unless there is clear and convincing evidence that a watercourse was navigable, it is presumed, and the commission shall find and recommend, that the watercourse was nonnavigable if, with respect to the watercourse as of February 14, 1912, any of the following applied:

1. No sustained trade and travel occurred both upstream and downstream in the watercourse.

2. No profitable commercial enterprise was conducted by using the watercourse for trade and travel.

3. Vessels customarily used for commerce on navigable watercourses in 1912, such as keelboats, steamboats or powered barges, were not used on the watercourse.

4. Diversions were made from the watercourse to irrigate and reclaim land by persons who made entries under the desert land act of 1877, as amended (43 United States Code §§ 321 through 339), any other federal act or to provide water to lands that are included in a federal reclamation project or an Indian reservation that would have been inconsistent with or impediments to navigation.

5. Any boating or fishing was for recreational and not commercial purposes.

6. Any flotation of logs or other material that occurred or was possible on the watercourse was not and could not have been regularly conducted for commercial purposes.

7. There were bridges, fords, dikes, man-made water conveyance systems or other structures constructed in or across the watercourse that would have been inconsistent with or impediments to navigation.

8. Transportation in proximity to the watercourse was customarily accomplished by methods other than by boat.

9. The United States did not regulate the watercourse under the rivers and harbors act of 1899 (33 United States Code §§ 401 through 467e).

E. In finding whether a watercourse was navigable, the commission shall not consider:

1. Waters that had been appropriated for beneficial uses on or before February 14, 1912 as being within the ordinary and natural condition of the watercourse.

2. The use of ferries to cross a watercourse.

3. Fishing from the banks of a watercourse.

4. Uses of the watercourse under flood conditions.

F. In finding whether a watercourse was navigable, the commission shall consider the existence of dams and diversions of water and the impact of other human uses that existed or occurred at the time of statehood as part of the ordinary and natural condition of the watercourse.

G. Subject to the specific standard of proof stated in subsection D of this section, if the evidence presented by the state land department or by any other person claiming that the watercourse was navigable does not establish that the watercourse was navigable, the commission shall issue its recommendation finding that the watercourse was nonnavigable.

H. With respect to those watercourses or portions or reaches of watercourses that the commission finds were navigable, the commission shall, in a separate, subsequent proceeding, identify and make a public report of any public trust values associated with the navigable watercourse or portion or reach of the watercourse. These findings of nonnavigability or navigability and identification of any public trust values shall be in writing and shall be supported with sufficient documentation and detail to confirm the rationale and basis for the decision. The commission's action pursuant to this section is not a final administrative decision subject to judicial review pursuant to title 12, chapter 7, article 6.[1]

I. The commission shall report its findings and recommendation to the president of the senate and the speaker of the house of representatives. The president and the speaker shall provide for legislative hearings, and if the legislature finds that the watercourse was:

1. Nonnavigable, the legislature shall enact legislation ratifying the commission's findings and recommendation and disclaiming title as provided by § 37-1130.

2. Navigable, the legislature shall enact legislation to authorize the state land department to claim the land in the bed of the watercourse and to authorize the department to file an action to quiet title to the land.

J. In an action to quiet title to land in the bed of a watercourse brought pursuant to subsection I, paragraph 2 of this section both of the following apply:

1. The commission's recommendation and the legislative finding shall not be used to support the state's claim of title.

2. The court may make a determination of any public trust values associated with the lands if title is quieted in the state.

Amended by Laws 1994, Ch. 277, § 9, eff. April 25, 1994.

[1] Section 12-901 et seq.

Historical and Statutory Notes

The 1994 amendment rewrote the section.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

1994 Reviser's Note:

Pursuant to authority of § 41-1304.02, in subsection D, paragraph 7 the spelling of "man-made" was corrected.

§ 37-1129. Repealed by Laws 1994, Ch. 277, § 10, eff. April 25, 1994

Historical and Statutory Notes

The repealed section, added by Laws 1992, Ch. 297, § 3, related to judicial review. See, now, § 37-1128.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1130. Title to bed of nonnavigable watercourse; appropriation of waters for public trust values

A. The enactment of legislation finding that a watercourse, portion or reach is nonnavigable constitutes a waiver, relinquishment and disclaimer of this state's right, title or interest in the bed of the watercourse based on its navigability.

B. This state may obtain any water that is necessary to maintain and protect public trust values that are identified by the commission pursuant to § 37-1128, subsection H only by complying with the requirements of title 45.[1]

Amended by Laws 1994, Ch. 277, § 11, eff. April 25, 1994.

[1] Section 45-101 et seq.

Historical and Statutory Notes

The 1994 amendment designated the existing provisions as subsec. A; substituted "the enactment of legislation finding" for "Subject to judicial review, the commission's determination" in subsec. A; and added subsec. B.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

§ 37-1131. Notice to landowners

A. If the legislature enacts legislation finding a watercourse to be navigable as provided in § 37-1128, the state land department shall do the following before it files quiet title actions:

1. Collect information and perform land surveys that are necessary to determine where the department believes the exact location of the boundaries of the bed of the watercourse are located. The bed of the watercourse to which the state claim applies is the bed of the watercourse existing on the date of the legislature's finding, unless clear and convincing evidence establishes a different location. Before making this determination, the department shall provide public notice and any opportunity for comment by the private property rights ombudsman and any other person.

2. Compile a complete description of each parcel of land lying wholly or partially in the bed of the watercourse, including record title ownership by any person, and a complete title search of each parcel to show how and when the lands were first conveyed in apparent violation of the public trust.

3. If the land was conveyed in apparent violation of the public trust by an agency of the United States, bring an action against the United States for damages and prosecute the action to final judgment. Any damages collected shall be placed in the riparian trust fund established by § 37-1156.

B. Within thirty days after compiling the parcel information pursuant to subsection A, paragraph 2 of this section the department shall notify each record owner or lessee of property that is located in the bed of the navigable watercourse and each person and entity that have an interest of record in the property of the finding by the legislature and that, by virtue of the decision, all or a portion of the property will be claimed as public trust land of this state in a quiet title action. The notice shall also provide information prepared by the private property rights ombudsman explaining the person's rights and any services available from the ombudsman.

C. The state land department shall not commence an action to quiet title to land under this article without legislative authorization pursuant to § 37-1128.

Amended by Laws 1994, Ch. 277, § 12, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment rewrote the section.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

Administrative Code References

Show cause hearing related to boundary survey determinations, see A.A.C. R12-5-2402.

§ 37-1132. Refunds to record title owners

A. If this state's ownership of a parcel or portion of a parcel of property is confirmed in a quiet title action under this article, the state treasurer shall pay to the record title owner an amount from the state general fund to:

1. Refund all property taxes ever paid on the property.

2. Compensate the person for all improvements to the property.

3. Refund the purchase price paid for the property, plus interest at the legal rate, if the property was purchased from this state by the person or any predecessor in title.

B. The department of administration, in coordination with the department of revenue and the state land department, shall certify to the state treasurer the amounts due to the record title owner pursuant to this section.

Added by Laws 1994, Ch. 277, § 13, eff. April 25, 1994.

Historical and Statutory Notes

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

ARTICLE 3. MANAGEMENT OF PUBLIC TRUST LANDS

§ 37-1151. Petition to release public trust status

A. In responding to a petition filed by a record title owner or lessee the department shall consider the extent to which the property that has been confirmed to the state's ownership in a quiet title action, either because of its nature or because of changes, is no longer of material use for protecting public trust values. If the department concludes that the property is not of material use for protecting public trust values, the department shall consider the extent to which a release of the trust is appropriate in light of the public benefit to be derived from alternate uses, and the equitable interests or hardships of the record title holder or lessee, including each of the following:

1. The year in which the property was acquired by the record owner or lessee.

2. The entity or person from whom the property was acquired by the record owner or lessee.

3. The manner in which the record owner or lessee acquired the property.

4. The purchase price or lease terms paid by the record owner or lessee.

5. The amount of property taxes paid each year since the record owner or lessee acquired the property.

6. The profit or benefit derived from the property by the record owner.

7. The extent to which the record owner on the date of acquisition knew or should have known that the property was potentially trust land.

8. All improvements made to the property since the record owner or lessee acquired the property.

9. The public trust values identified by the commission.

10. Whether any improvements on the property impair, obstruct, promote or destroy the value of the watercourse for public trust values.

11. The existing uses of the property, its reasonable highest and best use and whether such uses impair, obstruct, promote or destroy the value of the watercourse for public trust values.

12. Whether the physical condition of the watercourse has materially changed since February 14, 1912 adversely affecting the watercourse's capability of being navigated, including changes due to construction of dams, reservoirs, dikes, levees, canals and ditches that were constructed for water conservation or flood control purposes by public entities, municipal corporations or the United States.

13. Any diminution in value to the record owner's or lessee's contiguous property caused by this state's ownership.

14. The degree of effect of continuation of the current use or any proposed change in use of the property on public trust values.

15. The impact of continuation of the current use or any proposed change in use of the property on the public trust values.

16. The impact of continuation of the current use or any proposed change in use of the property when examined cumulatively in conjunction with existing authorized impediments to full use of the public trust values.

17. The impact of continuation of the current use or any proposed change in use of the property on the public trust values if those values are considered with respect to the primary purpose to which the property is now suited.

18. The degree to which continuation of the current use or any proposed change in use requires that broad public uses be set aside in favor of more limited and private uses.

B. At least thirty days before issuing a decision that land may be released from the public trust under this section the department shall provide written notice of the proposed action and an opportunity to comment to any person who has previously requested written notice of actions under this section. The department shall provide contemporaneous written notice of the final decision to any person who filed a comment.

Amended by Laws 1994, Ch. 277, § 14, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment in subsec. A rewrote the introductory paragraph, substituted "values" for "or navigation purposes" in par. 10, substituted "values" for "purposes" in par. 11, substituted "values" for "uses of navigation, fishing and recreation" in par. 14, substituted "values" for "resource" in par. 15, substituted "values" for "resource" in par. 16, and rewrote par. 17.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37-1101.

Administrative Code References

Release of lands from public trust status for sale, see A.A.C. R12-5-2404.

§ 37-1154. Public improvements in beds of navigable watercourses; definition

A. A determination that a watercourse or a portion or reach of a watercourse is navigable does not affect the right of a public entity to own, operate, maintain or repair a public improvement reasonably constructed in the bed of the watercourse under the public entity's powers if the improvement was constructed before the determination that the watercourse, portion or reach is navigable and does not materially impair the public trust. The public entity is considered to have obtained this state's consent to construct the public improvement and is not liable to pay compensation to this state for the land on which the public improvement is constructed if the improvement does not materially impair, obstruct or destroy the function of the watercourse for public trust purposes.

B. If the commissioner determines that the public improvement described in subsection A of this section does not, or will not if appropriate conditions are followed, materially impair the public trust uses, the department may require the public entity to obtain a permit for the improvement pursuant to § 37-1153 but shall not assess any fee for issuing the permit.

C. At least thirty days before issuing a decision under subsection D or E of this section the department shall provide written notice of the proposed action and an opportunity to comment to any person who has previously requested notice of actions under this section. The department shall provide contemporaneous written notice of the final decision to any person who filed a comment.

D. If the commissioner determines that the public improvement described in subsection A of this section destroys the function of the watercourse for public trust purposes and is not in furtherance of the public trust status of the land, the public entity may petition the department for release of public trust status pursuant to § 37-1151. In evaluating the petition, the department shall consider, in addition to the factors prescribed by § 37-1151, whether constructing the public improvement was undertaken pursuant to the public entity's authority and whether the public improvement continues to serve a public purpose.

E. If the commissioner determines that a release is appropriate under subsection D of this section, the public entity may purchase this state's interest in the land without a public auction by paying an amount to be determined by the department pursuant to § 37-1152 directly to this state pursuant to § 9-401, subsection A, § 11-251, paragraph 45 or § 48-3603, subsection C, paragraph 2, as applicable. No cause of action or claim for reimbursement accrues for the benefit of any public entity that exercises its right to purchase this state's interest pursuant to this subsection.

F. For purposes of this section, "public improvement" includes any facility established, constructed or maintained by a public entity pursuant to law and those works described in § 37-1101, paragraph 5.

Amended by Laws 1994, Ch. 277, § 15, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment in the first sentence of subsec. A deleted "by the commission" following "A determination", and deleted "commission's" preceding "determination that the watercourse,".

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37–1101.

§ 37–1156. Riparian trust fund; acquisition and management of riparian lands

A. The riparian trust fund is established in the state treasury consisting of monies received from the sale or use of sovereign streambed lands and resources under this chapter, damages collected from the United States pursuant to § 37–1131 and any other appropriations, gifts, grants or donations designated by the donor for that purpose. The state treasurer shall maintain the fund separate and apart from all other funds. On notice from the commissioner the state treasurer shall invest and divest monies in the riparian trust fund as provided by § 35–313, and monies earned shall be credited to the riparian trust fund. The state treasurer shall report and maintain a separate accounting of income and other proceeds from investing trust fund monies.

B. The state land commissioner shall use the income, other proceeds and not more than seventy-five per cent of any added principal of the fund in a fiscal year pursuant to this section:

1. To acquire, from willing sellers, land or interests in land located in riparian areas in this state for public purposes consistent with conservation of wildlife and recreation.

2. For such other expenditures as promote the purposes of the public trust.

C. The state land commissioner shall consult with and receive advice from the Arizona state parks board and the Arizona game and fish department regarding the acquisition and management of land and interests in land under this section.

Amended by Laws 1994, Ch. 277, § 16, eff. April 25, 1994.

Historical and Statutory Notes

The 1994 amendment inserted ", damages collected from the United States pursuant to § 37–1131" in subsec. A; and in subsec. B, deleted par. 1, and renumbered pars. 2 and 3 as pars. 1 and 2.

For severability provisions of Laws 1994, Ch. 277, see Historical and Statutory Notes under § 37–1101.

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Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

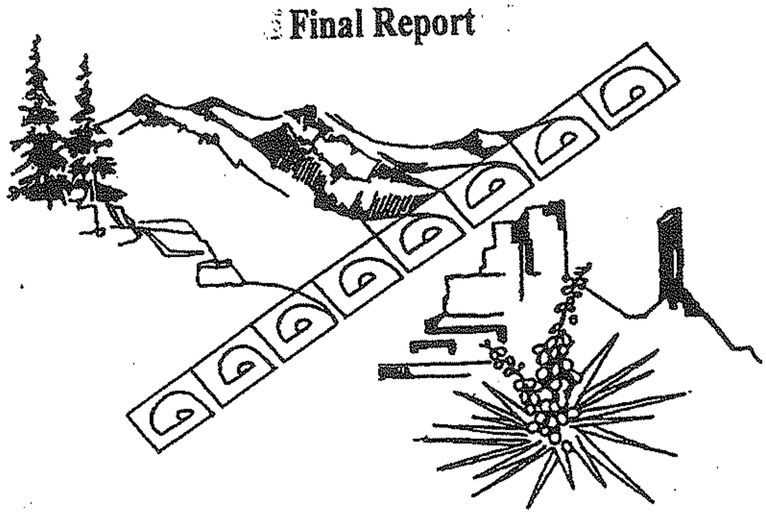
Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

Final Report



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and

SWCA, Inc. Environmental Consultants

Section 2

ARCHAEOLOGICAL OVERVIEW OF THE UPPER GILA AND SAN FRANCISCO RIVER VALLEYS, ARIZONA

Prepared for

SFC ENGINEERING COMPANY

Prepared by

SWCA, INC.
ENVIRONMENTAL CONSULTANTS

May 23, 1997

ARCHAEOLOGICAL OVERVIEW OF THE UPPER GILA AND SAN FRANCISCO RIVER VALLEYS, ARIZONA

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SWCA Report No. 97-77

May 23, 1997

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INTRODUCTION

Only a limited amount of archaeology has been done on the upper Gila and San Francisco rivers in Arizona. No Paleoindian or Archaic sites have been recorded in this area, although they are known elsewhere in the general vicinity. Formative period villages along the Gila River are assigned to the Mogollon archaeological culture but are located on a boundary between several archaeologically defined subunits. Although evidence of prehistoric irrigation may be present in the Safford Valley to the west, no evidence of prehistoric agriculture has been reported on the upper Gila or the San Francisco rivers above their confluence. Archaeologists have provided only a limited amount of description of the physical environment of the study area, but reconstructions of the streamflow of the Salt River are apparently applicable to the Gila River as well.

ARCHAEOLOGICAL PROJECTS

The major archaeological projects that have been conducted along the upper Gila and San Francisco rivers in Arizona are summarized in Table 1. Their locations are shown in Figure 1.

Descriptions of the archaeology of the upper Gila River valley began in 1846 when General Stephen Watts Kearny and the Army of the West traveled down the river. Lieutenant William Emory of the Corps of Topographical Engineers reported seeing the first Gila River valley ruins on October 23, while still in New Mexico (Emory 1951:105). On October 24 Emory observed additional ruins, the largest of which measured 60 × 20 feet (Emory 1951:107). On October 25 Emory observed two more ruins, the largest of which measured 40 × 30 feet (Emory 1951:107). "About none did we find any vestiges of the mechanical arts, except the potter; the stone forming the supposed foundation was round and unhewn, and some cedar logs were also found about the houses, much decayed, bearing no mark of an edged tool" (Emory 1951:107). Dr. John Griffin, the expedition's surgeon, and Captain Abraham R. Johnston also kept journals and mentioned seeing the ruins (Griffin 1943:26; Johnston 1848). Johnston, especially, took great interest in the prehistoric ruins the group encountered and made sketch maps of several of them, recording dimensions of the ruins and drawing

Table 1. Major Archaeological Projects along the Upper Gila and San Francisco Rivers

Sponsor	Type of Project	Area Extent	No. of Sites	Reference
Archaeological Institute of America	Reconnaissance	Southwest U.S. and Mexico	?	Bandelier 1884, 1892
Bureau of American Ethnology	Reconnaissance	Safford Valley	15+	Fewkes 1904
Smithsonian Institution	Reconnaissance	Gila River and its tributaries	7 on S. F. River	Hough 1907
Bureau of American Ethnology	Reconnaissance	Gila River and its tributaries	?	Fewkes 1910
Gila Pueblo	Reconnaissance	?	?	Gladwin and Gladwin 1935
University of California	Reconnaissance	Southeast Arizona	?	Sauer and Brand 1930
Peabody Museum, Harvard	Reconnaissance	Western New Mexico, eastern Arizona	638	Danson 1957
National Park Service	Survey	Gila River channel between Safford and Buttes Dam Site (approximately 110 miles)	39+	Tuohy 1960
National Park Service	Excavation	San Carlos Indian Reservation	2	Johnson and Wasley 1966
National Park Service	Excavation	Buttes Dam Site	1	Wasley and Benham 1968
Tucson Gas and Electric Company	San Juan to Vail Transmission Line Survey	approximately 120 miles long	3	Doyel 1972
Tucson Gas and Electric Company	Transmission Line Survey	San Juan to Clifton	9	Kane and Fuller 1972a
Tucson Gas and Electric Company	Transmission Line Survey	3 miles along San Francisco River at Arizona-New Mexico border	3	Fuller 1972
University of Arizona	Survey and excavation	Pueblo Viejo area, Safford Valley	?	Brown 1973
Public Service Company of New Mexico	Transmission Line Survey	Deming, New Mexico, to Greenlee County, Arizona	2	Bussey and Beckett 1975
Graham-Curtis Canal Company	Survey	North side of Gila River between Bryce and Cold Springs	4	Gilman and Sherman 1975
Coronado Resource Conservation and Development Project	Survey	Foote Wash and No Name Wash	21	Kinkade 1975
Continental Oil Company	Survey	7860 acres	9	Doelle 1975
Bureau of Reclamation	Buttes Reservoir Survey	approximately 9700 acres	272	Debowski et al. 1976
Public Service Company of New Mexico	Power Transmission Line Survey	?	1	Gomolak 1977
Public Service Company of New Mexico	Excavation	Duncan area	2	Beckett 1978; Berman 1978
Arizona Electric Power Cooperative	Survey	Approximately 123 km	89	Simpson and Westfall 1978
Arizona Electric Power Cooperative	Excavation	Excavation	11	Westfall, Rozen, and Davidson 1979
Bureau of Land Management	Survey	4000 acres	25	Roberts, Ahlstrom, and Doak 1995
University of Texas, Austin	Excavation	Excavation	1	Woodson 1995

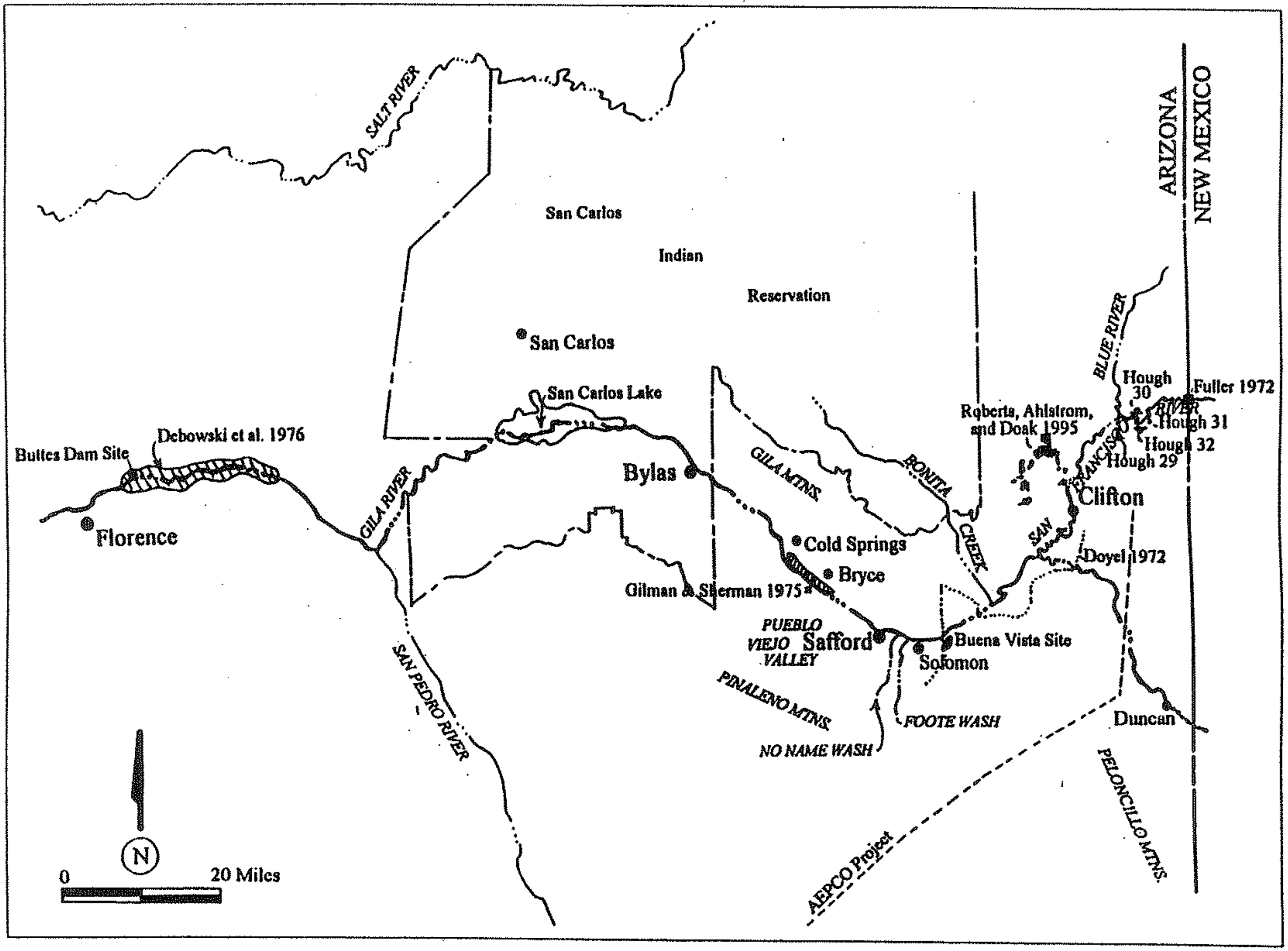

FIGURE 1
Locations of major archaeological projects and sites along Upper Gila and San Francisco Rivers in Arizona

76-46

the potsherds. In the Safford Valley, below the mouth of the San Francisco River, Emory observed the Buena Vista site.

Professional archaeology along the upper Gila River began in the 1880s, when the Archaeological Institute of America sent Adolph Bandelier to the Southwest with specific instructions for analyzing prehistoric and historic Pueblo Indian architecture (Lange, Riley, and Lange 1984:19-32). Bandelier's instructions were formulated by Lewis Henry Morgan, author of *Houses and House Life of the American Aborigines* (Morgan 1881) and were intended to provide data demonstrating the similarity between the architecture of prehistoric ruins and that of modern pueblos. In 1883 Bandelier passed through Fort Apache, San Carlos, and Fort Thomas, traveling up the Gila River as far as Solomonville (Lange and Riley 1970:97-98). Although he heard of cliff dwellings in the vicinity of Clifton, he never visited them (Lange and Riley 1970:97-98). In 1884 Bandelier visited and recorded the Gila Cliff Dwellings in New Mexico, then went on to Tucson via Silver City and Deming, New Mexico. Thus, Bandelier only generally described the location and architecture of sites along the Gila and San Francisco rivers in the vicinity of the study area (Bandelier 1892:359-362; Kidder 1924).

In 1897 Smithsonian archaeologists Jesse Walter Fewkes and Walter Hough visited the Buena Vista and Solomonville sites in the Safford region, noting that agriculture had almost destroyed the site of Solomonville (Fewkes 1904). Fewkes was attempting to find archaeological sites that corresponded to the places mentioned in Hopi migration stories. He identified evidence of prehistoric irrigation agriculture and remarked on the environmental changes that had occurred since the Kearny expedition passed through the area in 1846. Fewkes also mentioned that cliff dwellings were present along Bonita Creek, which enters the Gila below the mouth of the San Francisco. In 1909, Fewkes (1910) surveyed the Gila River valley as far west as Florence.

Hough (1907, 1914, 1917, 1918, 1919, 1923) conducted the first archaeological research on the San Francisco River, where he recorded seven sites above Clifton. Site 26 was a ruin and rock art site on the bluff above the Clifton hospital (Hough 1907:44). Site 27 consisted of low mounds of rubble opposite the Potter Ranch, 2.5 miles north of Clifton (Hough 1907:44). Site 28 was not described. Site 29, at the mouth of the Blue River, consisted of 20 rooms in two structures with a plaza between them (Hough 1907:44). Site 30, 1.5 miles above the mouth of the Blue River, was a walled-up cave; an adjacent recess contained a milling room (Hough 1907:45). On a terrace half a mile east of Site 30, Hough found the ruins of a polygonal stone pueblo (Site 31) consisting of several room blocks fronted by a 100-foot plaza (Hough 1907:45-46). Nearby, on the south bank of the San Francisco, the uppermost of two caves (Site 32) contained bows, arrows, and other ritual paraphernalia (Hough 1907:47). Although Hough was a protégé of Fewkes, he focused less on finding archaeological evidence of Hopi migration stories, concentrating instead on recording evidence of prehistoric lifeways and technology as well as the range of variability in archaeological sites in different areas of the Southwest. Near Luna, New Mexico, in the upper San Francisco River valley, Hough discovered a village of approximately 100 pit houses, circular structures 4 m in diameter and 1.5 m deep that had originally been roofed with conical structures of logs and earth (Hough 1919). These pit houses were associated with neck-banded utility pottery and black-on-white pottery decorated with designs similar to "pre-Pueblo" (Kidder's [1924:288] term) black-on-white pottery from the San Juan River drainage in northern Arizona and New Mexico. In the Los Lentes Valley, Hough (1907:63, Figure 28; 1919:409) excavated a rectangular pueblo and found similar pit houses beneath it. Hough was thus the first researcher in the area to document how changes had occurred prehistorically in pottery and house types of the region. In so doing, Hough was reflecting new archaeological concerns with reconstructing prehistoric chronologies and classifying variability in archaeological remains such as pottery, house types, and site types.

The leader of the archaeological movement to reconstruct chronologies and classify variability was Alfred V. Kidder. In 1924 Kidder summarized the archaeology of the upper Gila, based primarily on Hough's work and on his own brief conversations with local ranchers (Kidder 1924:280-288). Kidder (1924:Figure 24) contrasted the upper Gila archaeological district—all of the San Francisco River, the upper Gila above its confluence with the San Francisco, and the Black River above its junction with Fremont Creek—with the Mimbres archaeological district, which encompassed only the Mimbres River drainage basin. The pottery of the upper Gila district (including utility ware with thinly corrugated exteriors and smoke-blackened [smudged] interiors, a black-on-white painted pottery with interlocking designs of opposed solid and hachured elements, and, rarely, redware), referred to by Kidder as the Tularosa style, was its most distinctive feature.

From the 1920s to the 1960s, archaeologists working throughout the Southwest modeled their work on Kidder's, emphasizing chronology and regional variability. In 1928 Gila Pueblo (a private archaeological research foundation in Globe, Arizona) began a survey of the range of Hohokam red-on-buff pottery (Gladwin and Gladwin 1935). In 1931 the Gila Pueblo researchers surveyed the San Francisco River, and in 1933 they excavated Site Mogollon 1:15, a pit house site on the middle San Francisco River near Alma, New Mexico (Haury 1936a, 1936b). The site consisted of 12 pit houses (eight rectangular and four circular) and numerous storage pits.

In 1929 Sauer and Brand (1930) conducted a survey that covered the Gila River from approximately San Carlos to the Arizona/New Mexico border. Their goal was to locate the maximum number of archaeological sites in the time allotted and to collect a representative sample of artifacts. The number of sites located is not reported in the text. Tatman (Brown 1973) conducted brief excavations at the Buena Vista site, although they were never completed.

From 1939 to 1955, Paul Martin of the Field Museum of Natural History in Chicago directed a long-term archaeological research project in the Pine Lawn Valley of the San Francisco River near Reserve, New Mexico (Martin 1959). Martin excavated a series of sites ranging in date from Archaic times to about A.D. 1300. Although these sites are northeast of the Arizona reach of the San Francisco River, Martin's research confirmed Haury's belief that sites in the Mogollon highlands represented an archaeological culture distinct from the Hohokam of the Phoenix and Tucson basins and the Anasazi of the Colorado Plateau.

The Harvard Peabody Museum–Upper Gila Expedition conducted survey and excavation in the area during the late 1940s and early 1950s (Bullard 1962; Danson 1957; Danson and Brew 1948; McGimsey 1980; Smith 1973). From 1947 through 1949, the Upper Gila Expedition conducted reconnaissance of the area bounded by a line running from Springerville, Arizona, on the northwest to Magdalena, New Mexico, on the northeast to Silver City, New Mexico, on the southeast to Clifton, Arizona, on the southwest. Danson (1957:27-28, Figure 2) recorded two sites on the San Francisco River, just north of Clifton. Site 1 was a "small badly washed-out boulder pueblo" with an indeterminate number of rooms, which dated to the Mangas phase (A.D. 1000-1050). The Mangas Phase is no longer accepted by most archaeologists [LeBlanc 1986; LeBlanc and Whalen 1980], although Lekson [1990] still defends the concept.) Site 2, on a high bluff immediately above Site 1, had been previously recorded by Hough (1907:44) as Site 29. Dating to the late Mangas or early Mimbres Classic (A.D. 1050-1200) phase, it consisted of 20 rooms arranged in two blocks of rooms separated by a plaza and surrounded by a boulder wall. Danson (1957:28) also recorded a Reserve Phase (A.D. 1000-1100) masonry pueblo 25 miles northeast of Clifton on a ridge above Mule Creek, in New Mexico. This site, which contained Reserve Black-on-white and Tularosa Black-on-white ceramics, was constructed of masonry, not adobe (as was true of Mimbres pueblos).

Danson (1957:16-21) discussed the cultural history of the upper Gila and the San Francisco in terms of two regional sequences, for the Mimbres Region and the Pine Lawn Region. Danson (1957:16-18) included the Arizona portions of the San Francisco and the Gila in the Mimbres cultural province. Danson (1957:16-18) cited Haury (1936b) and Cosgrove and Cosgrove (1932) as defining five cultural-historical periods for the Mimbres Region: (1) the Georgetown phase (A.D. 500-700), (2) the San Lorenzo phase (A.D. 700-800), (3) the San Francisco phase (A.D. 800-900), (4) the Three Circle phase (A.D. 900-1000), and (5) the Mimbres phase (A.D. 1000-1250). The Pine Lawn Region included the upper San Francisco and the upper Gila in New Mexico. In this area, Danson (1957:18-21) defined four phases: (1) San Francisco (A.D. 700-900), (2) Three Circle (A.D. 900-1000), (3) Reserve (A.D. 1000-1100), and (4) Tularosa (A.D. 1100-1250).

From 1946 to 1960, Emil Haury directed the archaeological field school of the University of Arizona at Point of Pines, 35 miles northwest of the confluence of the San Francisco and the Gila (Haury 1989). Although Point of Pines is outside the area covered by this overview, the field school there influenced the interpretation of the archaeological record along the Gila River. For example, Haury (1958, 1989:58-60, 116-117) and Lindsay (1987) found evidence, in the form of ceramics and architecture, that around A.D. 1270, people from the Kayenta, Arizona, area migrated to southeastern Arizona and brought with them ceramics (notably Kiet Siel Polychrome), construction styles (particularly D-shaped kivas), and cultigens (in particular a type of squash). After living in pit houses outside the pueblo for a time, the immigrants built a room block within the pueblo. Over time, these northern immigrants (whom Haury called the Maverick Mountain people) began to produce pottery (Maverick Mountain Polychrome) similar to that of their homeland, but using local materials. Around A.D. 1300, however, the Maverick Mountain people were attacked by the other residents of Point of Pines Pueblo, and the Maverick Mountain residences within the pueblo were burned. Elsewhere along the Gila and San Pedro rivers, however, the Maverick Mountain immigrants established their own pueblos (Brown 1973; DiPeso 1958; Duffen 1937; Gerald 1975; Lindsay 1969, 1987; Wasley 1962; Woodson 1995).

From the 1960s to the present, most archaeological research along the upper Gila and San Francisco rivers in Arizona has been salvage work conducted prior to construction projects. In 1963 Vivian surveyed the proposed Buttes Reservoir area for the National Park Service (NPS), locating five sites. In 1966 the Arizona State Museum excavated one of the sites, the Buttes Dam site, a large Hohokam village on a terrace on the north side of the river (Wasley and Benham 1968). Two other sites were excavated for the NPS on the San Carlos Indian Reservation in 1963 (Johnson and Wasley 1966), but they represented a local variation of a mixture of cultural manifestations (Bronitsky and Merritt 1986). The original survey for the project (Gila River Channel Rectification Project) recorded 18 sites (Tuohy 1960) in 1959, 10 on the north bank and 8 on the south bank of the Gila River, near Bylas.

In the 1970s a number of surveys and other archaeological work were undertaken in conjunction with utility and water control projects. In 1972 Doyel conducted an archaeological survey from Clifton to Tucson for Tucson Gas and Electric (Doyel 1972). The right-of-way ran south from the Greenlee Country Club and crossed the Gila River near Apache Grove. Doyel found three sites along the right-of-way, none of them in the area between Clifton and the Gila River. That same year, the Museum of Northern Arizona conducted an archaeological survey for the portion of the project between San Juan and Clifton (Fuller 1972; Kane and Fuller 1972a, 1972b). Fuller (1972) reported three sites (all prehistoric) on the San Francisco River straddling the Arizona-New Mexico border. Two of the sites were in New Mexico; Site NA11,536 (a walled-up cave containing pottery, flaked stone, and corncobs and dating from about A.D. 600 to 800) was in Arizona. Kane and Fuller (1972a) reported nine sites (seven prehistoric and two historic), one of which (NA11,585, a prehistoric camp) was on the San Francisco River. In 1974 a survey was done for the Graham-Curtis Canal Company for the proposed construction of five flood control dams and their associated features (Gilman and Sherman 1975). This survey area was approximately 10 miles northwest of Safford, with four prehistoric sites recorded between the floodplain and the second terrace of the river. Dam site areas near Safford also were surveyed for the Coronado Resource Conservation and Development Project in 1975 (Kinkade 1975). Twenty-one sites were found along Foote Wash and No Name Wash, which empty into the Gila River Valley. Most of the sites represented small temporary camps, and some of these were excavated (Fitting 1977). A series of surveys were conducted for Arizona Electric Power Cooperative (AEPCO) in 1977 from their Greenlee Substation to their Cochise Power Plant south of Willcox. The surveys recorded 103 sites (Simpson and

Westfall 1978), and 11 sites subsequently were excavated (Westfall, Rozen, and Davidson 1979). Survey of the proposed Buttes Reservoir area in the 1970s located 250 prehistoric sites or site components, most of which were associated with Hohokam occupation (Debowski et al. 1976).

Other, smaller projects also took place during this time period. In 1973 survey and limited excavations in the Pueblo Viejo area, near Safford, examined the origins of Salado cultural influence seen there (Brown 1973). New Mexico State University conducted surveys in the vicinity of the Buena Vista Site near Safford (Buttigieg-Berman 1977), and Mills and Mills (1978) published a report on their excavations at this site. Two Salado sites were excavated by students from Eastern Arizona College in 1975 and 1976 (Bronitsky and Merritt 1986:65). New Mexico State University conducted archaeological surveys in the vicinity of Clifton and Duncan (Bussey and Beckett 1975; Gomolak 1977) and excavated two Mogollon sites: the Mesa Top site (Berman 1978) and the Cerro de Las Piedras site (Beckett 1978).

In 1979 Paul Martin wrote an overview of the Mogollon Culture (Martin 1979), in which he mapped the Mimbres Branch as extending just west of the Arizona-New Mexico state line, the Black River Branch (defined by the sites excavated by Haury and the Point of Pines archaeological field school) as including most of the study area, and the Cibola Branch as including the Blue River and the San Francisco River in New Mexico (Martin 1979:Figure 1). The conjunction of these three branches was just southeast of the confluence of the Blue River and the San Francisco River. Martin also described the Saladoan intrusion into the area.

In the early 1990s an archaeological survey by SWCA of approximately 4000 acres north, south, and west of Clifton resulted in discovery of 25 archaeological sites with 9 prehistoric components, 1 Apachean component, and 19 historic components (Roberts, Ahlstrom, and Doak 1995). The prehistoric components included two rock overhangs, four roasting features, one rock pile, and two artifact scatters. The Apachean component was an artifact scatter. The historic components included two mining camps, six mines, three structures, three sets of stone walls, one railroad grade, one trail, one rock overhang (also used prehistorically), one rock enclosure, and one artifact scatter. The 4,000 acres were distributed among 12 parcels, most of which were well away from the San Francisco River. Two parcels, though, were adjacent to the river. Parcel E, on the west side of the San Francisco River approximately 3 miles north of Clifton, contained only two isolated fragments of bottle glass. Parcel F, on the north side of the San Francisco River approximately 3 miles south of Clifton, contained two sites (one historic trail with associated rock alignments and artifacts and one prehistoric rock pile), six isolated flaked stone artifacts, one isolated ground stone artifact, two isolated glass fragments, one horseshoe, and one set of mining test pits.

Kyle Woodson of the University of Texas, Austin, has been conducting research on the Maverick Mountain Phase, originally defined by Haury. Woodson (1995) identifies at least eight Maverick Mountain Phase sites: Point of Pines, 76 Ranch, three sites along the Gila River (Spear Ranch, Goat Hill, and Bonita Creek), and three sites along the San Pedro River (Davis, Reeve, and Second Canyon). Woodson (1995) has excavated Goat Hill, a Maverick Mountain Phase pueblo of 35 rooms and a D-shaped kiva, in the Safford Valley.

Overviews for the area around the upper Gila River have been produced to date for the Bureau of Land Management. Separate overviews were compiled for the Middle Gila Planning Unit (Debowski and Fritz 1974), the Winkelman and Black Hills planning units (Teague 1974), the Geronimo Planning Unit (Doelle 1975), and for Southeast Arizona in general (Bronitsky and Merritt 1986). The earlier overviews do not always include maps, providing only descriptions of the planning units in the text.

CULTURE HISTORY

Archaeological chronologies of North America generally divide the prehistory and history of areas within the United States into four periods. These periods and their dates, as currently reconstructed for southeastern Arizona, are: (1) the Paleoindian Period (9500-6000 B.C.); (2) the Archaic Period (6000 B.C.-A.D. 1); (3) the Formative Period (A.D. 1-1540); and (4) the Historic Period (A.D. 1540-present). Local chronologies, such as the one developed by Roberts, Ahlstrom, and Doak (1995:Figure 1.8), modify this general chronology to reflect cultural changes specific to particular areas (Table 2).

Table 2. Cultural Chronology of the Upper Gila and San Francisco Rivers, Arizona

LIFEWAY	PERIOD	PHASE	DATE
Industrial	Late Historical		A.D. 1870-1940
Frontier/Apache	Early Historical		A.D. 1540-1870
Formative	Pueblo	Cliff	A.D. 1375-1450
		Black Mountain	A.D. 1180-1300
		Mimbres	A.D. 1000-1150
	Late Pit House	Three Circle	A.D. 750-1000
		San Francisco	A.D. 650-750
		Georgetown	A.D. 550-650
	Early Pit House	Cumbre	A.D. 200-550
Early Agricultural/Archaic	Late Archaic		2000/1000 B.C. - A.D. 200
Archaic	Middle Archaic		5000-2000/1000 B.C.
	Early Archaic		7500-5000 B.C.
Paleoindian	Paleoindian	Clovis	9500-9000 B.C.

From Roberts, Ahlstrom, and Doak 1995:Figure 1.8

Paleoindian Period

The Paleoindian adaptation to the Southwest is generally considered to have been oriented around hunting of large game using spears with distinctive lanceolate projectile points. The Paleoindian period is divided into the Clovis (Llano) (9500-9000 B.C.), Folsom (8800-8000 B.C.), and Cody (Plano) (8000-6500 B.C.) complexes. The Clovis complex was characterized by mammoth hunting using Clovis projectile points. Folsom-complex hunting focused on long-horned bison (*Bison antiquus*) using Folsom points. Cody-complex hunting focused on both long-horned bison and modern bison (*Bison bison*) using Midland, Plainview, Scottsbluff, Eden, Angostura, and Belen projectile points and Cody knives.

The Clovis Complex is well known in southeastern Arizona, where excavations at five sites (Double Adobe [Haury 1960], Naco [Haury 1953], Lehner [Haury, Sayles, and Wasley 1959; Haynes 1964; Mehringer and Haynes 1965], Murray Springs [Haynes and Hemmings 1968], and Escapule [Hemmings 1970; Hemmings and Haynes 1969] have documented the Clovis Complex as fully as anywhere in the United States. Folsom and Cody (Plano) Complex sites have not been identified in southeastern Arizona, but late Paleoindian sites have been found in southwestern New Mexico (Fitting and Price 1968). No Paleoindian materials have been found in Arizona along the San Francisco River or the upper Gila River (above the confluence with the San Francisco River).

Archaic Period

The Archaic Period in the Southwest and Great Basin has been referred to as the Desert Culture (Jennings 1968) and was based on hunting of wild animals and gathering of wild plants. The variant of the Desert Culture originally identified for southeastern Arizona was called the Cochise Culture (Sayles and Antevs 1941; Sayles 1983), which was divided into three stages: (1) Sulphur Springs, (2) Chiricahua, and (3) San Pedro. Dates assigned to each stage vary slightly with each researcher. Doyel (1972:22) dates the Cochise Culture between about 8,000 and 300 B.C. Wasley also proposed (in an unpublished paper) a Cazador Phase (7000-6000 B.P.), which has not generally been accepted.

The Sulphur Springs Stage is characterized by grinding stones in an occupation level below and earlier than a stratum containing mammoth bones. This stage was defined at the Double Adobe Site.

The Chiricahua Stage is characterized by shallow-basin milling stones and percussion-flaked stone artifacts (including biface blades, knives, scrapers, hammerstones, spokeshaves, and projectile points). Projectile points have concave bases and are side-notched, much like the San Jose projectile points of the Oshara Tradition (Irwin-Williams 1973) or the Pinto Points of the Great Basin Tradition (Jennings 1986:Figure 3, Figure 4), or are diamond shaped, much like the Gypsum Points of the Great Basin Tradition (Jennings 1986:Figure 3, Figure 4). At the Cienega Creek Site (W:10:112) on the San Carlos Apache Indian Reservation, maize pollen was found in a level dated 4200 years B.P., and 47 cremations were found dating 3135 ± 75 B.P. (Haury 1957).

During the San Pedro Phase, people began growing beans and constructing food-storage pits and pit houses. Doyel (1972:22) dates the San Pedro Stage from about 2000 to 300 B.C. (or perhaps to as late as A.D. 1).

More recent researchers (Huckell 1984; Wills 1988) have suggested alternative chronologies for the Southwestern Archaic, dividing the period into early, middle, and late periods. Huckell dates the Early Archaic from 8000-5000 B.C., the Middle Archaic from 5000-2000/1000 B.C., and the Late Archaic from 2000/1000 B.C. - A.D. 300). Wills dates the Early Archaic from 8000-5000 B.C., the Middle Archaic from 5000-2000/1000 B.C., and the Late Archaic from 2000/1000 B.C. - A.D. 300).

Late Archaic peoples in southeastern Arizona began growing corn at least as early as 850 B.C. (Huckell 1990:310-313) and at roughly the same time started building pit structures and using storage pits (Huckell 1990). These changes were part of a shift to the more sedentary life style of the Formative period.

Possible Archaic (8000 B.C. - 1 A.D.) sites have been found (Kinkade 1975) south of the river east of Safford. Securely dated Archaic sites are not known, but the Gila Valley is thought to be the northern boundary of the local Archaic occupation, the Cochise culture, in southeastern Arizona (Sayles 1945).

Formative Period

Following the Archaic period, the Gila River Valley was settled and influenced by different culture groups. The prehistoric culture that occupied the area around Safford and Clifton is called Mogollon by archaeologists, but, as can be seen from the history of archaeological research, the study area falls along archaeologically defined prehistoric cultural boundaries and has been variously classified as upper Gila (Kidder 1924), Mimbres (Danson 1957), or a combination of Mimbres, Pine Lawn, and Black River (Martin 1979). Moreover, prehistoric people in the area traded with and were influenced by the Hohokam, who lived primarily in the Phoenix and Tucson basins. Finally, the Salado Culture, a prehistoric culture unique to the transition zone between the Mogollon Highlands and the Sonoran Desert, appeared in the area about A.D. 1200, and groups from the Kayenta region of northern Arizona apparently migrated into the area and established their own pueblos about A.D. 1275.

The Mogollon Culture was originally defined as a population inhabiting mountain and mountain-lowland transition zones of east-central Arizona and western New Mexico (Wheat 1955). The Mogollon Culture originated by about 300 B.C. when pottery, maize, and other domesticated plants were introduced into the area (Doyel 1972:23). Mogollon Culture is generally defined on the basis of pit house architecture, brownware pottery, and flexed burials. Brownware pottery is made of high-iron clays derived from volcanic sources and usually containing fragments of volcanic material that act as a temper.

Anyon, Gilman, and LeBlanc (1981) and Lekson (1990) discuss the development and history of Mogollon Culture in terms of three broad periods (the early pit house period, the late pit house period, and the pueblo period) that they further subdivide into seven phases: (1) Cumbre (A.D. 200-550), (2) Georgetown (A.D. 550-650), (3) San Francisco (A.D. 650-750), (4) Three Circle (A.D. 750-1000), (5) Mimbres (A.D. 1000-1150), (6) Black Mountain (A.D. 1180-1300), and (7) Cliff (A.D. 1375-1400).

Until approximately A.D. 1000, Mogollon populations lived in pit house villages built in a dispersed pattern in easily defensible positions (Teague 1974:8). Early pit houses were oval or circular, and later (A.D. 950-1200) pit houses were rectangular. Rock-lined and masonry-lined rooms occur after the transition to surface structures. The AEPCO project (Simpson and Westfall 1978) found three Mogollon pit house villages on terraces north and south of the river. Ranging between 22.2 and 49.4 acres in area, these sites contained numerous features, including rock alignments, possible terraces, and other possible agricultural remains. Occupations dated from pre-A.D. 900 to approximately A.D. 1000. One of the sites contained rectangular cobble-lined pit houses, possibly indicative of the transition to above-ground masonry rooms (Simpson and Westfall 1978:95). After about A.D. 1000, the Mogollon peoples typically constructed above-ground pueblos and manufactured a distinctive pottery called Mimbres Black-on-white, which was commonly decorated with pictures of life forms in addition to geometric designs. Excavations near Bylas (Johnson and Wasley 1966) on the San Carlos Indian Reservation examined two sites with occupations dating from A.D. 1100 to 1200. They contained 88 surface rooms of rock-reinforced adobe construction, 2 pit houses, 4 cremations, and 5 trash mounds.

The Salado occupation, first identified by a series of pottery types such as Pinto, Gila, and Tonto Polychrome, is represented by a complex of characteristics that was centered around the Tonto-Globe area beginning about A.D. 1100-1500. Saladoan Culture is characterized by polychrome pottery, compound walls around villages, and extended burials. Gladwin et al. (1937) and McGregor (1965) thought that the Saladoan peoples originated in the Tonto Basin.

Brown's research focused on five sites, including Buena Vista, in the Safford area. He found comparisons of Salado traits among these sites and other sites from both the Point of Pines-Reserve and Tonto Basin areas. He called the Salado manifestations in the Safford area the Pueblo Viejo Salado. Sites investigated by Brown (1974) were pueblos with multiple (4 to 170), contiguous rooms and plazas, some of which were partially or fully enclosed by walls. He determined that they were occupied anywhere from post-A.D. 1250 to the early fourteenth century. The Gila River Valley was abandoned by A.D. 1400 (Doyel 1972:23).

From about A.D. 1275 to 1325, it appears that a group of people from the Kayenta region of northern Arizona migrated to the southern Mogollon Highlands and the upper Gila and San Pedro river valleys. Among the sites occupied by this group were Point of Pines Pueblo (Haury 1958, 1989:58-60, 116-117; Lindsay 1987), the 76 Ranch Site near Bonita, Arizona (Duffen 1937), the Davis, Reeve, and Second Canyon sites on the San Pedro River (DiPeso 1958; Gerald 1975; Lindsay

1969, 1987), the Spear Ranch and Bonita Creek sites (on the upper Gila River) (Brown 1973; Wasley 1962), and Goat Hill Pueblo near Safford (Woodson 1995). These people built pueblos with kivas (subterranean ceremonial rooms) and manufactured Maverick Mountain Polychrome, which looks like Kiet Siel Polychrome (manufactured in the Kayenta region) but is made of materials found in southeastern Arizona. The immigrants are known archaeologically as the Maverick Mountain Phase.

From approximately A.D. 100 on, contact with other cultural groups increased, and by A.D. 950-1200 many Hohokam traits were present (Simpson and Westfall 1978:24). In the Safford Valley, prior to the introduction of Salado polychromes, culture contact was north-south, from the White Mountains in the north to Casas Grandes, across the modern international border, in the south. With the introduction of Salado traits, interaction expanded to include contact west of the Safford Valley. The appearance of the Salado complex added traits such as polychrome and other ceramic types, puebloan architecture of coursed masonry or solid adobe, cliff dwellings, compounds or defense walls, and inhumation burials. According to Brown,

> Salado polychromes have been found on terraces above the Gila River, mainly on sites downstream from Safford. Salado in the Safford area differs from Tonto Basin Salado by the presence of Point of Pines-Reserve ceramic types, the absence of compound architecture, and the absence of late northern tradewares [Brown 1974, cited in Simpson and Westfall 1978:26].

Mogollon sites adjacent to the upper Gila and San Francisco rivers in Arizona range in date from about 50 B.C. to about A.D. 1200 and include farmsteads and hamlets as well as campsites and other more specialized sites. The earliest excavated Mogollon site in the area is the Mesa Top Site near Duncan, which was occupied from about 50 B.C. to A.D. 925 (Berman 1978). Other sites in the Duncan area, including Sites AZ CC:8:3(ASM) (A.D. 400-1000) and AZ CC:8:4(ASM) (A.D. 100-400), are roughly contemporaneous, dating to the pit house period (pre-A.D. 1000). Site NA11,536, on the San Francisco River, also dates to the pit house period (A.D. 600 to 800), but consists of a walled-up cave containing pottery, flaked stone, and corncobs. Pueblo sites dating from about A.D. 1000 to 1200 have been reported on both the Gila and San Francisco rivers. The largest pueblo site reported to date is Hough's Site 29 (Danson's Site 1), which is on the San Francisco River above Clifton and consists of 20 rooms in two structures separated by a plaza and surrounded by a boulder wall. This site dates from about A.D. 1050 to 1200 (Danson 1957:27-28, Figure 2). A nearby site dating from about A.D. 1000 to 1050 contains an indeterminate number of rooms. Furthermore, Hough recorded at least three other pueblo sites and two cave sites along the Arizona reach of the San Francisco River above Clifton, and although he did not provide room counts for these sites, at least two of the pueblos consisted of multiple room blocks, and one had a plaza 100 feet long (Hough 1907:42-47). Sites along the Gila River reported by Emory (1848a, 1848b), which were as much as 40-50 feet long and 20-30 feet wide, probably date to the same period and probably contain no more than 20 rooms. Some of the rock overhangs, roasting features, and artifact scatters reported by Roberts, Ahlstrom, and Doak (1995) in the Clifton area may be contemporaneous with these habitation sites.

Historic Period

Spanish accounts of the Coronado Expedition in 1540 suggest that the upper Gila and San Francisco rivers were sparsely populated by Yavapais. Apaches displaced the Yavapais around A.D. 1700. Both the Yavapai and Apache were relatively nomadic, living by hunting and gathering and occupying the shelters of overhanging rocks and constructing brush wickiups. Both groups also harvested agave roots, which they roasted in pits lined with heated stones. The two groups manufactured plainware pottery that is so similar that archaeologists cannot reliably distinguish the ceramics of from one group from the other, making the archaeological identification of Yavapai and Apache sites highly problematic. Few Native American sites of the historic period have been identified in the study area, although the SWCA survey of 4000 acres around Clifton identified one Apachean artifact scatter and two rock overhangs, four roasting features, one rock pile, and two artifact scatters that could be Yavapai or Apache (Roberts, Ahlstrom, and Doak 1995).

After the Coronado Expedition of 1540, Euroamericans do not seem to have explored the upper Gila and San Francisco rivers until about the 1820s, when trappers from Taos, New Mexico, began to trap along the rivers. In 1846 General Steven Watts Kearny and the Army of the West traveled down the Gila River, and throughout the 1860s, 1870s, and 1880s, the U.S. Army fought with the Apaches throughout the region. Permanent settlement of the area by Euroamerican miners and farmers began in the 1870s. Despite this history of Euroamerican presence, few historic Euroamerican sites in the area have been recorded, and none have been excavated. During SWCA's survey of 4000 acres around Clifton, two mining camps, six mines, three structures, three sets of stone walls, one railroad grade, one trail, one rock overhang (also used prehistorically), one rock enclosure, and one artifact scatter used by Euroamericans in the historic period were recorded (Roberts, Ahlstrom, and Doak 1995). In a number of historic sites in the area—including Apache Grove (near York), the Gila River concrete arch bridge (near Clifton), the Clifton–Casa Grande Building, the Chase Creek District (Clifton), the Clifton Jail, the Eastside District (Clifton), the North Clifton District, the Phelps-Dodge Guest House, the Shannon Hill Distrist (Clifton), the South Clifton District, the Patterson Wagon Road Truss Bridge (Clifton), the Park Avenue Highway Truss Bridge (Clifton), Dell Potter's ranch (on the San Francisco River above Clifton), Oroville (on the San Francisco River above Clifton), the Metcalf locomotives, and the Billingsley Home (Duncan)—are on the State Register of Historic Places, the National Register of Historic Places, or both (Bronitsky and Merritt 1986:413-416).

PREHISTORIC USE OF THE GILA RIVER

During the period of prehistoric occupation, the entire length of the Gila River played a major role in human settlement patterns and occupational success. As discussed above, most prehistoric habitations in the area were close to the river. Along the lower Gila, where Patayan populations settled, occupation was confined to the river valley (Breternitz 1957:1). Along the middle Gila, communities were able to settle about 2 km from the river floodplain because of the extensive canal systems that furnished irrigation water. In all segments of the river, site density dramatically decreased with distance from the river.

Most archaeological investigations along the upper Gila River have been surveys; thus, little detail is available. Also, most have taken place around the Safford Valley, where many prehistoric remains have been lost because of historic and modern farming. However, based on survey for the Graham-Curtis Project, Gilman and Sherman (1975) concluded that there had been villages of 50-200 rooms along the entire length of the Safford Valley and along the Pinaleño Mountain foothills (Gilman and Sherman 1975:5-6). Sites with agricultural features, such as gridded gardens, terraces, and canals, are found along the river floodplain and terraces and the Pinaleño Mountain foothills. Sites in the Gila Mountains were much smaller and included both open sites and rockshelters. Kinkade's (1975) survey southwest of Safford along two washes found numerous limited-activity sites that represented temporary camps associated with lithic manufacture and exploitation and possible check dams associated with water control.

Prehistorically, the Gila River provided a wide variety of dietary and other subsistence resources. The river itself provided a permanent water source and fish as a source of protein (Miller 1955). On the middle and lower Gila River, cobbles along the river bed were used extensively as raw material for tools and for Classic period Hohokam structures. In addition, the river promoted great diversity in floral and faunal resources along its banks. Riparian vegetation was more lush than it is today. Excavations at Escalante Ruin determined that a saltbush-mesquite community was prevalent around Casa Grande and Escalante during the prehistoric occupation (Doyel 1974:16). Today only dead mesquite trees and creosotebush are visible. In the past, mesquite bosques were common along the river, and the water table was relatively high. In fact, Haury (1978:9) describes a prehistoric well at the site of Snaketown no more than 3 m deep "that tapped a reservoir fed by Queen Creek" (Berry and Marmaduke 1982:20). There was a significant riparian community historically as well.

> "Along the formerly great Gila River (the now dry bed of which stretches across the Sonoran Desert of western Arizona) there were extensive marshes, swamps, and flood plains with cattail (*Typha domingensis*), bullrush (*Scirpus olneyi*), giant reed (*Arundo donax*), common reed (*Phragmites communis*), arrowweed (*Pluchea sericea*), and many trees. The dense vegetation of these well-developed riparian communities often stood 10 to 15 feet high and supported a tremendous quantity of wildlife" [Lowe 1964:30].

The riverine environment supported a wide variety of animal species, particularly rodents, small mammals, birds, and fish. When Father Kino visited the Pima of the Gila Valley, he noted that "all its inhabitants are fishermen, and have many nets and other tackle with which they fish all year" (cited in Berry and Marmaduke 1982:27). Fish remains (*Acipenser*) were also identified from prehistoric contexts at the site of Snaketown (Miller 1955:132).

Agriculture was a primary use of the river. Irrigation, dry farming, and floodwater farming were evident along most of its length, from the Gila Bend area to beyond the Safford Valley, from the pre-Classic to the Classic period. Arable land and water availability were primary factors in settlement location, and the type of agriculture that was practiced was based on the character of the river at any given point, as well as the character of the landscape and distance from the river. According to Debowski et al. (1976:90), the area around the proposed Buttes Reservoir did not have canals because the velocity of the river was not suited to canal irrigation; instead, water control features such as diversion dams, contoured terraces, rock alignments, and rock piles were used to capture rainfall or runoff for agricultural fields. These techniques maximized potentially arable land and expanded possibilities of procuring water for fields beyond the available irrigation canal zone. The inhabitants thus decreased the likelihood of failure by not relying on one system alone. This would have been important for an expanding Hohokam population that probably needed surplus to feed political and economic specialists. Moreover, river flooding would have washed out intakes and damaged canals, necessitating a backup system for crop production. Floodwater farming was practiced by Patayan inhabitants along the lower Gila (Schroeder 1957:177) and by Hohokam farmers. Canal irrigation was practiced by the Hohokam from the area around Gila Bend (Woodbury 1961) to the Pinaleño Mountain foothills (Doelle 1975:12). Canals are known archaeologically from the Gatlin site (Wasley and Johnson 1965:24), Casa Grande (Cummings 1927:9-10) and the surrounding area (Brooks and Vivian 1976:29-33; Midvale 1965), Snaketown (Haury 1978; Woodbury 1961) and other sites along the middle Gila (Berry and Marmaduke 1982:50; Fewkes 1910; Wilcox 1979:115), the Fortified Hill Site (McGuire and Schiffer 1982:106), the Gila Butte site (Greenleaf and Vivian 1971), the eastern Buckeye Valley (Midvale 1974), and near Gila Bend (McGuire and Schiffer 1982:133; Woodbury 1961).

ENVIRONMENTAL RECONSTRUCTIONS

Within recent years, enormous strides have been taken in understanding the prehistoric natural environment. Reconstructions have included paleoclimatic and hydrological conditions in the lower Colorado Plateau that are applicable to southern Arizona in general (Dean et al. 1985; Euler et al. 1979) and paleobotanical and paleofaunal types native to the Gila River Valley.

Euler et al. (1979) produced a paleoenvironmental record for the American Southwest by plotting geoclimatic and bioclimatic indicators for the Colorado Plateau. Indicators consisted of data from tree-rings, pollen records, and alluvial sediments. These data were analyzed within a temporal framework, and fluctuations through time were noted (Table 3). Dean et al. (1985) used similar data to produce a model of interaction between the cultural system (prehistoric populations) and the natural system (environment) and to identify periods of stress. In general, low water tables and channel entrenchment, or degradation, would have an adverse effect on agriculture; on the other hand, high effective moisture and aggradation, or surface stability, would be favorable to the development of irrigation systems, as well as other agricultural technologies. Variability in the dendroclimatic record might have produced some short-term responses prehistorically to accommodate unusually high or low precipitation, such as relocation of agricultural fields or the expansion of irrigation systems (Dean et al. 1985:542-543).

Prehistorically, the floodplain and terraces of the Gila River contained a wide variety of plant and animal species. Desertification and reduction in this habitat in recent times (Crosswhite 1981:67; Hastings and Turner 1965; Rea 1983) have decreased species diversity and changed some of the flora and fauna that characterize the Sonoran Desert landscape. Human influence over only the past 100 years has created changes along the river in the amount of groundwater, erosion, and depletion of native vegetation. The riparian forest is mostly gone or replaced by feral salt cedar, and weedy species proliferate. The water table, previously a few feet below the surface, now averages hundreds of feet underground (Rea 1983:3). The archaeological and historic records document the change in riparian and desertscrub communities from historic to modern times, yet the natural resources used by prehistoric peoples remained relatively constant. Archaeological data, such as pollen, macrobotanical, and faunal remains, indicate that there were no radical changes in the natural environment, and thus the climate, prehistorically.

Historically, Fewkes (1904:174-175) contrasted the Gila River in the Safford area as it was described by Emory (1848a, 1848b, 1951) and Johnston (1848) with what he observed in 1897. Fewkes quoted Emory:

> Everywhere there were marks of flowing water, yet vegetation was so scarce and crisp that it would be difficult to imagine a drop of water had fallen since last winter....The dust was knee-deep in the rear of our trail; the soil appears good, but for whole acres not a sign of vegetation was to be seen. Grass was at long intervals, and, when found, burnt to a cinder [Emory 1848a:68, cited by Fewkes 1904:174].

Table 3. Environmental Reconstructions Applicable to the Gila River Valley

Year (A.D.)	Effective Moisture*	Depositional and Erosional Cycles*	Dendroclimatic Variability*	Salt River Geomorphic Processes**
1500				
		Degradation	Frequent Oscillations	
1400				Marked lateral erosion and channel widening (A.D. 1356-1370)
				Stable Conditions; trend toward island-braided channel (infrequent high-magnitude flows); some channel avulsion probable; deepening of channel (A.D. 1197-1355)
1300				
	Low	Aggradation		
1200			Infrequent Oscillations	
		Degradation		Trend toward bar-braided channel (infrequent high-magnitude flows); some channel avulsion possible (A.D. 1052-1196)
1100				
				Trend away from bar-braided channel toward island-braided conditions; channel narrowing (A.D. 900-1051)
1000		Aggradation		
	High			
900				
			Frequent Oscillations	Establishment of bar-braided channel; channel widening and bank erosion (A.D. 798-899)
800	Low	Degradation		
				Channel Stabilization (A.D. 740-797)
700				
	High	Aggradation	Infrequent Oscillations	
600				

*From Masse 1991, after Dean et al. 1985 and Euler et al. 1979.
**From Gregory 1991, after Nials, Gregory, and Graybill 1989.

In 1897 Fewkes found that

> white settlers have worked marvels in other parts of the valley, which may now be said, using a familiar simile, to "blossom as the rose." At present Pueblo Viejo, from Buena Vista to Pima, which towns mark the author's acquaintance with it, is one succession of cultivated farms of corn, alfalfa, and melons, a garden of Arizona in which any crop can be raised....It seems incredible that in fifty years such great changes should have taken place, yet it was to be expected, for in prehistoric times Pueblo Viejo was a garden spot, and there is every reason to believe that when it was inhabited by aboriginal farmers more acres of its land were under cultivation than at present [Fewkes 1904:174-175].

SUMMARY AND CONCLUSIONS

In summary, archaeological studies of the upper Gila and San Francisco rivers in Arizona have been fairly limited, and although archaeologists have documented some 11,000 years of human use of southeastern Arizona, most archaeological sites in the study area date to the period from about 50 B.C. to A.D. 1200 when farmers of the Mogollon archaeological culture lived in the area. The Mogollon farmers lived in farmsteads and hamlets of as many as 20 rooms scattered along the Gila River and in the vicinity of Clifton. Archaeological reconstructions suggest that streamflow changed little from the A.D. 740-1370 period to the A.D. 1800-1979 period, but no evidence of prehistoric irrigation agriculture has been reported above the Safford and Solomonville areas. In addition to the riverside farming communities, campsites and specialized activity sites were scattered throughout the uplands adjacent to the rivers. In the early historic period (circa A.D. 1540 to 1870) the area was occupied by the Yavapai and Apache, who lived primarily by hunting wild animals and gathering wild plants. Their sites consist primarily of rock overhangs, agave-roasting features, and campsites. Euroamerican sites of the recent historic period (1870 to present) include towns, farms, ranches, mines, mining facilities, and transportation routes. Archaeological research has not documented any use of the river for commercial trade and travel nor any regular flotation of logs.

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Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

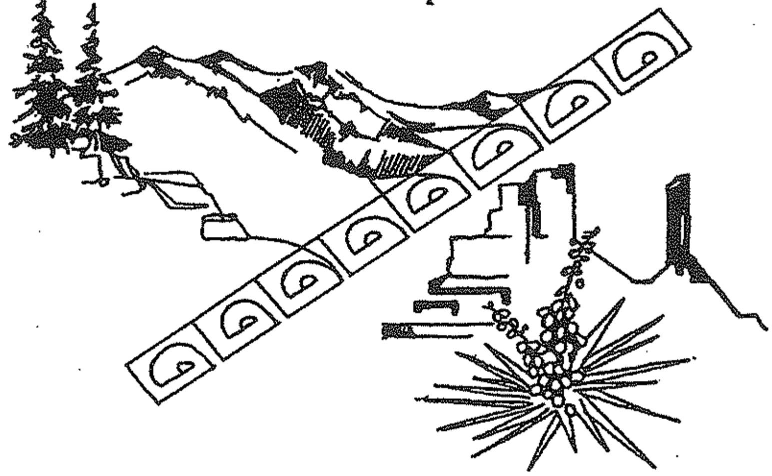
Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

Final Report



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and

SWCA, Inc. Environmental Consultants

Section 3

HISTORICAL OVERVIEW OF THE UPPER GILA AND SAN FRANCISCO RIVER VALLEYS, ARIZONA

Prepared for

SFC ENGINEERING COMPANY

Prepared by

**SWCA, INC.
ENVIRONMENTAL CONSULTANTS**

June 1997

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SWCA Project No. 38-51185
SWCA Report No. 97-75

June 1997

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INTRODUCTION

Historically the upper Gila and San Francisco Rivers were occupied by the Yavapai (until about 1700) and (after about 1700) the Western Apache and Chiricahua Apache. The Western Apache practiced some irrigation agriculture, but their fields were along streams higher in the mountains north of the Gila. The Chiricahua Apache only rarely practiced agriculture, but are reported to have built bullboats to cross streams (although not specifically the Gila or San Francisco rivers. The Spanish and Mexicans were largely kept out of the upper Gila and San Francisco rivers by the Apaches, but as early as 1825 or 1826, trappers from the United States (via the Santa Fe Trail and Taos, New Mexico) were traveling to the Santa Rita Copper Mines near modern-day Silver City, New Mexico, then trapping down the Gila and San Francisco rivers and beyond. Although these trappers constructed canoes and rafts to use on the Colorado River, they apparently did not float the upper Gila and San Francisco rivers.

In 1846, Stephen Watts Kearny and the Army of the West marched down the Gila River, guided by Christopher "Kit" Carson. Lieutenant William Emory of the Corps of Topographical Engineers described the study area in some detail. Despite this early use of the upper Gila River as a military route, however, later travelers took the 1846 route of Colonel Philip St. George Cooke and the Mormon Battalion across southern Arizona. Not until the 1860s did the United States begin to make a concerted effort to subdue the Apaches and open the upper Gila and San Francisco rivers to white settlement, and these military actions spanned nearly 25 years, from about 1862 to Geronimo's surrender in 1886. Army units made the first discoveries of mineral deposits in the area, resulting in the founding of the Clifton-Morenci mining district in 1872. Farming and ranching along the Gila and San Francisco rivers proceeded concomitantly with the development of mining. By 1901 most of the Gila River valley above the confluence of the San Francisco River was irrigated, but irrigation agriculture along the San Francisco was limited to only a few farms. Beginning in 1880, Clifton was struck by a series of floods from the San Francisco River. Early forms of transportation included horses, mule trains, wagons, and stagecoaches, and railroads to the mines began to be constructed in the late 1870s. In 1883 the Arizona and New Mexico Railroad was built to connect Clifton to the main line, which had been built across southern Arizona in 1881. During the early 1900s, Clifton was on one of the principal transcontinental highways, but this route was superseded by Route 66 and the current Interstate 20 route.

Both the upper Gila River and the San Francisco River are considered boatable streams today (Anderson and Hopkinson 1982, 1987). Several accounts describe boating on the upper Gila, and two accounts describes floating the San Francisco. Accounts of boating on the upper Gila date to 1895 (*Graham County Bulletin*, February 22, 1895, p. 3; *Phoenix Herald*, February 18, 25, 1895), 1909 (Granger 1983:259), and the 1980s (Salmon 1986). Accounts of floating the San Francisco River date to 1895 (*Graham County Bulletin*, February 22, 1895, p. 3; *Phoenix Herald*, February 18, 25, 1895), circa 1915-1926 (Shortridge 1990:41), and 1973 (Jones 1973).

HISTORICAL OVERVIEW/CHRONOLOGY

Historical documentation of the upper Gila and San Francisco rivers may have begun with the Coronado Expedition in 1540, although the Coronado's route is the subject of debate. Subsequently the Spanish apparently had little direct familiarity with the area, and it remained an Apache stronghold. During the Mexican period (1821 to 1848) American trappers penetrated the area, providing sketchy accounts of the stream. Guided by Christopher "Kit" Carson, Stephen Watts Kearny led the Army of the West down the Gila in 1846, and Lieutenant William Emory of the Corps of Topographical Engineers provided the first accurate maps and descriptions of the upper Gila River. The United States military began a concerted effort to subdue the Apaches in the area in 1862, and mining began in earnest on the San Francisco River in 1872, resulting in the founding of Clifton and other mining towns. Thereafter, an uninterrupted history exists for the area. A chronology of the principal historical events along the upper Gila and San Francisco rivers can be found at the end of this report. Historical maps showing the principal localities mentioned in the text are in Appendix A. Historical photographs are in Appendix B.

Historic Indian Use

Two Native American groups, the Yavapai and the Apaches, used the study area in historic times. The Yavapai preceded the Apache and probably used the area until about 1700, when the Apaches moved into the area.

The Yavapai are a Yuman-speaking tribe who are thought to have numbered about 2,000 in the 1860s (Khera and Mariella 1983:Table 1). Prehistorically the Yuman speakers lived on the lower Colorado River, and began to spread east about A.D. 1100-1300 (Dobyns and Euler 1970; Pilles 1981:172-177; Rogers 1945:190), migrating into the Mogollon Highlands by the sixteenth century when they were probably observed north of the Gila River by the Coronado Expedition in 1540 (Winship 1896), and certainly seen in the Verde Valley by the Espejo Expedition in 1582 (Hammond and Rey 1966). Although the Yavapai practiced some limited agriculture, their subsistence was based on hunting wild game and gathering wild plants (Khera and Mariella 1983). Agave could be harvested year-round by moving to different elevations. The fruits of saguaro and other cactus were available in the summer. Piñon nuts, sweet acorns, walnuts, sunflower seeds, and grass seeds were gathered and stored for use in the winter. Each family group operated independently, but when resources were abundant, groups of families would camp together. Because the Yavapai were so mobile, they often lived in natural shelters of rock overhangs and more rarely built dome-shaped huts of brush or mud.

In 1540, the Coronado found a few people living in the vicinity of Chichilticale, a ruin at the northern edge of the Sonoran Desert. These people, who were probably Yavapai, were described as "the most barbarous yet seen. They live in separate cabins and not in settlements. They live by hunting" (Winship 1896:143).

Some time between the Coronado Expedition of 1540 and about 1700, the Yavapai were largely displaced by the Apache, who were the principal group to use the Gila and San Francisco rivers in historic times. The Apache and Navajo speak mutually intelligible dialects of a single language, Southern Athapaskan. Southern Athapaskan speakers are believed to have split from the main group of Athapaskan speakers in the western subarctic regions of Canada about 1,000 years ago. Drifting south, the Southern Athapaskans probably entered the Southwest between about A.D. 1540 and 1582. Gunnerson (1956, 1974) notes that when the Coronado Expedition passed through the Southwest in 1540, they did not report seeing any groups of people that can be identified as the Apache. Once the Coronado Expedition reached the Great Plains, however, they came across a groups of people who lived in conical skin tepees, used dogs as beasts of burden, and hunted the buffalo. Coronado's Pueblo Indian guides reported that these people, who Gunnerson believes to have been Apaches, arrived in the area about 15 years before. In 1582, the Espejo Expedition reported Querechos near Acoma Pueblo in New Mexico, and this group of people is often interpreted as Apaches, perhaps the ancestors of the modern Navajo (Gunnerson 1956, 1974).

Once in the Southwest, the Southern Athapaskans split into seven groups, known since the late nineteenth century as the Kiowa-Apache, Lipan Apache, Jicarilla Apache, Mescalero Apache, Navajo, Western Apache, and Chiricahua Apache. These names are relatively recent, however. The term Apache was first used by Don Juan de Oñate in 1598 (Opler 1983:385). Apaches are said to have been allied with Acoma Pueblo during Oñate's siege of Acoma in 1598 (Di Peso 1956:33-35). Fray Alonso de Benavides mentioned the Apaches de Gila (probably ancestors of the Chiricahua Apache) in the 1620s (Benavides 1945:82, 84-85). In 1697, Captain Juan Manje observed Apaches de Gila at the junction of the Gila and San Pedro (Di Peso 1956:33-35; Manje 1954).

By the mid-nineteenth century, the San Francisco River was an informal dividing line between the Western Apache and the Chiricahua Apache. The Western Apache lived primarily by hunting wild animals and gathering wild plants, although practiced some agriculture (Basso 1983). Their winter camps were in the Salt, Black, and Gila River valleys; their summer camps were along streams in the mountains, where they practiced irrigated agriculture. The Western Apache lived in wickiups brush-covered wickiups. They comprised five divisions, the Northern Tonto, Southern Tonto, Cibecue, San Carlos, and White Mountain Apaches.

The Chiricahua Apaches lived almost exclusively by hunting wild animals (especially deer, more rarely antelope, and often small game) and gathering wild plants (especially agave). The

Chiricahua practiced only limited agriculture and even that probably dates to historic times. Dwellings were primarily brush-covered wickiups. Opler (1983:414) reports that the Chiricahua manufactured bull boats (hide-covered, wooden-frame boats) for crossing streams. Geronimo divided the Chiricahua Apaches into four groups (Barrett 1970); Opler (1983) recognizes three: the Eastern Chiricahuas (the Chihennes group described by Geronimo); the Central Chiricahuas (including Geronimo's own group, the Bedonkohes, and Cochise's band, the Choconens); and the Southern Chiricahuas (the Nednais of Mexico). Geronimo said that he was born in 1829 at the headwaters of the Gila, in Arizona. Since the headwaters of the Gila are in New Mexico, the exact location of Geronimo's birthplace is a matter of debate. Debo (1976) believes that it was at the junction of the San Francisco and the Gila.

In addition to hunting, gathering, and agriculture, a substantial portion of Apachean subsistence in historic times was based on raiding and warfare. Throughout the Spanish and Mexican periods (see below) the Apaches were considered a threat to neighboring Indian and European settlements. In 1862, the United States established a chain of forts in Arizona to control the Apaches, initiating nearly 25 years of warfare that ended with Geronimo's final surrender in 1886.

Spanish Period

Spanish exploration of the Southwest was originally prompted by the stories of Cibola heard by Cabeza de Vaca during his 1528-1536 trek from Florida to Mexico. Sometime near the end of April, 1536, Cabeza de Vaca, and three companions--the only survivors of 300 men who had debarked on the coast of Florida eight years before--arrived in Sinaloa, having walked across the Gulf Coast and through the American Southwest.

In 1539, Fray Marcos de Niza and Estevan (a black who had accompanied Cabeza de Vaca) set out from Culiacan to investigate the stories of Cibola. Estevan went as far as Zuni, where he was killed, and when Fray Marcos (who was traveling some distance behind Estevan) heard of Estevan's death, he retreated to New Spain, spreading tales of the wealth of Cibola.

These stories led to the organization of the Coronado Expedition, which explored the Southwest from 1540 to 1542 (Winship 1990:37-57).

In February of 1540, Francisco Vásquez de Coronado set out from Compostela, Mexico, leading an expedition of over 230 mounted men, 62 foot soldiers, and over 800 Indian allies, to explore what is now the southwestern United States. The expedition's route to Zuni has been variously reconstructed (Bolton 1916, 1949, 1990; Day 1964; Di Peso 1951; Hodge 1933; Hodge and Lewis 1907; Riley 1985; Sauer 1932, 1937; Schroeder 1955, 1956; Winship 1896; for a summary see United State Department of the Interior, National Park Service 1991). After entering what is now the United States near the International Four Corners, however, the expedition traveled through a *despoblado* (deserted area) most of the way to Zuni. The location of Coronado's route through southern Arizona is largely dependent on the location of a pueblo ruin he called Chichilticale. The location of this ruin has been debated by archaeologists and historians (Haury 1984; Riley 1985), and no consensus has been reached.

Castañeda heard that Chichilticale had been built by a people "who separated from Cibola," and he believed that "it must have been destroyed by the people of the district, who are the most barbarous people that have yet been seen. They live in separate cabins and not in settlements. They live by hunting" (Winship 1990:143).

Captain Juan Jaramillo (Winship 1990:206) described how, after following the Nexpa River (which Winship thought was the San Pedro) to Chichilticale, the Coronado Expedition had to cross a series of rivers, including the Rio de San Juan (Saint John's River), the Rio de los Balsas (River of Rafts), the Rio de la Barranca (Slough River), and El Rio Frio (Cold River) before reaching the Bermejo (Red) River, which was two days from Cibola (Zuni) and is usually considered to be the Little Colorado River. The Rio de las Balsas received its name because the army had to cross it on rafts. A number of students of the Coronado Expedition have suggested that the Rio de las Balsas was the Gila. Granger (1983:260) states that the Gila was the Rio de las Balsas (River of Rafts), a name based on Indian use of wicker baskets to cross the stream.

North of the Gila River, Coronado met a small group called Nixoras. Ferg (1992:5), Gifford (1932), and Schroeder (1974:1) say they were Yavapais; Goodwin (1942:67), Oakes (1996:Table 1), and Riley (1985:160) believe they could have been Apaches.

The Coronado Expedition entered Hawikuh on July 7, 1540. On August 3, 1540, while still at Zuni, Coronado wrote to Viceroy of Mexico, Don Antonio de Mendoza, describing the progress of the expedition. Coronado briefly described the difficulties in traveling through the mountains from the Sonoran Desert to the Mogollon Rim, "beyond which the country becomes pleasant, and there is a river called the River of the Flax (del Lino)" (Winship 1990:177).

As Coronado was working his way through what is now eastern Arizona, Captain Hernando de Alarcon sailed up the Colorado River as far as the mouth of the Gila, which he named the Rio Brazo de Miraflores, and it appears as such on the 1541 map of Domingo de Castillo (Granger 1983:259). In subsequent years, the Spaniards extended their knowledge of the Gila River, based on their encounters with the stream below the current study area. Juan de Oñate named the Gila "Rio del Nombre de Jesus" and explored the river to its junction with the Colorado River in 1604 (Granger 1983:259-260). Fray Alonso de Benavides, who wrote in the 1620s, referred to the Apaches de Xila, although he did not specifically state that the Xila was a river (Benavides 1945).

The first use of the name Gila River was in 1697, when Fr. Eusebio Kino and Lt. Cristobal Martin Bernal explored the San Pedro River to its junction with the Gila (Granger 1983:26-). "In 1701 Kino called it Rio Grande de Hyla. However, in 1701 he also named its upper reaches the Rio de los Santos Apostoles (="river of the sainted Apostles"), because he had already suggested naming its four principal tributaries after the four major Apostles and the name applied to their joining in forming the larger stream" (Granger 1983:260). "The Name Rio de los Santos Apostoles was still in use on a map made by Capt. Clark and sent to President Thomas Jefferson on April 7, 1805" (Granger 1983:260). Kino noted that Sir Francis Drake called the Gila the Rio del Coral (Red River) (Bolton 1916:444). Father Juan María de Salvatierra, the Provincial Father of New Spain, who got most of his information from Kino, called the Gila the Rio de Grande (Granger 1983:260).

From 1766 to 1768, the Marqués de Rubí inspected the presidios of New Spain. His cartographer, Nicolás de Lafora reported Apaches living along the Gila, San Francisco, and Mimbres rivers (Lafora 1958; Opler 1983:403). In 1775, Father Francisco Garces, who was familiar with the lower Gila, called the Gila the Rio Jaquesila (Granger 1983:260).

The Spanish began mining at Santa Rita del Cobre near present-day Silver City, New Mexico, about 1800 (Weber 1971). According to Calvin (1946:62), Apaches showed the copper deposits to Colonel José Carrasco in about 1800, and don Francisco Elguea subsequently received a land grant for the area and developed the mines.

Mexican Period and American Trappers

Mexico won its independence from Spain in 1821. The Mexican government sponsored few expeditions in to western Arizona. Despite Mexico's attempts to discourage incursions into its territories by citizens of the United States, fur trappers began exploring the Southwest while it was still part of Mexico. Contrary to their popular image, the mountain men generally rode horseback through the Southwest and did not normally use boats. On at least three occasions (Ewing Young's party in 1826, the Yount-Pattie group in 1827, and Leroux in 1837), however, trappers canoed the lower Colorado River (see below). The Santa Rita Mines in New Mexico and the Gila River were the gateway to the Southwest for these American trappers.

In the early 1800s, citizens of the United States began to settle in Santa Fe and Taos. The Mexican government discouraged trapping, but in 1826, James Ohio Pattie and his father Sylvester Pattie and 12 others made an illegal trip to the Gila (Weber 1971:96-67). (Note that Davis [1982] argues that the Patties' first trip to the Gila was in the winter of 1824-1825.) They went first to the Santa Rita copper mines, near what is now Silver City, New Mexico, then traveled westward to the Gila. While still in New Mexico, seven trappers deserted the Patties, going ahead of them to get the first chance at the beavers. On January 1, 1825 (Davis 1982) or 1826 (Weber 1971) they left the Gila and started up the San Francisco, returning to the Gila on January 19 (pp. 55-56). Between the mouth of the San Francisco and the mouth of Bonita Creek, they ran into the deserters, who had been attacked by Indians, resulting in the death of one man and the wounding of the others. On January 31, they reached the Safford Valley (p. 59). The group went as far west as the San Pedro River (which they called the Beaver River), trapped up the San Pedro, then went over the Galiuro Mountains back to the Safford Valley. They returned to the Santa Rita copper mines on April 29, 1825. James left Sylvester at the mines and returned to Santa Fe for horses and supplies. He then returned to the Gila to recover their caches, but they had been stolen.

Ewing Young and William Wolfskill also organized an expedition to the Gila in the summer of 1826, but Ewing Young became ill, and William Wolfskill led the group, which comprised 11 to 16 men, including Milton Sublette, Thomas (later to be known as "Pegleg") Smith, Maurice le Duc, Alexander Branch, S. Stone, Richard Campbell, and George C. Yount (Weber 1971:124). Templeton (1965:51) says that Ceran St. Vrain was in this group also. This group went to the Santa Rita mines, then down the Gila to the Salt. The group was subdivided into three smaller groups: Smith, Branch, and Stone were in one group; Ceran St. Vrain headed a third group; and Wolfskill and approximately 10 other men were in the third party. Wolfskill's group (which included Milton Sublette) got in a battle with Indians at the mouth of the Salt and had to retreat.

In the fall of 1826, four groups of trappers went to the Gila. One group, led by William Sherley ("Old Bill") Williams and Ceran St. Vrain, consisted of 20 men. A second group, led by John Rowland, consisted of 18 men. A third group, led by Antoine Robidoux, consisted of 30 men, including James Ohio Pattie. Finally, Ewing Young led a party of 18 (Weber 1971:119-120). The Robidoux party went to the Santa Rita, New Mexico, copper mines, then went down the Gila to the Salt River, where Indians killed all the men except for Robidoux, Pattie, and an unnamed French trapper (Weber 1971:123). The survivors joined Ewing Young's party. George C. Yount was with Ewing Young's 1826 group. Like Robidoux's group, Young's party had gone through the Santa Rita Mines on their way to the Gila. They had then gone through San Francisco Hot Springs and trapped up the San Francisco River, returning to the Gila. The combined Young and Robidoux parties continued on down the Gila to the Colorado. Yount wrote,

> "In trapping the Colorado it was found convenient to construct small water-craft, which was done by scooping out logs of Cottonwood, after the method practiced by the Indians--With these canoes our trappers ascended the River till they reached the nation of the Mohavies" [Camp 1966:33].

They went upstream to the bend in the Colorado River, then back to the Mohave villages (Camp 1966:38). At the mouth of the Virgin River, the group divided up (Weber 1971:125). Pattie and others went east and returned to Santa Fe by traveling down the Rio Grande (Weber 1971:125). George Yount returned to Santa Fe via Zuni Pueblo (Weber 1971:126). This group apparently went north of the San Francisco Peaks to Black Falls and across to Zuni (Camp 1966:33). Yount does not mention going through Hopi on this trip, but he does describe recovering from their arduous trip at Zuni (Camp 1966:38). Thomas ("Pegleg") Smith, S. Stone, and Alexander Branch may have taken a still different route back to New Mexico; Humphreys (1966:318) says that after they left the main group at the mouth of the Virgin River, they built rafts and crossed the Colorado River. Ewing Young returned to Santa Fe in May, 1827 (Weber 1971).

On April 23, 1827, the Mexican government confiscated 115 beaver pelts, trapped along the Gila, from Ira A. Emmons, even though he claimed to be a resident of Santa Fe (Weber 1971:127-128).

In September of 1827, George C. Yount and Sylvester Pattie led a group of 24 men "including servants and campkeepers" to the Gila and Colorado rivers. On this trip, the Patties' third, they left Santa Fe in September of 1827 and reached the Gila River on October 6, 1827. "They followed the usual route--to the Copper Mines, down the Gila to the Pima Villages" and then to the Colorado (Camp 1966:43). At the Colorado, Sylvester Pattie, James Ohio Pattie, and six others "became insubordinate, and parted from the main body, above the mouth of the Gila, built canoes, and descended the Colorado to try their fortunes alone" (Camp 1966:45). Reaching the Gulf of California, the Patties and their followers went across Baja California to Santa Catalina, where they were imprisoned for traveling to the Gila and California without proper authorization. Sylvester died in prison, but James was released and returned to Kentucky in 1830 (Weber 1971:139-140). The rest of Yount's group continued along the route followed in 1826, going up the Colorado to the vicinity of present Lake Mead, returning to the Mohave villages, then traveling overland to the Grand Canyon (at the mouth of Spencer Canyon), then to Grand Falls and Hopi (Camp 1966:53-54). From Hopi, they went through Zuni and Laguna to Taos (Weber 1971:140-141).

In August of 1829, Ewing Young led a group of 40 American, Canadian, and French trappers (including Kit Carson on his first trapping expedition) from Taos to Zuni, and then to the Salt River. The group went up the Verde River to its headwaters, where the group split up, some of the men going back to Taos, while Young, Carson, and others went to California (Weber 1971:142-143), crossing the Colorado River at the later site of the Eldorado Ferry, some 40 miles northeast of modern-day Needles (Holmes 1967). In September of 1830, Young and Carson went back to the Colorado River, down to the Gila, then up the Gila to the Santa Rita mines (arriving at Santa Rita in January of 1831). They continued on to Santa Fe (Carter 1968:44-50).

Trapping on the Gila continued throughout the 1830s, until as late as 1842. Antoine Leroux arrived in Taos in 1824, and explored the West from 1833 to 1840. Leroux was on the Gila in 1825 or 1826. Parkhill (1965:57) quotes Stanley (1917:29) as saying, "He [Leroux] had trapped the Gila River for beaver and his party being discovered by the Apaches, he kept up a fight with them for three weeks." Lingenfelter (1978:16) says that Leroux rafted the Colorado from the mouth of the Virgin River in 1837.

United States Military Exploration

Kearny

American military exploration of the Gila began in 1846, when General Stephen Watts Kearny and the Army of the West went down the Gila (see Cutts 1965; Emory 1848; Griffin 1943; Johnston 1848; Turner 1966). Kearny was guided by Kit Carson. Lieutenant William Emory of the Corps of Topographic Engineers mapped the route and recorded information about it (Emory 1848). Dr. John Griffin, the expedition's surgeon, and Captain Abraham R. Johnston also kept journals that describe the route through eastern Arizona.

The group passed Steeple Rock, near present-day Lordsburg, New Mexico, on October 22, and on October 23 camped near the present-day New Mexico-Arizona border. In the last miles of New Mexico, Emory remarked that "the general appearance, width of the valley, and soil" along the Gila reminded him of the Rio Grande in New Mexico, so it is not surprising that on that day, they came across "one of the long-sought ruins," rectangular stone alignments and "immense quantities of broken pottery, extending for two miles along the river." (Emory 1951:105). Dr. Griffin wrote,

> "This morning we left camp about 9 oclock, crossed the River, and marched down the bottom on the north side of the stream, the road was quite level, but ye gods the dust. I never suffered or saw men suffer more from any trifling annoyance in my life. The grass & weeds indicated quite strong soil, and might be cultivated by proper irrigation. We saw one or two wild geese & two or three flocks of ducks--the advanced guard saw the black quail & the common quail of the United States. No other game was seen, the fact is Carson says he never knew a party on the Gila, that did not leave it starving" [Griffin 1943:26].

Johnston took great interest in the prehistoric ruins the group encountered and made sketch maps of several of them, recording dimensions of the ruins and drawing the potsherds. He marveled at the notion that farming could ever have been practiced in the area:

> "It can scarcely be believed that this sterile region was ever inhabited by a people differing much from the savage race now found here, the country does not afford resources for a civilized population. The soil is sterile beyond conception, producing the cactus in every variety, and in great abundance, but nothing else save a sparse growth of grass, which though scarce, is of excellent quality--as a stock raising country it might have been settled at one time, and maybe settled again, but nothing else I feel assured" [Johnston 1848:89].

On October 24, the group passed additional ruined villages, including house foundations measuring 20 by 60 feet. Emory wrote that "We feasted to-day on blue quail and teal, and at night Stanly came in with a goose. `Signs' of beaver and deer were very distinct; these, with the wolf, constitute the only animals yet traced on the river." (Emory 1951:106). Griffin (1943:26) wrote, "We have been fishing & caught nothing. ... No fish caught and only one goose killed."

On October 25, Emory described the country "as much the same as before represented" (Emory 1951:106), and they passed two more ruins, including house foundations measuring up to 30 by 40 feet (Emory 1951:107). Towards evening, the terrain "broke into irregular and fantastic-looking mountains" (Emory 1951:106), and that night they camped just east of the confluence of the Gila and the San Francisco (which Emory called the Prieto River). Johnston (1848:90) wrote, "We have marched today about 20 miles--greater part of the time on the bottom of the river, then taking to the hills marched several miles over precipitous hills and deep ravines, and are encamped on a high hill which enables us to the course of the river for miles." Johnston (1848:91) further remarked on seeing "innumerable partridges" that day.

On October 26,

> "Soon after leaving camp, the banks of the river became gullied on each side by deep and impassable arroyos. This drove us insensibly to the mountains, until at length we found ourselves some thousand feet above the river, and it was not until we had made sixteen miles that we again descended to it" [Emory 1951:108].

Emory noted that the mountains to the north were "deeply indented by the ingress into the Gila of the Prieto (Black) [today's San Francisco] and Azul (Blue) [today's Eagle Creek] rivers" (Emory 1951:108). Emory (1951:109) heard from Londreau (Antoine Leroux?) stories about the Pattie misfortunes some 20 years before:

> "As the story goes, the Prieto flows down from the mountains, freighted with gold. Its sands are said to be full of this precious metal. A few adventurers, who ascended this river hunting beaver, washed the sands at night when they halted, and were richly rewarded for their trouble. Tempted by their success, they made a second trip, and were attacked and most of them killed by the Indians. My authority for this statement is Londreau [Leroux?], who, though an illiterate man, is truthful" [Emory 1951:109].

"The Name Rio de los Santos Apostoles was still in use on a map made by Capt. Clark and sent to President Thomas Jefferson on April 7, 1805" (Granger 1983:260).

The Boundary Survey

The Gila was the boundary between the United States and Mexico from 1848 to 1853, when the Gadsden Purchase extended United States territory to the south. From 1850 to 1853, John R. Bartlett of the United States Army Corps of Topographical Engineers attempted to survey the boundary between the United States and Mexico, as this boundary was described in the Treaty of Guadalupe Hidalgo. The description in the Treaty of Guadelupe Hidalgo was based on inaccurate maps and misunderstandings about the regional geography. Therefore, the Gadsden Purchase was negotiated and was based primarily on latitude and longitude and not on topographic or geographical features. The new boundary was surveyed in 1854 and 1855 by William Hemsley Emory. Bartlett prepared a two-volume report that was essentially a travel book (Bartlett 1854); Emory produced a two-volume report (Emory 1857) that was as much a geographical treatise as a description of the survey.

Bartlett (1854[II]:160) commented on the navigability of the Gila as follows, concluding that in the best of circumstances the Gila was navigable only in its lower reaches (below its confluence with the Salt). He wrote, "It is doubtful whether it can ever be navigated, except at its floods, and these are by no means regular. At such times flat-bottomed boats might pass to the mouth of the Salinas, near the Pima villages" (Bartlett 1854[II]:160). Furthermore, Lieutenant Amiel Weeks Whipple of the Corps of Topographical Engineers, who did virtually all of the actual surveying, felt that the Gila River was an impracticable route for a wagon road or railroad because of the canyons along it:

> "From what precedes [Whipple's descriptions of various canyons] it may be inferred that it would hardly be practicable to construct "a road, canal, or railway" to run wholly upon the river Gila. The Cañon of the Pinall Leño Mountains is a complete barrier. The Pass below the junction of the Rio San Pedro, is equally impracticable. Between the Pimo settlements and the junction of the Gila with the Colorado, nature imposes no serious obstacle to the construction of a way of communication, such as the travelling public may demand. But from the Pimo village to the Rio Del Norte, I know of no practicable route even for a wagon road, except by entering the State of Sonora to avoid the Pinall Leño Mountains" [Whipple 1852:599].

One of the stipulations of the Treaty of Guadalupe Hidalgo was that the United States would recognize Spanish and Mexican land grants. Subsequently, numerous claims of land grants had to be adjudicated. The Peralta-Reavis claim, which was found not to be valid, included 13,000,000 acres in the Gila River Valley from the Arizona-New Mexico border nearly to the Gila-Salt confluence (Tellman and Yarde 1996:18).

The Apache Wars

Beginning in the 1860s, the United States miliary began establishing a system of military posts throughout southeastern Arizona to control the Apaches. Among these bases were Fort Aravaipa (later Fort Breckinridge, then Camp Grant, and finally Fort Grant), Fort Bowie, Fort Goodwin (on the Gila River below the study area), Fort Apache, Camp San Carlos, and Fort Thomas (on the Gila River below the study area). The Apaches were then forced onto reservations that were usually outside the traditional homelands of most of the Apaches who were expected to live there. Furthermore, boundaries of reservations were reduced to accommodate mining, grazing, and other interests, and even entire reservations (such as the Chiricahua Apache Indian Reservation) were abolished. The Apachean groups that used the San Francisco and upper Gila rivers in eastern Arizona were expected to move first to the Chiricahua Apache Indian Reservation, established in 1872 and abolished in 1876, and then were ordered to move to the San Carlos Apache Indian Reservation, established in 1872. Resistance to these moves resulted in a number of conflicts in the study area, perhaps the most famous of which was the 1882 attack on the York ranch by a band of Chiricahua Apaches led by Loco, Chatto, and Naiche (Woody and Schwartz 1977:57-). Apachean resistance continued until 1886, when Geronimo surrendered for the final time.

Mining

During the Apache wars, troops discovered copper deposits on the San Francisco River. These deposits began to be developed in 1872, resulting in the creation of the Clifton-Morenci mining district.

According to Granger (1983:158), "Lt. John G. Bourke says that he was with an army scouting expedition c. 1869 which found rich ore in the vicinity of the later Clifton. The men took pieces of ore to Tucson, but not until c. 1872 did prospectors and miners from Silver City, New Mexico, explore the area and establish copper mine locations." Bourke (1891) wrote:

> "We were among the very first to come upon the rich ledges of copper which have since furnished the mainstay to the prosperity of the town of Clifton, on the border of New Mexico, and we knocked off pieces of pure metal, and brought them back to show the people there, on returning from our scouts in the upper Gila" [Bourke 1891:98-99].

In 1871, J. H. Holbrook led a group of 21 prospectors (including "Mase" Greenlee) from Pueblo, Colorado, to the Gila River Valley, and they prospected in the area that would later become Clifton and Morenci, but they were forced out by Indians (Patton 1977:155 n.14).

In 1872, three groups of prospectors established claims for copper mines in the Clifton area (Patton 1977:9). The first group included J. M. Bullard, Joe Yankie, and six others from Silver City, New Mexico. The second group was led by Captain Jay and I. N. Stevens. These two parties located the Montezuma, Copper Mountains, Yankie, and Arizona Central Mining Claims. The third group of miners who staked claims in the area were led by Bob and Jim Metcalf, who established the Longfellow and Metcalf mines. According to Granger (1983:158), the prospectors and miners from Silver City, New Mexico included Charles M. Shannon, Charles Lezinsky, and Lezinsky's brother. In August, 1872, the Copper Mountain Mining District was organized (Patton 1977:9).

"Among the first miners in the Clifton area were Charles and Baylor Shannon, nephews of Robert and Jim Metcalf. Charles located claims on Chase Creek. At what was later Metcalf, he built the Shannon smelter for the Shannon Copper Company on [Shannon Mountain]" (Granger 1983:555). "The smelted ore which Lesinsky produced at this time he shipped by ox and mule team to Kansas City twelve hundred miles away" (Patton 1977:13). Patton (1977:48) published a photograph of one of the burro trains with the caption, "Burro ore trains were used to transport the ore in the beginning."

In 1883, James Colquhoun arrived in Clifton, having taken the train from Lordsburg. Colquhoun described the communities along the Gila River as follows (Patton 1977):

> "Duncan was a mere hamlet, the home of the Parks family, a hardy fearless race of natural pioneers. Seven miles north of Duncan we passed the York ranch, home of the beautiful York girls whose father was slain by the Apaches. Nearer Guthrie was the Coronado ranch. These were the only settlements found between Lordsburg and Clifton" [Patton 1977:20].

At this time "The courthouse, made of canvas, stood in what is now the river bed" (Patton 1977:21).

> "The bridge over the Gila near Old San Carlos, one of the biggest on the road, was severely damaged in the summer of 1898, half of it being washed away by a flash flood. The missing supports were replaced temporarily by a sort of matchstick method using 5000 railroad ties. The next day, another flash flood took all 5000 of them downstream toward the Gulf of California" [Woody and Schwartz 1977:199].

Circa 1900, "The only means of crossing the river was by means of swinging bridges. ... Since these bridges were small and intended only for foot passengers, horses and wagons had to ford the stream" (Patton 1977:27).

Clifton reached its peak population about 1910, when it had about 5,000 residents (Patton 1977:70). According to Patton (1977:70), "The greatest building boom in Clifton's history was in 1912 and 1913. At that time the Chase Creek, Shannon Hill, and High School buildings, were built, and Mrs. Reardon had the fine little hotel constructed in South Clifton which was soon to replace the Clifton Hotel as the town's leading hostelry." The Arizona Copper Company built a mansion for its president at "the site of the old circus grounds on Eastside. ... It was low, so a ten foot levee was built and the ground filled in behind it to the top of the wall" (Patton 1977:71). In 1912, the "Southern Pacific Railway Company built a fine new passenger and freight station" (Patton 1977:71).

Farming and Ranching

Farming and ranching developed at about the same time as mining in the study area, during the 1870s. Farming was concentrated on the Gila River, which provided water for irrigation of adjacent fields. A number of farming communities--including Duncan, Franklin, Guthrie, Purdy, Sheldon, and York--were located along the Gila River. A limited amount of irrigation agriculture was also practiced on the San Francisco River.

One of the earliest cattle trails through Arizona passed through the upper Gila River valley along the old Kearny route. As described by Haskett (1935):

> "The one leading into central Arizona diverged from this [Goodnight-Loving or Pecos] trail near Roswell, New Mexico, ran west by way of Tularosa and Silver City to the San Francisco River, thence down that stream to its juncture with the Gila on into Arizona, where it divided, its branches going to various parts of the territory" [Haskett 1935:21].

York Ranch was one of the earliest ranches in the region, and a small community grew up around it. As described by Woody and Schwartz (1977):

> "The York family came to the Gila country from Colorado in 1877, stopping in Silver City and ranching for a time in New Mexico. The settled as ranchers in wild country in 1878 in a large adobe house, located on a bench above the Gila River, which often served as a resting place for travelers en route to Clifton" [Woody and Schwartz 1977:57].

In 1882, York ranch was attacked by a band of Chiricahua Apaches that included Loco, Chatto, and Naiche (Woody and Schwartz 1977:57-60).

One of the largest ranches in the Clifton area was the Double Circle Ranch. It was started in the late 1870s as a sheep ranch. In 1884, Joseph H. Hampson purchased it and began running cattle. He sold the ranch in 1908 to a group that formed the Double Circle Cattle Company in 1909. The ranch was dissolved in 1936 (Patton 1977:118-120).

George Wells started a ranch on the San Francisco River above Clifton in the late 1870s. By 1886 it was being farmed by Charley Wing (Granger 1983:452).

One of the most luxurious ranches in the area belonged to Dell Potter. Patton (1977) described it as follows:

> "Early in the twentieth century he had a beautiful home built on his ranch two miles above Clifton. He sent to Los Angeles and had an architect draw up plans for it. The design was a mixture of Spanish and southern plantation. When complete it was the show place of Clifton and one of the finest residences in Arizona. It had hardwood floors and running water. A broad verandah extended around two sides of it. The grounds were beautified with fruit trees and shrubbery. The water supply was pumped by an ingenious pumping device, which utilized a large amount of water from the river to furnish power to pump a small amount to a tank high on the side of the mountain from which it flowed into his fields and orchards. He planted an acre of mulberry trees and sodded the ground with fine grass. Anyone who wished could go there for picnics under the mulberry trees free of charge" [Patton 1977:74 n.15].

A notation on a photograph of Clifton in April of 1905 (University of Arizona, Special Collections, File: Clifton [Ariz.] File 1, Fol. 1, and Stereographs, Photographs) described Potter's Ranch as follows: "Up the cañon on the right, the train takes you to the camp of Metcalf, and the stage road to Morenci also runs in this direction. There is a beautiful farm up this canyon owned by a man named Potter. The home is exceptionally attractive and the orchard and flower beds are a veritable Eden compared with the surrounding walls of high, barren mountains."

A map of irrigated areas in Arizona in 1901 (Bureau of the Census 1901) shows most of the Gila River valley above the confluence with the San Francisco River was irrigated, but only one small area of the San Francisco River (well above Dell Potter's ranch) was irrigated.

From about 1900 to 1905, large herds of goats were introduced to the mountains above Clifton, and caused so much erosion that they were blamed for the floods that occurred in Clifton in subsequent years. In response to this overgrazing, the federal government closed the area north of Clifton to further settlement in 1905 (Olmstead 1919:65).

Rush (1922) described the irrigation agriculture in Greenlee County circa 1922, stating, "At present there are about 54 miles of main irrigation canals in the valley, carrying water to about 4500 acres of farm land. Winding through the valley is the Gila River, which furnishes water for the cattle that feed on the ranges adjacent to the valley, and also irrigation water for the many fertile farms which have been developed along the banks of the river."

Cities and Towns

A number of cities and towns were located in the vicinity of the study area. Clifton is located on the San Francisco River. Oroville, now abandoned, was located upstream. The communities of Duncan, Franklin, Guthrie, Purdy, Sheldon, and York were located on the Gila River. Benton, Boyles, Coronado Mining Community, and Morenci were among the communities located nearby.

Benton. Benton, now the Rail H U Ranch, was located 3.5 miles above the junction of the Blue and Little Blue. It was named after a "cattle rancher (first name unknown) killed in the first Apache raid on the Blue River c. 1889" (Granger 1983:60). Benton was the location of a Sawmill run by Ira Harper. It also had a school. 1904-6 flooding destroyed the town. The post office was established in 1903 and abandoned in 1907 when postmaster Max A. Balke and his family left.

Boyles. Boyles was at the location of the Dick and Abe Boyles Ranch. "After Benton was flooded out of existence, Mr. and Mrs. Dick Boyles stated a saloon and little store which contained the post office. It was first called Carpenter after the name of its postmistress. (Boyles had bought out the old Carpenter Ranch.) The name was later changed to Boyles Ranch" (Granger 1983:88-89). The post office was established as Carpenter on February 12, 1903, replaced by Boyles on April 4, 1906, and dissolved on October 31, 1906. Note that these dates indicate that Boyles and Benton were contemporaneous.

Clifton. As has been described above, Clifton was settled in 1872 as a mining camp, but grew to become the largest town in the study area and in 1899 was named the county seat of Greenlee County. Located along the San Francisco River, Clifton suffered from regular flooding.

Duncan. Duncan, named after J. Duncan Smith (whose brother was sheriff Guthrie Smith) was built in 1883 along with the Arizona and New Mexico Railroad (Granger 1983:218). In 1922, Duncan had a population of 750 and contained 15 businesses, 2 garages, 1 bank, 2 hotels, restaurants, churches, and a high school (Rush 1922). A dairy farm was nearby (Rush 1922), and a dairy had been operated by Ed and Wayne Lunt since 1919 (Fenn 1977:37).

Coronado Mining Community. Coronado Mining Community on Coronado Mountain had a post office from 1913 to 1919. On August 15, 1913, nine miners were killed in an ore car accident (seven survived) (Granger 1983:175-176).

Franklin. Thomas A. McGrath was the first settler along the Gila River in the area that later became Franklin (McClintock 1921:250). In 1895, a group of Utah Mormons led by Thomas J. Nations settled the community and began irrigation works. In 1898, the community was organized as a ward and named for Franklin D. Richards, a deceased apostle of the L. D. S. church (McClintock 1921:250). The community was 7 miles long and extended into New Mexico (McClintock 1921:250). Franklin had numerous orchards (Rush 1922).

Guthrie. Guthrie Smith and J. Duncan Smith sold land in 1883 to the Arizona Copper Company, which built the Arizona and New Mexico Railroad. Guthrie was a railroad station (Granger 1983:282).

Morenci. About 1871, John A. "Slim" Joy operated Joy's Camp at this location. In 1881, "William Joy sought a loan of $50,000. from the Phelps Dodge Corp. in New York City and offered his copper mine and smelter in Morenci as security" (Granger 1983:421).

Oroville. Oroville was located on the San Francisco River a few miles above Clifton, across the river from the Wells Ranch, established by George Wells in the 1870s and farmed by Charley Wing in 1886 (Granger 1983:452). According to Granger (1983),

> "Chinese living here raised produce for Clifton residents. ... Unfortunately, local Mexican-Americans knew that the Chinese hoarded money to pay their passage to China, and in January 1904, a dynamite blast forced the Chinese to leave their homes, which were then subject to looting. About four Chinese were killed as they fled" [Granger 1983:452].

Purdy. Purdy, across the river from Duncan, was replaced by Duncan when the railroad was constructed in 1883 (Granger 1983:218).

Sheldon. Sheldon was a railroad station established in 1884 (Granger 1983:557). Circa 1922 it had stores, farms, and ranches (Rush 1922).

York. York and the York Valley were named after the George R. York Ranch. In 1882 (elsewhere it says 1883), the railroad was built, and a station was established at York. On April 22, 1882, Loco and 500 other Apaches attacked the station/ranch (Granger 1983:691). Circa 1922 York had stores, farms, and ranches (Rush 1922).

Floods in Clifton

Floods in Clifton occurred in the 1870s, in 1880, in 1891, in 1903, twice in 1905, in 1906, and in 1916 (Patton 1977:79-84).

The 1903 flooding killed at least 13 people, and prompted the Arizona Copper Company to build a stone wall 10 feet high along one side of Chase Creek to protect its property. Residents on the other side of Chase Creek were then forced to build their own flood wall, which was paid for using local subscriptions and city and county aid (Patton 1977:79-81).

Two floods occurred in 1905. The first flood killed five people; the second flood caused less damage, primarily because areas and buildings that were susceptible to flooding were destroyed by the first flood (Patton 1977:81).

On December 4, 1906, another flood struck Clifton, and this one killed 18 people (Patton 1977:81-82). After this flood, "Floodwalls were built along the river banks to supplement the ones already along Chase Creek. They were constructed of slag which was mortared together and were sixteen inches thick" (Patton 1977:84).

A flood in 1916 went over the flood walls but did not cause much damage. As a result of this flood, however, the citizens of Clifton raised the floodwalls 2 feet (Patton 1977:84).

National Forests

In 1896 President McKinley created the Black Mesa Forest Preserve (Haskett 1896:36). By 1908 the Black Mesa Forest Preserve had been divided into Apache National Forest (Greer, Springerville, Blue River, and Clifton), and Sitgreaves National Forest (everything north) (Applewhite 1979:52). In the meantime, large herds of goats introduced into the mountains above Clifton from about 1900 to 1905 were thought to have overgrazed the area so extensively that they were blamed for much of the flooding in Clifton in 1905 and 1906 (Olmstead 1919:65).

As a result, the federal government closed the area north of Clifton to further settlement in 1905 (Olmstead 1919:65).

HISTORICAL DESCRIPTIONS

The earliest descriptions of the upper Gila and San Francisco rivers are those of the trappers who found both streams were perennial and supported populations of beaver. When Kearny and the Army of the West passed down the Gila in 1846, they found a perennial stream that was often narrow and shallow enough to allow travel down the riverbed, although it often descended into impassable canyons. Emory (1951:106) reported seeing signs of beaver, deer, and wolf along the river, and Griffin (1943:26) and Johnston (1848:89) mentioned geese, ducks, quail, and partridges. Griffin (1943:26), though, noted that attempts at fishing were unsuccessful. Emory, Griffin, and Johnston mentioned the presence of ruins along the river, expressing amazement that sedentary farmers could ever have lived there. Bartlett (1854[II]:244) felt that the Gila, above its confluence with the Salt, was the smaller of the two rivers: "The quantity of water passing down the Salina is more than double that of the Gila, which only becomes a respectable river after it receives the water of the former." The *Weekly Arizonan* (April 7, 1859, p.1, col. 1-2) has a description of the Gila River and Valley and the ruins there. Bartlett (18 In later years, residents of the upper Gila River valley only rarely commented on the river.

The San Francisco River also has been little remarked upon, except when it flooded (see above). Shortridge (1990:1, 41) notes that circa 1915-1926 it was usually "relatively shallow" with "uncontaminated, cold mountain water" flowing across a "large expanse of white sand and reeds."

Carothers et al. (1982) describe the Frisco Canyon of the San Francisco River, between Frisco Hot Springs, New Mexico, and the Martinez Ranch, above Clifton, Arizona, as follows:

> "The San Francisco River between Frisco Hot Springs and Martinez Ranch flows through a steep-walled canyon with a relatively flat floodplain averaging 300-600 ft (100-200 m) in width. The average elevational descent of the canyon is approximately 23 ft (7 m) per mile. Under nonflood conditions, the permanent flow stream width is generally less than 30 ft (10 m), and meanders back and forth across the floodplain. Changes in the position of the stream occur with each flood, ranging from minor shifts in channel preference to major changes which scour gravel bars, cut terraces, and topple large trees. During maximum flood stage the river flows from wall to wall across the floodplain, often with major effects on the riparian vegetation and channel position" [Carothers et al. 1982:27].

> "The flow of the San Francisco River meanders from wall to wall throughout it narrow confining canyon. These meanders often abut the canyon wall on either side, necessitating numerous river crossings for vehicular as well as foot traffic between Frisco Hot Springs and the Martinez Ranch" [Carothers et al. 1982:87].

Historical Uses

The primary uses of the upper Gila and San Francisco rivers have been for mining and irrigated agriculture, as described above.

Regional Transportation

The Gila River served as the pathway into southern Arizona by American trappers from the 1820s to the 1840s. In 1846 it also served as the pathway through southern Arizona by Kearny and the Army of the West. That same year, though, Colonel Philip St. George Cooke and the Mormon Battalion pioneered a route farther south that became the preferred route through southern Arizona. Thus, it was not until the mines at Clifton were established that regular transportation routes began to be established along the upper Gila and San Francisco rivers.

The earliest transportation in the area was by horseback, ox and mule team, and stagecoach. Railroads between mines and smelters began to be constructed in 1878, and in 1883-1884 the Arizona and New Mexico Railroad constructed a line that connected Clifton to the Southern Pacific line. Toll roads were constructed in the 1880s and 1890s, and by the early 1900s, highways suitable for automobile traffic were in place.

"The smelted ore which Lesinsky produced at this time he shipped by ox and mule team to Kansas City twelve hundred miles away" (Patton (1977:13). Patton (1977:48) published a photograph of one of the burro trains with the caption, "Burro ore trains were used to transport the ore in the beginning."

> "In the very earliest days of Clifton, i.e. in the 1870's, the town had two connections with the outside world. One of these was a stage road to Solomonville forty-five miles down the river. There was another stage road to Silver City, New Mexico a hundred miles to the southeast. These roads were typical of the western roads of that day in that they were made by merely cutting down the mesquite bushes and other desert plants. There were no bridges or culverts so a heavy rain made them impassable. During the eighties the road to Solomonville was made a toll road by Graham county, after which there was constant conflict between the people of Clifton and the county officials concerning rates. During the eighties and nineties Wells Fargo operated a stage and freighting business into Clifton from Solomonville" [Patton 1977:72].

The earliest railroads in the area connected mines and smelters. A railroad was built from Clifton to Longfellow in 1878 (Patton 1977:vi). In 1881, the Southern Pacific Railroad reached Lordsburg, New Mexico (Patton 1977:18). In 1883, the Arizona and New Mexico Railroad was built to connect Clifton to the main line (Granger 1983:218). Duncan and Guthrie were established at this time (Granger 1983:218, 282). Walker and Bufkin (1879:46-47) date the construction to 1883-4, and note that the Arizona and New Mexico Railroad included the Clifton & Southern Pacific (New Mexico) and Clifton & Lordsburg (Arizona) (Walker and Bufkin 1979:46-47). Patton (1977:72) also says that the railroad reached Clifton in 1884.

Dell Potter built a 20 gauge railroad from Clifton to his ranch 2 miles upstream. He called it the Clifton and Northern, but it consisted of ore cars pulled by mules (Patton 1977:74 n.15).

Around 1901, Dell Potter began to advocate a state road running east to west across southern Arizona (Patton 1977).

"By 1911 he had gotten a broader vision and was advocating an ocean to ocean highway through Clifton. He organized a state Ocean to Ocean Highway Association of which he became president. ... In 1912 ... he made a trip from Los Angeles to New York with a party sponsored by the Los Angeles Times, who were supposed to find the most feasible route for and ocean to ocean highway. Potter persuaded them to come through Clifton. For awhile he though he had them convince that a route through Phoenix, Globe, Fort Thomas, Clifton, and on to Silver City via Mule Creek was practicable. He sent jubilant telegrams from New York City saying that Clifton was assured of being on the trans-continental route. Later, when one of the State's trans-continental routes went a hundred miles south through Duncan, Potter lugubriously admitted that there 'really was only one good route for a highway through Clifton, and the San Francisco River got it first' " [Patton 1977:76].

From 1896 to 1899 Victorian Carrasco, Jose Morales, Francisco Montez, and Andrez Serna built toll road from Buena Vista to the Coronado Station on the Arizona-New Mexico Railroad (Fenn 1977:41-42). The Coronado Trail, the highway from Clifton and Morenci north to Alpine and Springerville, was completed in 1926 (Shortridge 1990:68).

Boating

Several accounts describe boating on the upper Gila, and two accounts describe floating the San Francisco. Accounts of boating on the upper Gila date to 1895 (*Graham County Bulletin*, February 22, 1895, p. 3; *Phoenix Herald*, February 18, 25, 1895), 1909 (Granger 1983:259), and the 1980s (Salmon 1986). Accounts of floating the San Francisco River date to 1895 (*Graham County Bulletin*, February 22, 1895, p. 3; *Phoenix Herald*, February 18, 25, 1895), circa 1915-1926 (Shortridge 1990:41), and 1973 (Jones 1973).

The Graham County Bulletin (2/22/1895, p. 3) has a story by G. W. Evans and Amos Adams, who started at Clifton, January 2, and reached Riverside. The Arizona Pioneers Historical Society in Tucson did not allow this article to be photocopied, but the text of the article is as follows:

DOWN THE GILA

G. W. Evans and Amos Adams Report a Perilous Trip between San Carlos and Riverside

THE BULLETIN is in receipt of a long letter from Evans and Adams, who started from Clifton sometime ago for a voyage down the Gila in a boat. The letter is dated at Riverside, February 4. They report having had what a Pike county man would call a "hog killing" time until San Carlos was reached. Here the boys were advised by Marijilda Grijalva and others not to attempt to go down through the box canyon below there in a boat. The advice was not heeded and the navigators went through, but they were six days making 20 miles. Now we will let Evans speak:

"The canyon is a continuous series of rough rapids and falls for 81 miles. There was one place where the side of a quartzite cliff probably a thousand feet high had peeled off into the river, making an immense jam of boulders from the size of I. M. Solomon's brick store to a hen egg. We had supplied ourselves with about two hundred feet of half-inch rope and it came in very good play. In one place I did not see the boat for more than one hour, the water made so much spray and the chute was so narrow and crooked. I could not hear Adams' voice and had to pay the rope out by jerks. One place the rope broke and I thought good bye, poor Amos Adams; you can imagine my lonely feelings there amidst all that roaring, seething foaming mass of rocks and water. Hoping that perhaps the boat might be safe I concluded to try and reach it by swimming and plunged in clothes and all. After going some 75 feet, around a large rock, the water dashed me up against the cliff so hard that I was compelled to stay there and rest. In looking around for some way to get farther down stream, I happened to see a narrow shelf leading down stream, but with an upward trend of some 15 degrees; so pulling myself upon it, I looked directly down narrow chute of boiling and roaring water and beheld Adams, up to his knees in water in the boat, with nothing in sight except the top of the cabin in the center. As the boat seemed to be in very still water, I concluded to try and reach it by following the rock shelf I was on; after following it for 150 feet it ended in a dropoff of 50 feet. It was an awful looking distance to me, but `needs must when the devil drives,' so making a large knot in the end of my rope I secured it in a crevace of the rock and began lowering myself down; but soon found that the rope would not let me to the water by 20 feet, and not being able to hold any longer, I gave myself a shove with my feet, so as to clear all projecting rocks, and letting all holds go, I made as nice a kerplunk as was ever seen, so Adams says. I know I never touched any bottom. I left a nice piece of new rope hanging there for any fool tourist that may try the same route in the future. We finally got the boat to an eddy where we found one end is [sic] stove in. After taking off four inches we got it repaired and made a camping place, a pair of the most forlorn specimens of cold and wet humanity you ever saw. We are out of the box canyon now and have a smoother stretch of river ahead."

From Sacaton, the two hauled the boat overland to Phoenix, and then boated down the Salt and Gila rivers to Yuma (*Phoenix Herald*, February 18, 25, 1895).

In 1909, Stanley Sykes of Flagstaff canoed the entire length of the Gila River in Arizona, according to Granger (1983:259). This float trip is not mentioned, however, in Giclas's (1985) biographical sketch of Sykes.

In his reminiscences about his boyhood in Clifton from about 1915 to 1926, Harold Shortridge describes building a raft and taking a short trip down the San Francisco River:

> "The San Francisco River was one of the favorite places where we boys liked to be, although our mother expressly forbade our going there. There was a large expanse of white sand and reeds and the river itself was relatively shallow, lending itself beautifully to our needs. One of these needs was to float a raft. At one time we dressed ourselves as pirates, got aboard our raft waving wooden swords, and imagining great deeds. We decided to embark upon a long journey down to the sea and join Blackbeard. Since we overloaded our craft with eager boys, she foundered. The venture was reluctantly abandoned" [Shortridge 1990:41].

M. H. Salmon (1986) describes a trip down the Gila, on foot and in a canoe, from the headwaters of the Gila in New Mexico to below the Arizona Box, between Clifton and Safford. The entire portion of the trip in Arizona was made in a canoe. Salmon (1986:205-208) also describes 1970s and 1980s discussion about wilderness designation for Frisco Canyon (the San Francisco River canyon between Frisco Hot Springs in New Mexico and Clifton, Arizona). For the Frisco Canyon, he cites studies by Carothers (1982) and Hubbard and Hayward (1973).

The two float trips down the San Francisco are the one made by G. W. Evans and Amos Adams in 1895 from Clifton to the Gila (described above) and the one made by Jones (1973) in 1973.

Anderson and Hopkinson (1982, 1987:120) state that the Safford District Office of the Bureau of Land Management wrote them as follows:

> "The policy of this office is not to encourage floating the Gila and San Francisco Rivers. Submerged debris, such and fence wire and trees, and fluctuating water levels (flooding) make floating these rivers very hazardous. However, floating does occur in a variety of water craft" [Anderson and Hopkinson 1982, 1987:120].

Anderson and Hopkinson (1982, 1987:120) found other literature from the Safford District Office of the Bureau of Land Management indicating that the river could be run in rubber rafts or aluminum canoes,

SUMMARY AND CONCLUSIONS

Both the upper Gila and the San Francisco rivers are perennial streams and are considered boatable streams today. The first accounts of boating the San Francisco River from Clifton to the Gila and then downstream on the Gila date to 1895. Apparently Stanley Sykes of Flagstaff boated the Gila from state line to state line in 1909. Shortridge describes trying to raft the San Francisco River at Clifton circa 1915 to 1926. Jones (1973) describes floating the San Francisco River in modern times; Salmon (1986) describes floating the upper Gila in recent years. Boating and rafting of the San Francisco River occurred during the heydays of mining, which began in the 1870s. Farming along the Gila River began in the 1870s, at about the time that mining began in the Clifton-Morenci area, and a map of irrigated areas in Arizona in 1901 (Bureau of the Census 1901) shows most of the Gila River valley above the confluence with the San Francisco River was irrigated, but only one small area of the San Francisco River was irrigated. Historical accounts describe irrigation agriculture at Oroville and Dell Potter's ranch, both above Clifton, in the early years of the twentieth century. Although both the upper Gila and the San Francisco rivers have been considered boatable both before and after the time of Arizona statehood, transportation has almost always been overland.

A NOTE ON SOURCES

Many of the primary sources on upper Gila and San Francisco River history are published and are available at the three major research libraries in the state: the University of Arizona library, the Hayden Library at Arizona State University, and the Cline Library at Northern Arizona University. The Flagstaff Public Library also has many of the key references. Each of these research libraries has photographic collections, which contain numerous historic photographs of the San Francisco River as it flows and floods through the town of Clifton. A few photographs of Dell Potter's ranch and of isolated reaches of the upper Gila River are also in these collections (see Appendix B).

General histories of Arizona (Bancroft 1888, 1889; Farish 1915; Hamilton 1928; Lockwood 1932; McClintock 1916a, 1916b; Wallace W. Elliott & Co. 1884) began to appear in the 1800s. At about the same time, promotional literature and guidebooks (Guild 1891; Hamilton 1884; Hinton 1878; Hodge 1877; James 1917) were published that provide contemporary descriptions of rivers, towns, mining, agriculture, transportation, and so forth.

More recent histories of Arizona include Faulk (1970), Trimble (1977, 1986), Wagoner (1970, 1975, 1977). Walker and Bufkin's (1986) historical atlas is extremely useful. Granger (1960, 1983, 1985) provides histories of Arizona place names. Often inaccurate, these books are nonetheless useful introductions to general historical patterns in a region. Davis (1982) is a good summary of the wildlife encountered by the earliest explorers of various parts of Arizona.

Corle (1951) is the classic history of the Gila River. Calvin (1946) is another general history of the Gila. The Arizona State Land Department, Arizona Geological Survey, and SWCA, Inc., Environmental Consultants (1996) did a study of Gila River navigability. McNamee (1994) has written a history of the Gila that has been criticized by a number of historians (Barbara Tellman: personal communication, 8/31/95).

The physical environments of the two streams are described in Anderson and Turner (1978); Carothers et al. 1982); Hjalmarson (1990); Humbard and Hayward (1973); Turner

(1974); United States Department of the Interior, Bureau of Land Management (1984); United States Department of the Interior, Bureau of Reclamation (1974); and United States Department of Agriculture, Forest Service, and United States Department of the Interior, Bureau of Land Management (n.d.).

Khera and Mariella (1983) is usually cited as the ethnography of the Yavapai. Pilles (1981) discusses the archaeology of this group. Gunnerson (1956, 1974) is the authority on the migration of the Apaches to the American Southwest, and Di Peso (1951, 1956), Ferg (1992), and others have discussed evidence for the arrival of the Apaches in southeastern Arizona. Basso (1983) is an excellent, recent, accessible description of the Western Apache; Opler (1983) fills the same need for the Chiricahua. Barrett (1970) and Debo (1976) are standard biographies of Geronimo, who (according to Debo) was born in the study area. Opler (1983) is also an excellent summary of the Apache wars.

The Spanish period is discussed generally in Officer (1987). Winship (1896, 1990) published the primary sources on the Coronado Expedition. Other accounts of the Coronado Expedition, its antecedents, and reconstructions of its route can be found in Bolton (1949, 1990), Day (1964), Di Peso (1951, 1956), Di Peso and Fenner (1974), Haury (1984), Hodge (1933), Hodge and Lewis (1907), Riley (1985), Sauer (1932, 1937), Schroeder (1955, 1956), and United State Department of the Interior, National Park Service (1991). Later Spanish explorations in the region are described in Benavides (1945), Bolton (1916), Hammond and Rey (1966), Lafora (1958), and Manje (1954).

The history of the fur trade in the Southwest has many students, although the primary documents are almost hopelessly inexact about dates and personnel. Hafen (1965) edited a ten-volume set of biographical sketches of individual mountain men involved in the fur trade. Weber (1971) is a general history of the fur trade in the Southwest. Pattie (1831, 1905, 1930, 1988) is the primary source on James Ohio Pattie's story of his years in the Southwest. Pattie is also discussed in Hill (1923a) and Kroeber (1964). Hill (1923b) and Holmes (1967) are biographies of Ewing Young. Carter (1968) is a biography of Kit Carson. Biographies of George C. Yount include Camp (1936, 1966), Wood (1941), and Yount (1923). Foreman (1941a, 1941b) and

Parkhill (1965, 1966) have published biographies of Antoine Leroux. Templeton (1965) has published a biography of Thomas "Pegleg" Smith.

Emory (1848) is the foremost account of the 1846 Kearny expedition; Emory (1951) is a more accessible edition. The United States-Mexico Boundary Survey was described by Bartlett (1854). The Apache wars have an immense bibliography. Bourke (1891) is the classic primary account. Opler (1983) is a concise and dispassionate summary of the Apache wars.

A number of community histories have been written about Clifton (Carmichael and Keddie 1924; Colquhoun 1924, 1935[?]; Dillon 1992; Fenn 1977; Hatch, Dahood, and Fernandez 1982; Patton 1945, 1977; Rush 1922; Shortridge 1990; Vinson 1992). Dreyfus's (1972) history of Arizona counties includes information on Clifton. Fenn (1977) and Rush (1922) have information on neighboring towns. McClintock (1921) is the standard account of Mormon settlement in Arizona, including the town of Franklin. Sarah York (1928) described her family's settling in the area. Haskett (1935, 1936) has provided histories of stock raising in Arizona.

Development of transportation is described by B. Harris (1960) and C. Harris (1973) on the Gila Trail, Myrick (1975) on railroads, Applewhite (1979) on highways. Modern boating of the Gila and San Francisco rivers is described by Anderson and Hopkinson (1982, 1987), Jones 1973, and Salmon (1986a, 1986b).

CHRONOLOGY

1764 "Fr. Figueroa inaccurately mapped a San Francisco River" (Granger 1983:246).

1821 Mexican independence

1824-5 Sylvester and James Ohio Pattie trapped along the upper Gila and San Francisco rivers (Granger 1983:246). Granger cites Pattie (:90).

1826 William Wolfskill, Milton Sublette, George Yount and others trapped along the upper Gila in the summer of 1826 (Weber 1971).

1826 In the fall of 1826, at least four trapping expeditions were operating along the upper Gila: (1) a group led by Bill Williams and Ceran St. Vrain; (2) a group led by John Rowland; (3) a group led by Antoine Robidoux (and including James Ohio Pattie); and (4) a group led by Ewing Young (Weber 1971).

1827 In the fall of 1827, a group of trappers led by George C. Yount and Sylvester Pattie trapped along the upper Gila (Pattie 1831; Weber 1971).

1830 In September of 1830, Young and Carson went back to the Colorado River, down to the Gila, then up the Gila to the Santa Rita mines (arriving at Santa Rita in January of 1831). They continued on to Santa Fe (Carter 1968:44-50).

1846-8 Mexican War

1846 Stephen Watts Kearny and "The Army of the West?" passed down the Gila. Kearny was guided by Kit Carson. Lieutenant William Emory of the Corps of Topographical Engineers accompanied the expedition and described it.

1853 Gadsden Purchase

1856 U.S. Army officers reported outcrops of minerals in the Clifton area (Patton 1947:vi).

1869 "Lt. John W. Bourke says that he was with an army scouting expedition c. 1869 which found rich ore in the vicinity of the later Clifton. The men took pieces of ore to Tucson, but not until c. 1872 did prospectors and miners from Silver City, New Mexcio, explore the area and establish copper mine locations" (Granger 1983:158).

1870 Clifton established (Hjalmarson 1990). Note that this does not agree with Granger (1983) or Patton (1947), below. Granger and Patton are probably correct.

1871 J. H. Holbrook led a group of 21 prospectors (including "Mase" Greenlee) from Pueblo, Colorado, to the Gila River Valley, and they prospected in the area that would later become Clifton and Morenci, but they were forced out by Indians (Patton 1977:155 n.14).

1872 15 Mexicans founded Pueblo Viejo, later Solomonvillle, the first settlement in the Gila Valley (Granger 1983:503).

1872 Prospectors and miners from Silver City, New Mexico (including Charles M. Shannon, Charles Lezinsky, and Lezinsky's brother), established claims for copper mines in the Clifton area (Granger 1983:158). Patton (1947:9) says that three groups were in the area. In August, 1872, the Copper Mountain Mining District was organized.

1875 Clifton Post Office established (Granger 1983:158).

1878 Railroad built from Clifton to Longfellow (Patton 1977:vi).

1879-80 Coronado Rail Road built to Morenci (Walker and Bufkin 1979:46-47).

1880 Flood in Clifton (Hjalmarson 1990:30; Patton 1977:79).

1881 Southern Pacific Railroad reached Lordsburg, New Mexico (Patton 1977:18).

1882? York established (Granger 1983:691).

1883 Arizona and New Mexico Railroad built to connect Clifton to the main line (Granger 1983:218). Duncan, Guthrie established (Granger 1983:218, 282).

1883-4 Arizona and New Mexico Railroad built. Included Clifton & Southern Pacific (New Mexico) and Clifton & Lordsburg (Arizona) (Walker and Bufkin 1979:46-47).

1884 Sheldon established as railroad station (Granger 1983:557).

1885 Flood in Clifton (Hjalmarson 1990:30).

1891 Flood in Clifton (Hjalmarson 1990:30; Patton 1977:79). "The 1891 flood extended from mountain to mountain and inundated nearly all of Clifton" (Hjalmarson 1990:30).

1895 Mormons colonize Franklin (Granger 1983:247; McClintock 1928).

1896 President McKinley created Black Mesa Forest Preserve (Haskett 1896:36). By 1908 divided into Apache National Forest (Greer, Springerville, Blue River, and Clifton), and Sitgreaves National Forest (everything north) (Applewhite 1979:52).

1896-9 Victorian Carrasco, Jose Morales, Francisco Montez, and Andrez Serna built toll road from Buena Vista to the Coronado Station on the Arizona-New Mexico Railroad (Fenn 1977:41-42).

1901 Morenci Southern Railroad built (Walker and Bufkin 1979:46-47).

1903 Flood in Clifton killed at least 13 (Patton 1977:79-80).

1903 Boyles Post Office (Granger 1983:88-89).

1905 Two floods in Clifton, the first killed 5, the second was not as bad (Patton 1977:81).

1906 A major flood on the San Francisco River on December 4, 1906, killed 18 in the Clifton area (Granger 1983:158; Patton 1977:81-82).

1909 Shannon-Arizona built (Walker and Bufkin 1979:46-47).

1909 Clifton incorporated (Granger 1983:158).

1909 Stanley Sykes of Flagstaff canoed the entire length of the Gila River in Arizona (Granger 1983:259).

1909 Greenlee County created March 10, 1909, but did not begin operation until 1911 (Granger 1983:278; Patton 1977:157).

1910 Clifton made county seat of Greenlee County, November 8, 1910 (Granger 1983:158).

1912 Arizona Statehood.

1916 Two floods in Clifton (Hjalmarson 1990:30; Patton 1977:84).

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Opler, Morris E.
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1955 Fray Marcos de Niza, Coronado, and the Yavapai. *New Mexico Historical Review* 30(4):283.

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1956 Fray Marcos de Niza, Coronado and the Yavapai. *New Mexico Historical Review* 31(1):24-37.

1974 A Study of Yavapai History. In *Yavapai Indians*, edited by David Agee Horr, pp. 23-354. Garland Publishing, New York.

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19?? *Souvenir of Graham County, Arizona. A Collection of 138 Graham County Views*. Vredenburg & Company, Printers, Rochester, N.Y.

Photographs of Graham County, including Clifton, Duncan, and Guthrie. Since these became part of Greenlee County in 1909, the photographs must antedate that year. Since the book includes photographs of the Arizona-New Mexico Railway bridge, it must postdate 1883.

Shortridge, Harold T.
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Tellman, Barbara, and Richard Yarde
1996 *A Historical Study of the Santa Cruz River: Background Information for Determination of Navigability of the River at the Time of Arizona Statehood, 1912*. Water Resources Research Center, University of Arizona, Tucson.

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1965 *The Lame Captain: The Life and Adventures of Pegleg Smith*. Westernlore Press, Los Angeles.

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1977 *Arizona: A Panoramic History of a Frontier State*. Doubleday, Garden City, New York.

1986 *Roadside History of Arizona*. Mountain Press Publishing Company, Missoula, Montana.

Turner, Henry Smith
1966 *The Original Journals of Henry Smith Turner*, edited by D. L. Clarke. University of Oklahoma Press, Norman.

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1901 *Census Bulletin No. 68*. U.S. Bureau of the Census, Washington, D.C.

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1991 *National Trail Study, Environmental Assessment, Coronado Expedition: Arizona/New Mexico/Texas/Oklahoma/Kansas.* U.S. Department of the Interior, National Park Service, Denver Service Center, Denver.

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n.d. San Francisco Wild and Scenic River Study Report and Draft Environmental Impact Statement. United State Department of Agriculture, Forest Service, Southwestern Region, and United States Department of the Interior, Bureau of Land Management.

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Voelker, Frederic E.
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1977 *Arizona's Heritage.* Peregrine Smith, Santa Barbara, California.

Walker, Arthur L.
1935 Early Mining in Arizona. *Arizona Historical Review* (April 1935):39.

Walker, Henry P., and Don Bufkin
1979 *Historical Atlas of Arizona.* University of Oklahoma Press, Norman.

Wallace W. Elliot & Co.

1884 *History of Arizona Territory Showing its Resources and Advantages with Illustrations: Descriptive of its Scenery, Residences, Farms, Mines, Mills, Hotels, Business, Houses, Schools, Churches, Etc.* Wallace W. Elliot & Co., Publishers, San Francisco.

Main theme: Detailed description of Arizona history from the first Spanish entradas to a description of its natural resources, early expeditions, missions, pioneers, Spanish territories, military campaigns, civil war in Arizona, public lands, counties, metals, Indians.

Weber, David J.

1971 *The Taos Trappers: The Fur Trade in the Far Southwest, 1540-1846.* University of Oklahoma Press, Norman.

Whipple, Amiel Weeks

1852 Official Report of the Survey of the River Gila, by Lieutenant A. W. Whipple, of the Topographical Engineers, dated San Diego, California, January 10th, 1852. In *Personal Narrative of Exploration and Incidents in Texas, New Mexico, California, Sonora, and Chihuahua, connected with the United States and Mexico Boundary Commission, during the Years 1850, '51, '52, and '53* (Vol. 2), by John Russell Bartlett (1854), pp. 597-602. D. Appleton & Co., New York.

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Woody, Clara T., and Milton L. Schwartz

1977 *Globe Arizona: Early Times in a Little World of Copper and Cattle.* Arizona Historical Society, Tucson.

Wuerthner, George

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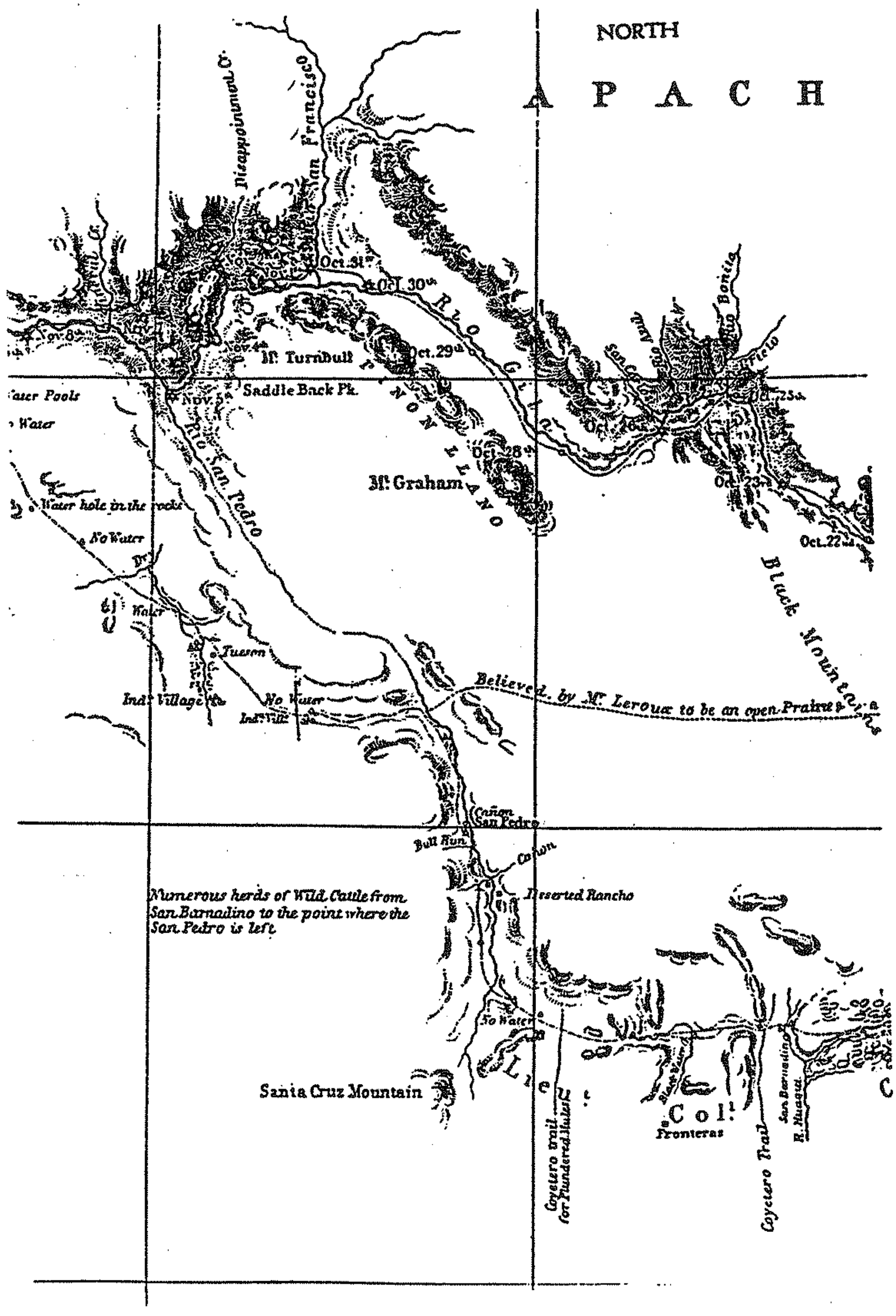
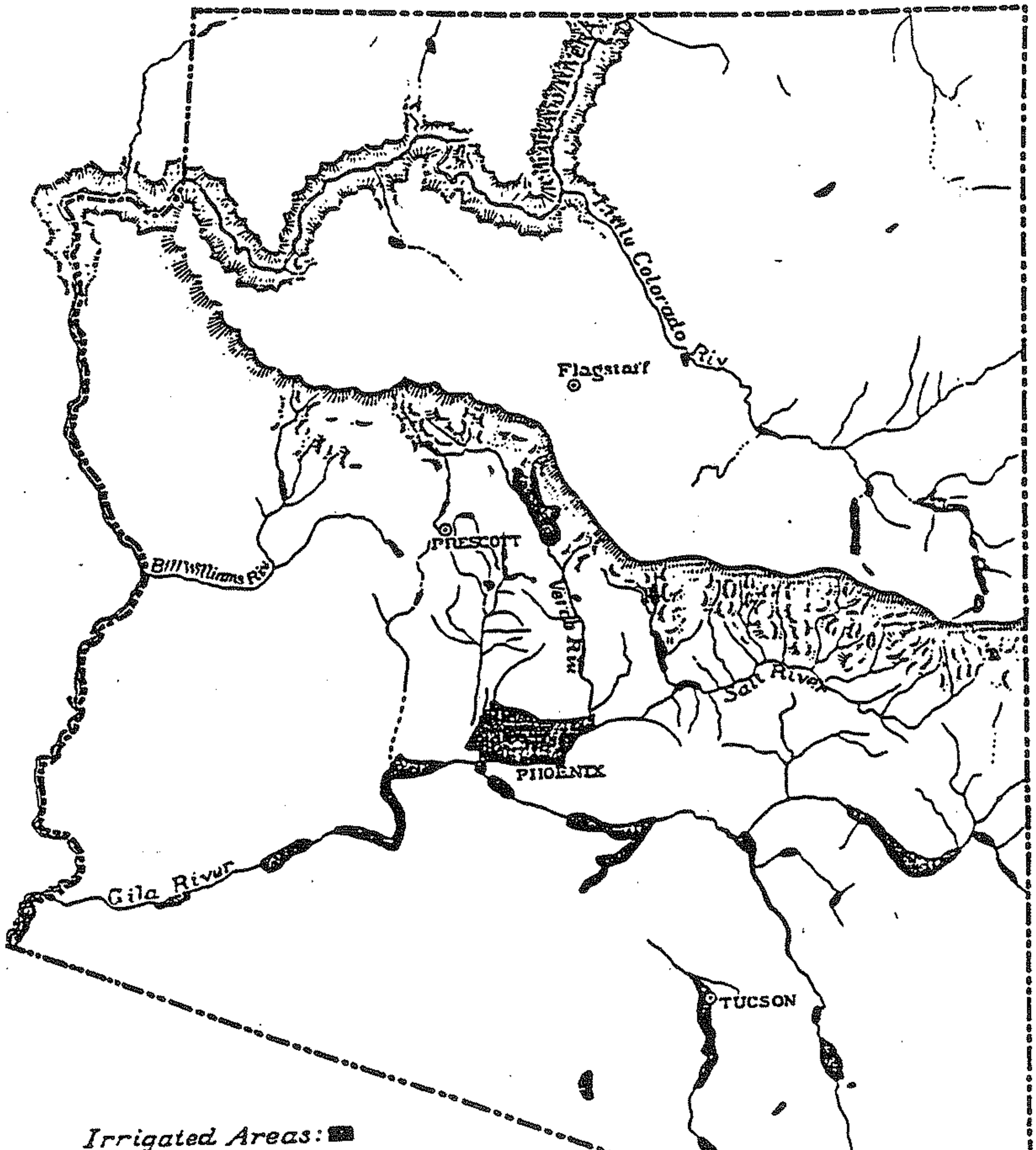
Yount, George C.
1923 The Chronicles of George C. Yount. *California Historical Society Quarterly* 2(1):3-66.

APPENDIX A

MAPS

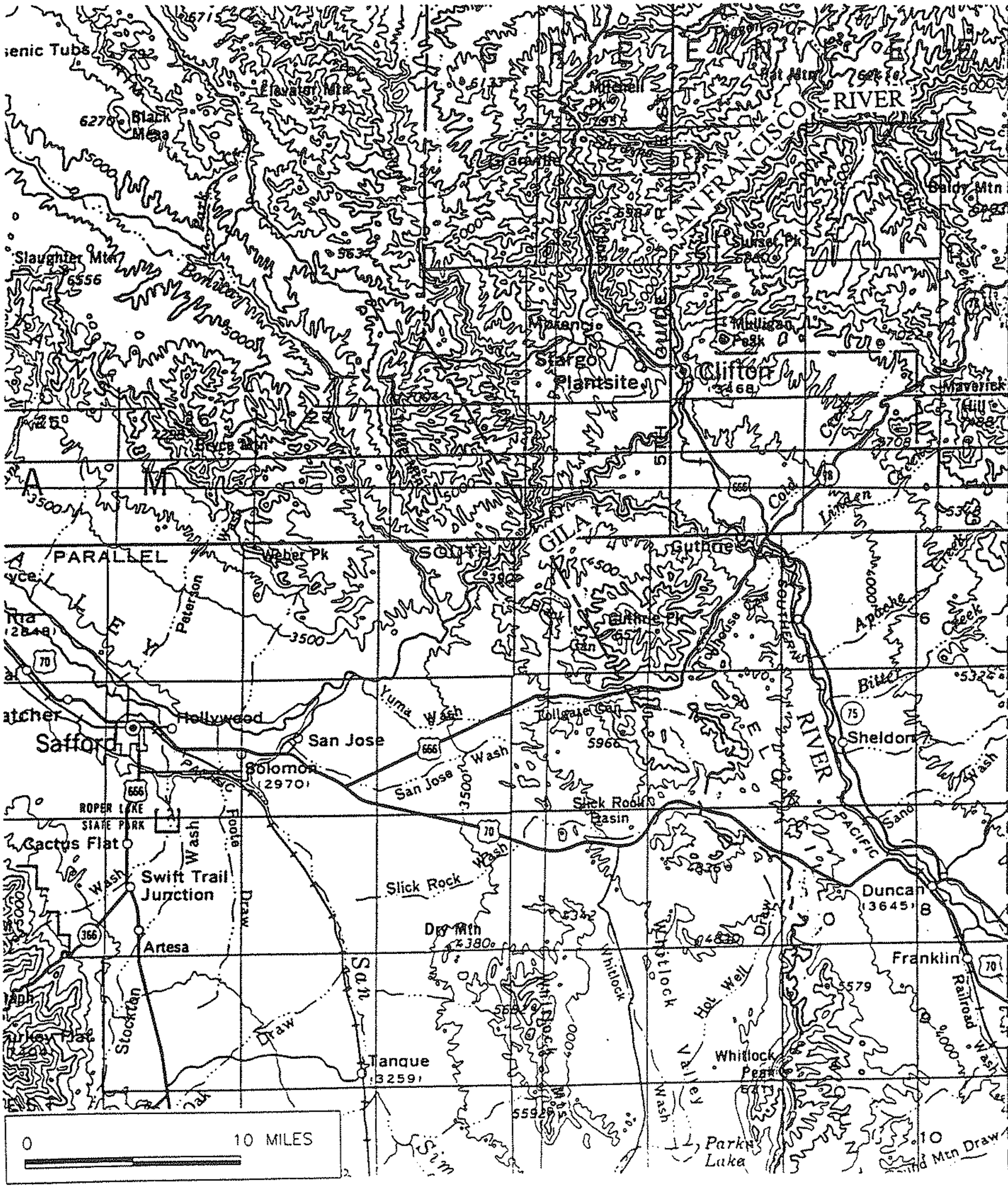


Portion of Emory's (1848) map showing Kearny's route from October 23, 1846 (current Arizona-New Mexico border), to October 25, 1946 (east of mouth of San Francisco River, which Emory called the Rio Prieto).



¹ From Census Bulletin No. 68, July 29, 1901

Map of irrigated areas in Arizona from Census Bulletin No. 68, July 29, 1901.



Enlarged detail of modern map showing Upper Gila and San Francisco rivers (from State of Arizona, 1:500,000 USGS base map, revised 1981).

APPENDIX B

HISTORICAL PHOTOGRAPHS

INVENTORY OF HISTORICAL PHOTOGRAPHS
UPPER GILA AND SAN FRANCISCO RIVERS

Upper Gila River

Title: Gila River between Ft. Thomas and Solomonville, Oct. 7, 1885
Location: Arizona Pioneers Historical Society, Tucson; File: Estate of Charles B. Gatewood, Folder 13
Number: 19,677
Description/Comments: Estate of Charles B. Gatewood; since this is below the confluence of the Gila and the San Francisco, it may not be relevant to the navigability study.

Title: Gila River
Location: Arizona Pioneers Historical Society, Tucson; File: Places - Gila River
Number: 50192
Description/Comments: From Mrs. Arthur Curtis Hall, July 1971. Post card produced by Feldman's, El Paso.

Title: Gila Bridge between Safford and Clifton
Location: Arizona Pioneers Historical Society, Tucson; File: Places - Gila River
Number: 50193
Description/Comments: From Mrs. Arthur Curtis Hall, July 1971. Post card produced by Feldman's, El Paso.

Title: Gila River along the Silver City-Clifton Highway
Location: Arizona Pioneers Historical Society, Tucson; File: Bledsoe, Dr. Nelson C., Collection, Box 2
Number: 55109
Description/Comments: "Gila River, very much alive near its headwaters in southwwestern New Mexico." Since this is in New Mexico, it is probably not relevant to the navigability study.

Title: Gila River near the Silver City-Mogollon Highway
Location: Arizona Pioneers Historical Society, Tucson; File: Bledsoe, Dr. Nelson C., Collection, Box 2
Number: 59020
Description/Comments: "Gila River near Silver City, N. M." Since this is in New Mexico, it is probably not relevant to the navigability study.

Title: Crossing the Gila with Freight Team a Quarter Century Ago
Location: Published photograph in Rush (1922)
Number: N/A
Description/Comments:
Title: Duncan Bridge - Method of Crossing Gila Today
Location: Published photograph in Rush (1922)
Number: N/A

Description/Comments:

Title: On the Road from Duncan to Clifton
Location: Published photograph in Rush (1922)
Number: N/A
Description/Comments: Gila River bridge and dirt road

Title: A. & N. M. R. R. Bridge at Guthrie, Arizona
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View across bridge with Gila River in normal flow below.

Title: R. R. Bridge of the A. & N. M. R. R. at Guthrie, Arizona
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View under bridge with Gila River in normal flow on left.

San Francisco River

Title: Railroad along San Francisco River in Flood
Location: Arizona Pioneers Historical Society, Tucson
Number: 51196; File: Places - Clifton - Floods
Description/Comments: Risdon Photograph, from James J. O'Neil, M.D.

Title: Railroad Bridge in River - Clifton Flood 1905
Location: Arizona Pioneers Historical Society, Tucson
Number: 58651; File: Pictures - Places - Clifton - Floods
Description/Comments: From Mrs. Roy W. Hagan (Flossie Whipple) April 12, 1976

Title: Water in Front of Row of Houses - Clifton Flood 1905
Location: Arizona Pioneers Historical Society, Tucson
Number: 58652; File: Pictures - Places - Clifton - Floods
Description/Comments: From Mrs. Roy W. Hagan (Flossie Whipple) April 12, 1976

Title: Railroad along San Francisco River in Flood
Location: Arizona Pioneers Historical Society, Tucson
Number: 51196; File: Pictures - Places - Clifton - Floods
Description/Comments: Risdon Photograph, from James T. O'Neil, M.D., Dec. 1971

Title: Flood at Clifton, Arizona - February 27, 1891.
Location: Arizona Pioneers Historical Society, Tucson
Number: 2296; File: Places - Clifton - Floods
Description/Comments: "Flood at Clifton, Arizona - February 27, 1891. Salcidos and the bridge at Clifton during the flood. No. 1 where section house stood before the flood. The following information from Samuel Kelly, 3/11/74. Far end of RR bridge leads to what was later called Hills

addition. Canyon leading off to left between dark hill (foreground) and light mountain (background) is Word's Canyon. Where No. 1 is shown on photo is the site of the early Arizona and New Mexico RR freight sheds. Tracks, old depot and about 100 yards north (up stream) were the residences of the officials of the Arizona Copper Company (not in photo)."

Title: Clifton, Arizona, Looking North Up River, Jan. 3, 1891
Location: Arizona Pioneers Historical Society, Tucson
Number: 2302; File: Places - Clifton- Floods
Description/Comments: "Clifton, Arizona, Looking North Up River, Jan. 3, 1891. Photo taken before the flood that occurred February 27, 1891. In center below prominent peak is Arizona Copper Company Smelter, and the Arizona and New Mexico RR shops. To right of this peak and at river's `East Side' buildings and footbridge across river. Left half of picture shows railroad tracks."

Title: Clifton, Arizona, During the Flood of Feb. 27, 1891
Location: Arizona Pioneers Historical Society, Tucson
Number: 2303; File: Places - Clifton - Floods
Description/Comments: "Clifton, Arizona, During the Flood of Feb. 27, 1891. From right to left: Sherman's, Hopkins, the old Arizona and New Mexico Depot, and the residence of James Colquhous, Supt. on the Arizona Copper Co."

Title: Clifton, Arizona During Flood of Feb. 27, 1891
Location: Arizona Pioneers Historical Society, Tucson
Number: 2304; File: Places - Clifton - Floods
Description/Comments: "Clifton, Arizona During Flood of Feb. 27, 1891. From right to left: Shermons, Hopkins and residence of James Colquhoun (Supt. at Arizona Copper Co.). Vacant space between homes is where the Arizona and New Mexico R.R. Depot was just before the flood carried it away. See Photo #2303."

Title: Flood in Clifton, Arizona - ca 1903
Location: Arizona Pioneers Historical Society, Tucson
Number: 51028; File: Places - Clifton - Flood
Description/Comments: "Flood in Clifton, Arizona - ca 1903. Woodoen bldg at left center has Herald over door." Original Card Print by J. Nephew, Photographer. Original from Mrs. Tyler, Overpeck, Dec. 1971.

Title: Clifton, Arizona, After the Flood that Occurred Feb. 27, 1891
Location: Arizona Pioneers Historical Society, Tucson
Number: 2299; File: Places - Clifton - Floods
Description/Comments: "Clifton, Arizona, After the Flood that Occurred Feb. 27, 1891. The following information is from Samuel S. Kelly, 3/12/1974. Looking north upriver, the buildings in center below prominent peak is Arizona Copper Company smelter and Arizona and New Mexico R.R. shops. The 2 story frame building *may* have been an early general offices building of the Arizona Copper Co. To the right of the peak and at river's edge is North Clifton. To left of peak is chase Creek Canyon (in front of the smoke stack). Right half of photo shows `East Side' buildings and foot bridge across river."

Title: Clifton, An Arizona Mining Camp
Location: Arizona Pioneers Historical Society, Tucson
Number: 24960; File: Places - Clifton - General
Description/Comments: Original Card Print from Geo. H. Smalley estate. Same view as #, to north with San Francisco River in normal flow bottom center, smelter in center.

Title: The Arizona Copper Company's Reduction Plant at Clifton, Arizona Territory.
Location: University of Arizona, Special Collections
Number: None; File: Clifton, Arizona - Photographs (Oversize)
Description/Comments: "The Arizona Copper Company's Reduction Plant at Clifton, Arizona Territory. In 1882 the Metcalf brothers, Jim and Bob, sold the mines to the Arizona Copper Company of Edinburgh, Scotland. This picture was taken by early Arizona photographer, Albert S. Reynolds, who recorded the Territory in the 1880s and 1890s. Courtesy AHS."

Title: San Francisco River (N.M. & Ariz.)
Location: University of Arizona, Special Collections
Number: N-6027 a124; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: View from mountainside looking down at a footbridge across a bend in the river, which is at normal flow. Apparently from the L. Burr Hall collection, date circa 1920s, exact location unknown, although other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton. This is definitely the same footbridge that is shown in #N-6027 a129 (and possibly the footbridge in #N-6028 a126).

Title: San Francisco River (N.M. & Ariz.)
Location: University of Arizona, Special Collections
Number: N-6027 a129; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: Illustrates a suspension footbridge over a river at normal flow. Cottonwoods are present on the sandy banks. View is from river bed up towards footbridge. Apparently from the L. Burr Hall collection, date circa 1920s, exact location unknown, although other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton. This is definitely the same footbridge that is shown in #N-6027 a124 (and possibly the footbridge in #N-6028 a126).

Title: San Francisco River (N.M. & Ariz.)
Location: University of Arizona, Special Collections

Number: N-6027 a131; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: L. Burr Hall, Box 462, Tucson, Arizona, "#82," "1920s," illustrates a bend in the river, which is at normal flow, with a two-track dirt road on the left side. Two photographs designated N-6249 illustrate this same general scene and describe it as the San Francisco River in the vicinity of Del Potters, a ranch located upstream from Clifton.

Title: San Francisco River (N.M. & Ariz.)
Location: University of Arizona, Special Collections
Number: N-6028 a121; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: L. Burr Hall, Box 462, Tucson, Arizona, "#82," "1920s," illustrates a wooded floodplain, river not visible. From the L. Burr Hall collection, date circa 1920s, exact location unknown, although other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton.

Title: San Francisco River (N.M. & Ariz.)
Location: University of Arizona, Special Collections
Number: N-6028 a126; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: Illustrates sandy river bed, partly vegetated, river not visible, but a footbridge crosses the river. Apparently from the L. Burr Hall collection, date circa 1920s, exact location unknown, although this could be the same footbridge that is shown in #N-6027 a124 and #N-6027 a129. Also note that other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton.

Title: San Francisco River (N.M. & Ariz.)
Location: University of Arizona, Special Collections
Number: N-6028 a130; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: Illustrates a bend in the river, view upstream, with a road on the right side. Sandy river bottom, wooded floodplain. Apparently from the L. Burr Hall collection, date circa 1920s, exact location unknown, although other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton.

Title: San Francisco River Burro Wood Train, Late 1920s?
Location: University of Arizona, Special Collections
Number: N-6247; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: Illustrates a train of burros hauling wood across the river. Apparently from the L. Burr Hall collection, date circa 1920s, exact location unknown, although other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton.

Title: San Francisco River Scene about Del Potters, Late 1920s?
Location: University of Arizona, Special Collections
Number: N-6249; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: Same scene generally as N-6027 a131. Apparently from the L. Burr Hall collection, date circa 1920s, exact location unknown, although other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton.

Title: San Francisco River Scene about Del Potters, Late 1920s?
Location: University of Arizona, Special Collections
Number: N-6249; File: San Francisco River (N.M. & Ariz.) Photographs, Folder 1
Description/Comments: This is labeled the same as above, but it is a different scene. It is the same scene generally as N-6027 a131 and was taken from the same angle but from farther away. Apparently from the L. Burr Hall collection, date circa 1920s, exact location unknown, although other photographs in this series were taken in the vicinity of Del Potter's ranch, upstream from Clifton.

Title: Flood Flow in San Francisco River at Clifton, Ariz., December 1906
Location: University of Arizona, Special Collections
Number: N-6188; File: Floods - Arizona Photographs, Folder 2
Description/Comments: "Flood flow in San Francisco River at Clifton, Ariz., December, 1906. Damage at Clifton alone was estimated at $150,000." This photograph is in an envelope labeled "Photographs of Floods and Flood Damage in Arizona from files of Wilbur Weir, formerly with US Forest and Range Experiment Station, Tucson, Ariz. Photographs of flood waters of San Francisco River at Clifton, Ariz. were taken in 1906."

Title: 14-Mule Team in Morenci
Location: University of Arizona, Special Collections
Number: N-150; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs
Description/Comments: A 14-mule team in Morenci. "Gift of Peter Riley, 1960." Photograph by Lucas and Burlan, Silver City, N.M. This photograph does not show the river, but it is a good example of transportation. N-11291 (35 mm) is the same shot.

Title: The Old Smelter
Location: University of Arizona, Special Collections
Number: N-151; File: Clifton (Ariz.) File 2, Folder 2, Photographs - Gift of Walter Hadsell, 1961 (This photograph may be misfiled. It should probably be filed under Clifton [Ariz.] File 2, Folder 1, Photographs - Lucas & Burlan). Also in File: Clifton (Ariz.) Photographs File 1, Folder 3
Description/Comments: "The old smelter and where the present bridge is located. Gift of Peter Riley, 1960." A Lucas & Burlan photograph (#45). this is the same general view as #N-155, looking straight across the river at the smelter with a little water at the bottom of the photograph. This photograph is not very informative with regard to streamflow or navigability.

Title: Clifton in 1882
Location: University of Arizona, Special Collections
Number: N-153; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also in File: Clifton (Ariz.) Photographs File 1, Folder 3
Description/Comments: "Clifton in 1882. Stream to left is from Hot Springs rising where the depot now stands. Gift of Peter Riley, 1960." Photograph by Lucas and Burlan, Silver City, N.M. This photograph shows the river (a braided stream) at normal flow looking upstream. The distinctive peak above Clifton is at left center. A garden in located in the floodplain in the left foreground.

Title: The Smelter in Clifton Nearing Completion
Location: University of Arizona, Special Collections
Number: N-155; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also in File: Clifton (Ariz.) Photographs File 1, Folder 3
Description/Comments: "The smelter in Clifton nearing completion. Gift of Peter Riley, 1960." Photograph by Lucas and Burlan, Silver City, N.M. Like N-151, this photograph shows the smelter as seen from directly across the river, which appears as an area of slack water in normal flow at the bottom of the photograph. This picture is not very informative with regard to river flow or navigation.

Title: Footbridge, Smelter, Store, Chase Creek Business Section and Residences in Clifton in 1884
Location: University of Arizona, Special Collections
Number: N-157; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also in File: Clifton (Ariz.) Photographs File 1, Folder 3
Description/Comments: "This picture shows the footbridge, smelter, store, Chase Creek business section and residences of the company officials of the Copper Co. The first house with windows was where the brewery was located. 1884. Gift of Peter Riley, 1960." Photograph by Lucas and Burlan, Silver City, N.M. The smelter is on the right, the footbridge on left.

Title: Railroad into Clifton about 1884
Location: University of Arizona, Special Collections
Number: N-158; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also in File: Clifton (Ariz.) Photographs File 1, Folder 3
Description/Comments: "Clifton in 1882. Gift of Peter Riley, 1960." Front is labeled "Clifton, A.T." and numbered "47." Photograph by Lucas and Burlan, Silver City, N.M. This photograph shows a railroad bridge across the river at normal flow in a gravel streambed. The town of Clifton is not visible.

Title: Flood Scene about 1884 at Clifton, Arizona
Location: University of Arizona, Special Collections
Number: N-159; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs
Description/Comments: "Flood scene about 1884 at Clifton, Arizona. Chinamen lived in the house shown in the stream. This scene is north of the bridge in Clifton. Gift of Peter Riley, 1960." Photograph by Lucas and Burlan, Silver City, N.M." This photograph shows the river flowing from mountain to mountain with two houses or tents and two trees on a tiny island in midstream.

Title: The Flume Bringing Water from the ? Frisco River above Clifton
Location: University of Arizona, Special Collections
Number: N-160; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also in File: Clifton (Ariz.) Photographs File 1, Folder 3
Description/Comments: "The flume bringing water from the ? Frisco River above Clifton. Gift of Peter Riley, 1960." Photograph by Lucas and Burlan, Silver City, N.M. This photograph shows a railroad on the right and the river at normal flow in a gravel streambed.

Title: This Was the 1884 Flood
Location: University of Arizona, Special Collections
Number: N-161; File: Clifton (Ariz.) File 2, Folder 1, Photographs - Lucas & Burlan; also in File: Clifton (Ariz.) Photographs File 1, Folder 3
Description/Comments: "This was the 1884 flood, shows the narrow guage railroad that ran to Clifton from Lordsburg, New Mexico. The depot and stores in the background. Gift of Peter Riley, 1960." Photograph by Lucas and Burlan, Silver City, N.M. This photograph shows the railroad apparently still under construction, with pilings, but no bridge, crossing the river to a floodplain flat (Metz's Flat?). The river is high and solid, but does not stretch from mountain to mountain. On the flat, a few buildings are visible on both sides of the railroad. "Bridge on Metz's Flat, 1885(?) shows this same location.

Title: None
Location: University of Arizona, Special Collections
Number: N-167; File: Clifton (Ariz.) Photographs, File 1, Folder 3
Description/Comments: This is a view looking down at the stream from a hillside. Houses, tents, and garden plots are visible.

Title: San Francisco River Flows By
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 2, Folder 2, Photographs - Gift of Walter Hadsell, 1961
Description/Comments: Post card. "San Francisco River flows by, enters into the Gila River, then into the Salt River, & ends in the Colorado River. Notice that all the bldgs, Post office RR Depot, Bank all bang up against the mountain not afraid of rocks falling down." This is the standard shot of Clifton looking towards the smelter with the river in the lower center of the photograph and the river at normal flow. It is undated.

Title: Clifton, A.T., When the Snow Melts in the Mountains
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 2, Folder 2, Photographs - Gift of Walter Hadsell, 1961
Description/Comments: Post card. "Clifton, A.T. When the snow melts in the mountains look out for high water in the river." This is the same shot as N-6188 showing flooding from mountain to mountain.

Title: Bridge on Metz's Flat, 1885(?)
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 2, Folder 2, Photographs - Gift of Walter Hadsell, 1961
Description/Comments: "Bridge on Metz's Flat, 1885(?)" This photogaph is another Lucas & Burlen photograph (#48), but is not a Peter Riley gift. It shows the same location as N-161.

Title: Lower Clifton from Road to Morenci
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 2, Folder 2, Photographs - Gift of Walter Hadsell, 1961 (Walter Hadsell Album 1901)
Description/Comments: "Lower Clifton from Road to Morenci." This photogaph shows the river in normal flow with fields in the floodplain.

Title: Clifton, 1923
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs
Description/Comments: "Clifton 1923 No. 46" This photograph is a view across the river at a church. It is not very informative with regard to streamflow or navigability.

Title: Clifton, Arizona, April, 1905, Bird's Eye View
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs
Description/Comments: "Clifton, Arizona, April, 1905 This is sort of a bird's eye view of Clifton.... The last rain washed away thirteen buildings and rendered many others unsafe.... Up the cañon on the right, the train takes you to the camp of Metcalf, and the stage road to Morenci also runs in this direction. There is a beautiful farm up this canyon owned by a man named Potter. The home is exceptionally attractive and the orchard and flower beds are a veritable Eden compared with the surrounding walls of high, barren mountains. Population of Clifton about 5000 at present...." This is a good panorama of Clifton measuring approximately 3 x 12 inches. The river has normal flow.

Title: Clifton, Arizona, April, 1905
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs
Description/Comments: "Clifton, Arizona, April, 1905 This photo shows the `A.C.' smelter more distinctly.... The suspension footbridge leads to the entrance of the hotel. There is no other bridge, so all baggage is carried over by those human pack-animals, the Mexicans." This is a good panorama of Clifton measuring approximately 3 x 12 inches. The river has normal flow.

Title: 1903 Clifton, AZ

Location: University of Arizona, Special Collections
Number: N-3079; File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs; also File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs
Description/Comments: Stereograph, "1903 Clifton, AZ. Underwood & Underwood Publishers, New York, London, Toronto, Canada, Ottawa, Kansas Works and Studios Orlington, N.J., Westwood, N.J., Washington, D.C." This is a view to the north from the southeastern section of Clifton among the houses on the hillslope. A rock and adobe building is shown in the foreground, a circus tent in the floodplain on the left in the middle ground, the distinctive peak in the far background. Just a thin sliver of the river is visible in the far background, and thus the photograph is not very informative with regard to streamflow or navigability.

Title: Arizona Copper Co. 1906
Location: University of Arizona, Special Collections
Number: N-5037; File: Clifton (Ariz.) File 1, Fol. 1, and Stereographs, Photographs
Description/Comments: "Arizona Copper Co. 1906 General view of smelter Arizona Copper Co., Clifton, Arizona." The river is visible in front of the smelter, but the photograph provides little information on streamflow or navigability.

Title: Clifton (Ariz.) ca. 1910
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 1, Fol. 2, Photographs
Description/Comments: This photograph (which may be a view to the west) shows the river running along the base of the photograph and crossed by a footbridge. Beyond the river is the railroad and a mountain. The river then curves back into the photograph and is crossed by the railroad bridge on the left side of the photograph.

Title: Clifton
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 1, Fol. 2, Photographs
Description/Comments: This is the standard view of Clifton, looking north up the river with the smelter and the distinctive mountain in the center of the photograph. The footbridge across the river is visible in the foreground and the circus tent is present on the right bank of the river just to the right of the footbridge. Since the stereograph "1903 Clifton, AZ" also shows the circus tent, this photograph probably also dates to 1903. Here the river is in normal flow and is sort of braided.

Title: Arizona Copper Co., Clifton
Location: University of Arizona, Special Collections
Number: None; File: Clifton (Ariz.) File 1, Fol. 2, Photographs
Description/Comments: This view is looking directly across the river at the smelter, but it was taken from high enough on the opposite slope that the dry riverbed, with only a few damp spots, is clearly visible.

Title: Clifton 1911
Location: University of Arizona, Special Collections
Number: N-2805; File: Clifton (Ariz.) Photographs, File 1, Folder 3
Description/Comments: "Clifton 1911 Percy Jones Collection" This photograph is looking across a mostly dry river bed with a small stream perhaps 10 feet wide and 6 inches deep in the foreground. Houses are visible, but no other landmarks.

Title: Concrete Bridge over San Francisco River
Location: Published photograph in Rush (1922)
Number: N/A
Description/Comments: Concrete bridge in Clifton

Title: Steel Bridge at Clifton over San Francisco River
Location: Published photograph in Rush (1922)
Number: N/A
Description/Comments:

Title: Clifton, Arizona, Looking North
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: This is the standard view of Clifton, looking north up the river with the smelter and the distinctive mountain in the center of the photograph. The footbridge across the river is visible in the foreground and the circus tent is present on the right bank of the river just to the right of the footbridge. Since the stereograph "1903 Clifton, AZ" also shows the circus tent, this photograph probably also dates to 1903. This is pretty much the same view as in "Clifton," above, but here the river flows bank to bank.

Title: South Clifton, Shannon Works in the Distance, A. & N. M. Railway Bridge
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View downstream with railroad bridge in center foreground, river in normal flow with some sand or gravel bars.

Title: Cottonwood trees on the `Frisco.
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: Cabins on sandy banks beneath cottonwood trees with San Francisco River on right, full and placid.

Title: South Clifton
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View to west; San Francisco River appears to be almost dry.

Title: Arizona Copper Co.'s Reduction Works, Clifton, Arizona
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View to north across Chase Creek, San Francisco River appears as a braided stream on right side of photograph.

Title: Scenery on the San Francisco Three Miles Above Clifton
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: Buggy on sandy bank, telephone/telegraph pole on left, cottonwood tree on right, fence in background, river not visible.

Title: On the Frisco River, Three Miles Above Clifton
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: River fills foreground, placidly flowing, with small cataract in middle ground and placid pool beyond.

Title: Birdseye View of the Arizona Copper Co.'s Reduction Plant, Clifton
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View to west up Chase Creek on left, with river forming braided stream past slag heaps from mill.

Title: Portion of Clifton, Looking South
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View to south from east side of river, south end of Clifton; river bend can be seen in background.

Title: Clifton, Looking South
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View downriver from braided riverbed.

Title: Foot Bridge, Clifton
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: View to west across footbridge.

Title: Burro Ore Train
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: Although the river is not shown in this photograph, the photograph is an excellent picture of one of the burro trains that transported ore from mine to mill.

Title: "To the Log Camp" Scenery on the `Frisco, Four Miles Above Clifton
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: Train of horse-drawn wagons crossing a placid but full San Francisco River.

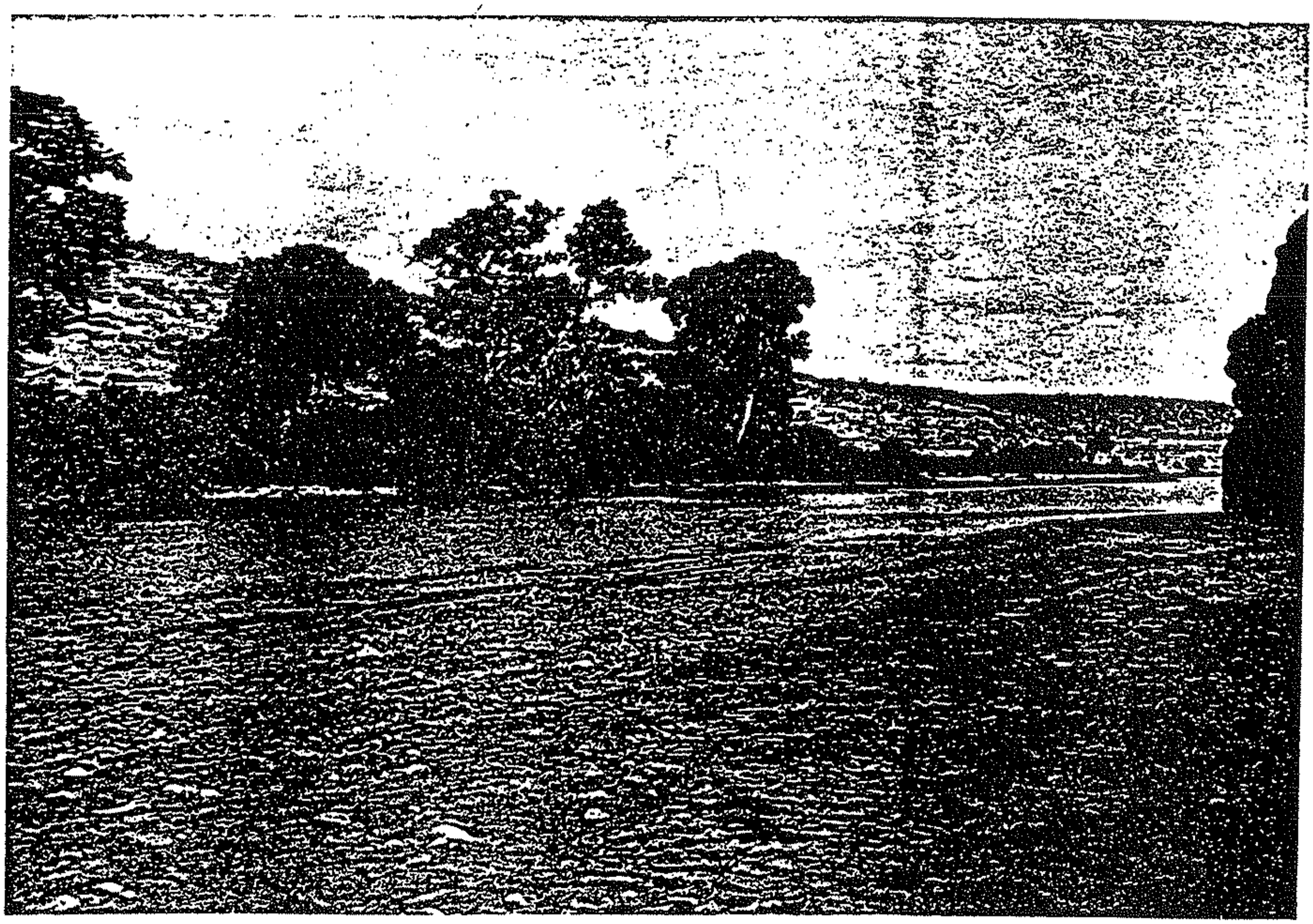
Title: Railroad Bridge and Hospital at Clifton
Location: Published photograph in Segal (n.d.)
Number: N/A
Description/Comments: Railroad bridge crossing San Francisco River in normal flow.

Title: Upper Reaches
Location: Published photograph in Olmstead (1919:Plate 19)
Number: N/A
Description/Comments: Stream flowing through meadows, probably near Alpine, Arizona.

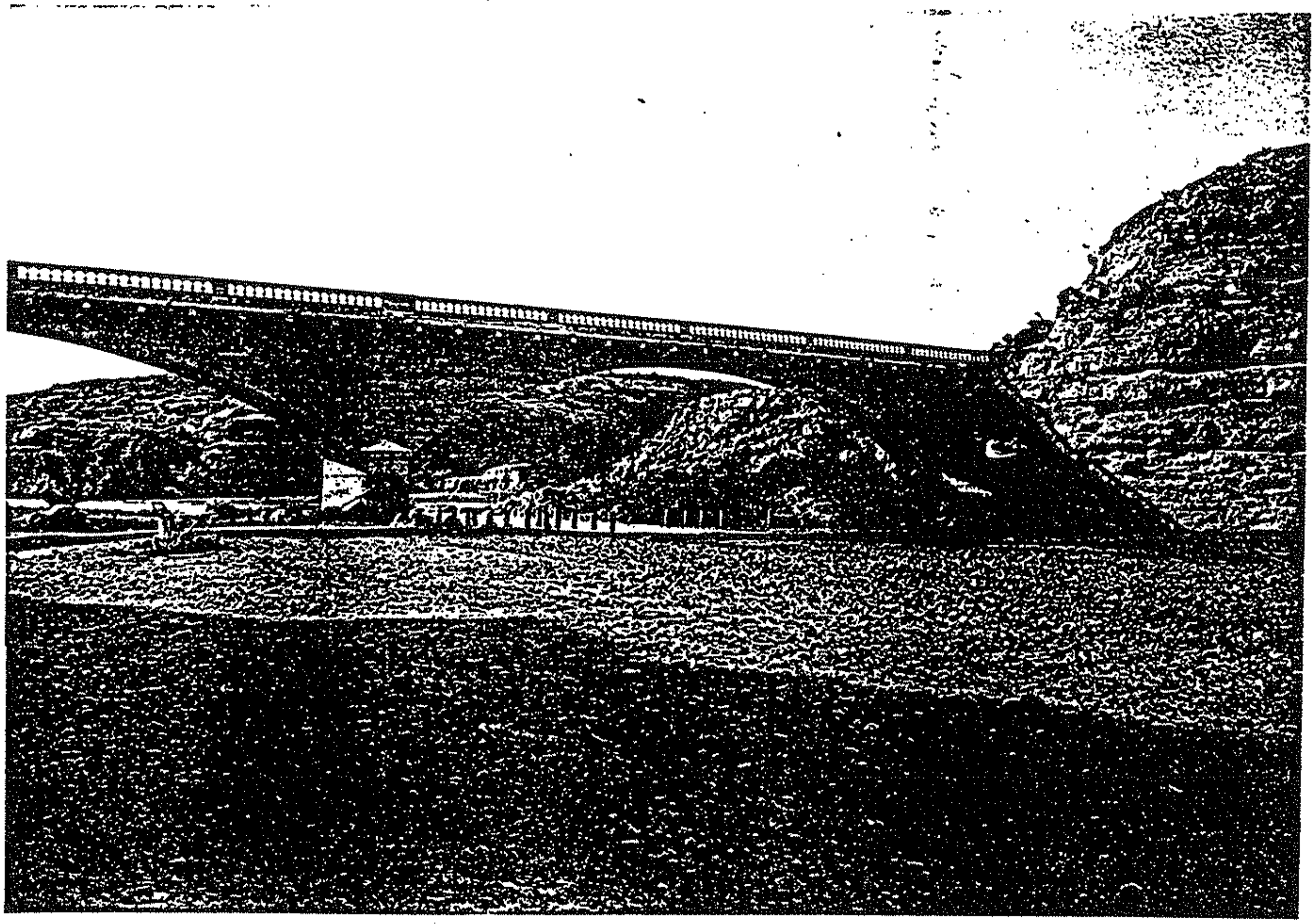
Title: At Junction with Gila
Location: Published photograph in Olmstead (1919:Plate 19)
Number: N/A
Description/Comments: Stream flowing through canyon.

Title: Scenes of San Francisco River at Clifton, Ariz.
Location: Published photographs (3) in Olmstead (1919:Plate 29)
Number: N/A
Description/Comments: (Top) Francisco River in flood looking south towards railroad bridge; (Middle) San Francisco River in flood looking south from mouth of Chase Creek; (Bottom) dry bed of San Francisco River looking upstream to bridge.

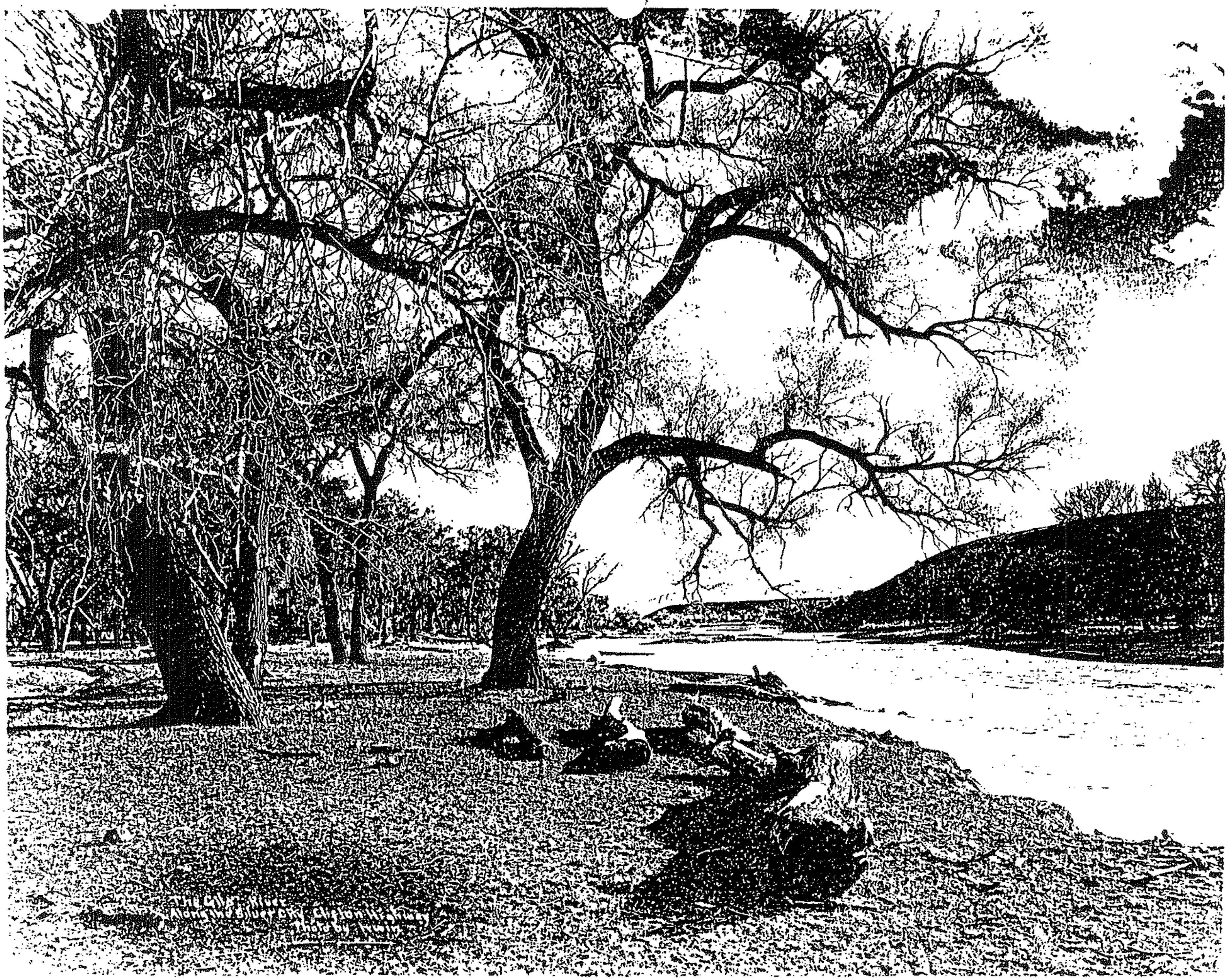
Gila River between Ft. Thomas and Solomonville, October 17, 1885. #19, 677 Arizona Pioneers Historical Society, Tucson



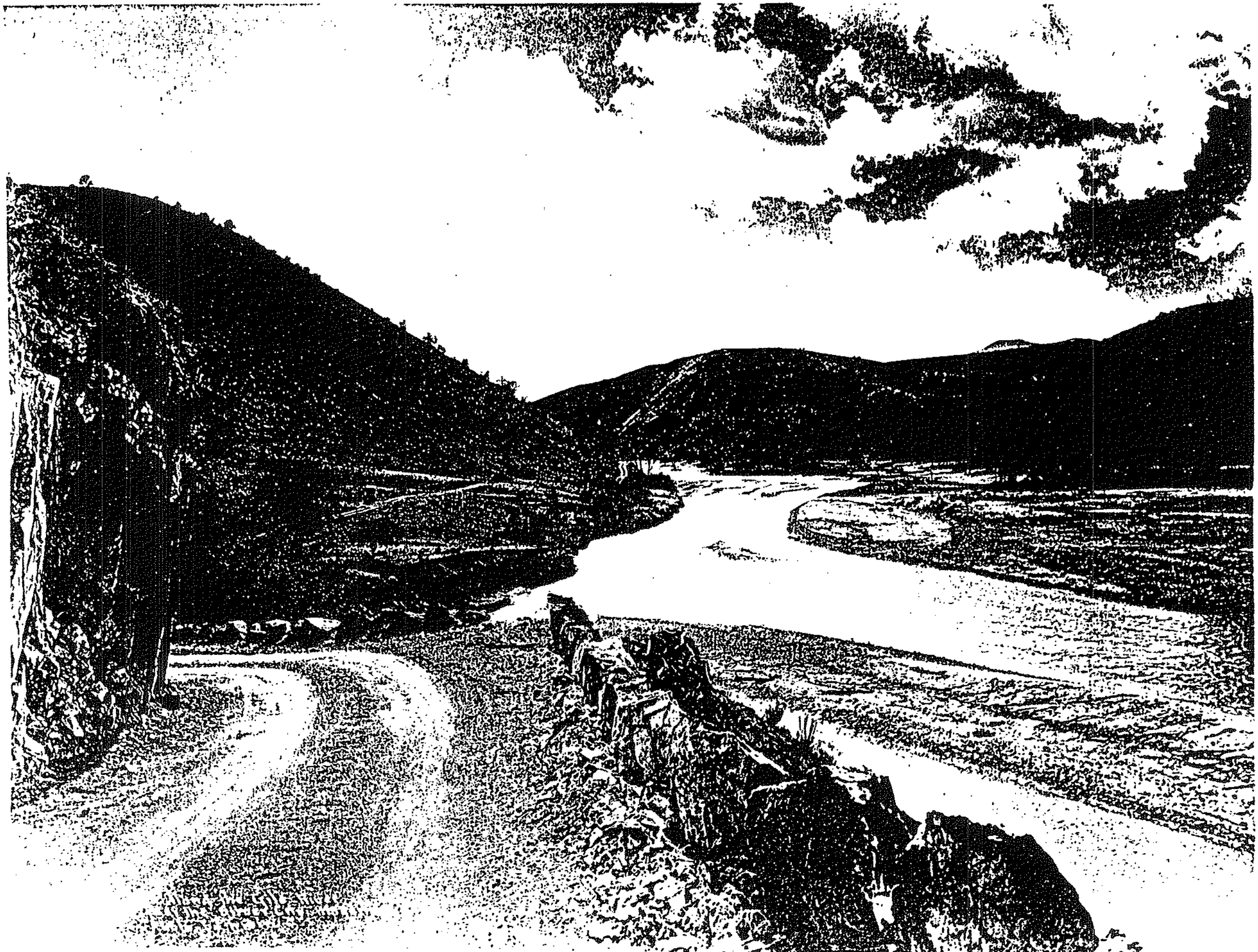
Gila River. #50192 Arizona Pioneers Historical Society, Tucson



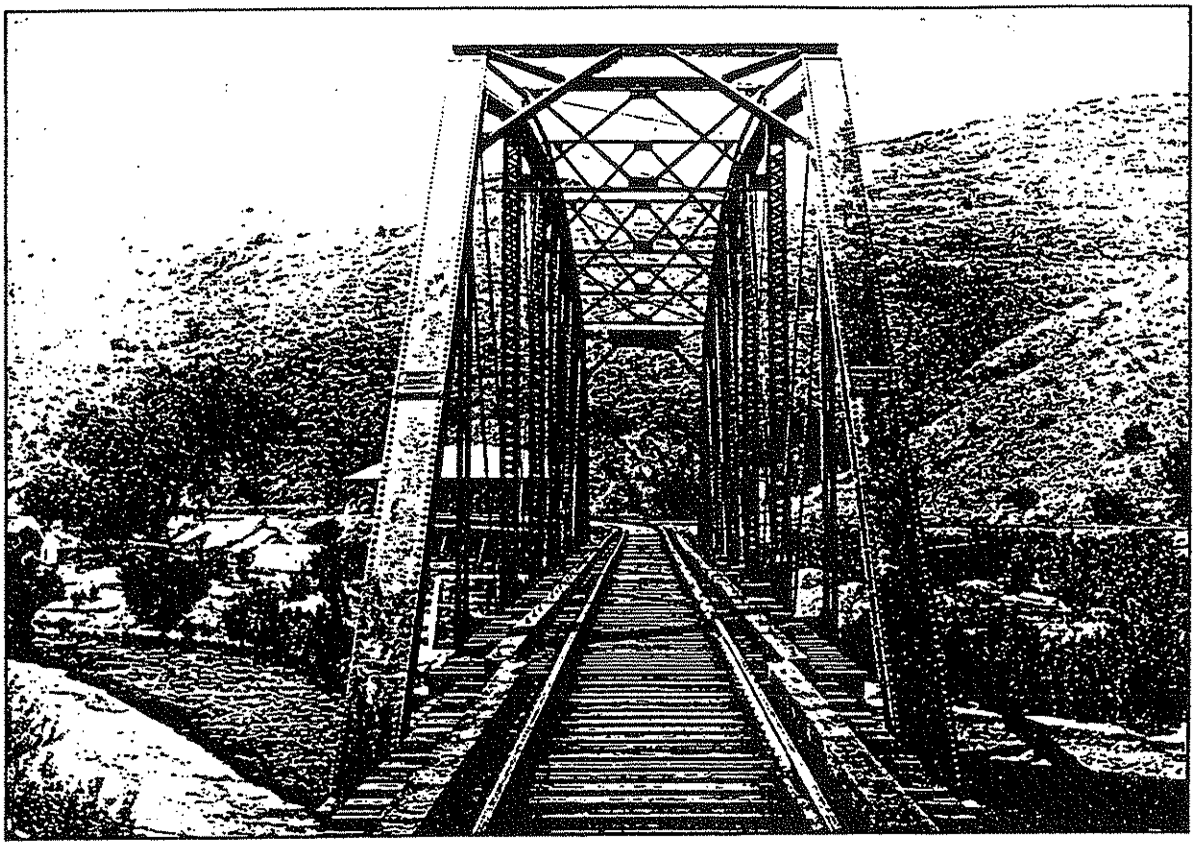
Gila Bridge between Safford and Clifton. #50193 Arizona Pioneers Historical Society. Tucson



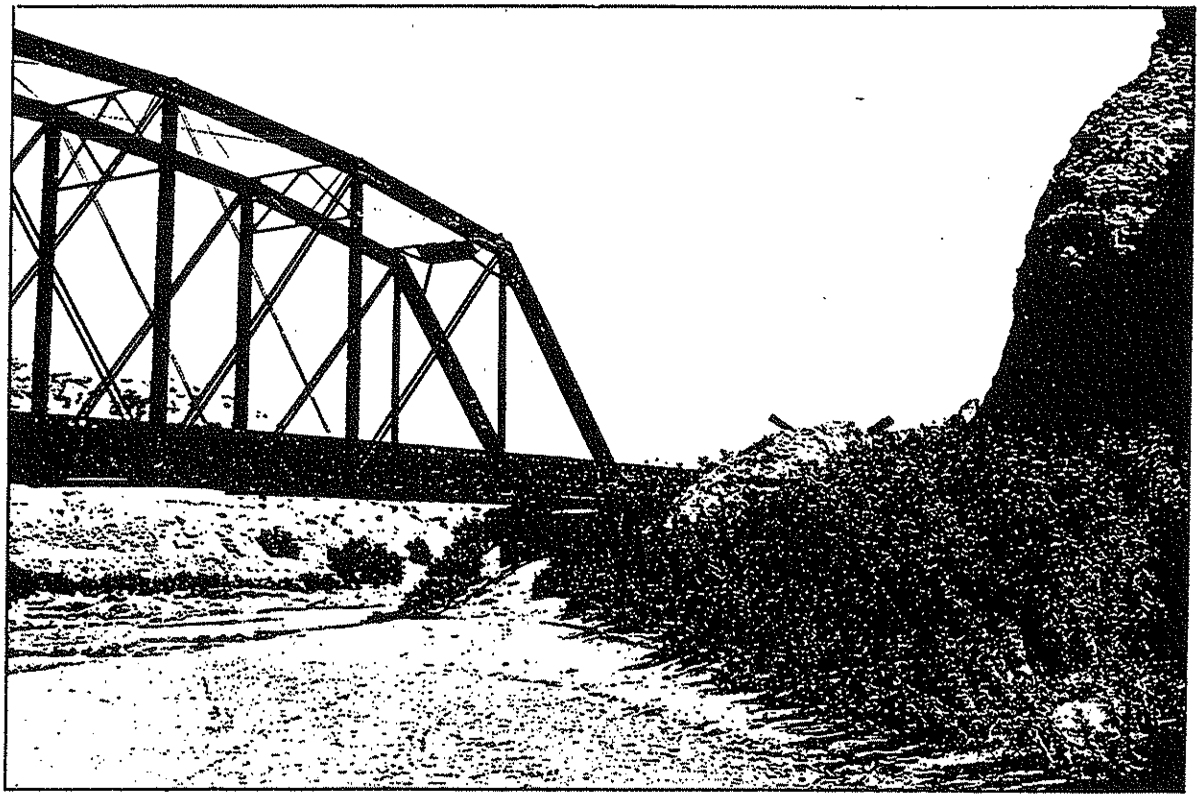
Gila River along the Silver City - Clifton Highway. #59100 Arizona Pioneers Historical Society



Gila River near the Silver City - Mogollon Highway. #59020 Arizona Pioneers Historical Society, Tucson



A. & N. M. R. R. Bridge at Guthrie, Arizona. Segal (n. d.)

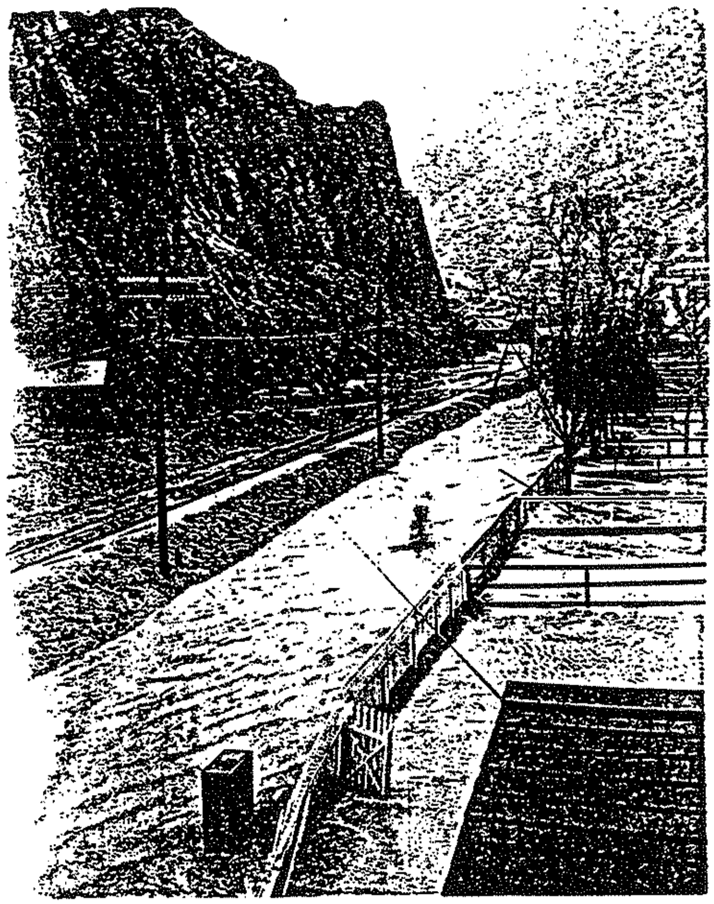


R.R. Bridge of the A. & N. M. R. R. at Guthrie, Arizona. Segal (n. d.)

Railroad along San Francisco River in flood. #51196 Arizona Pioneers Historical Society, Tucson

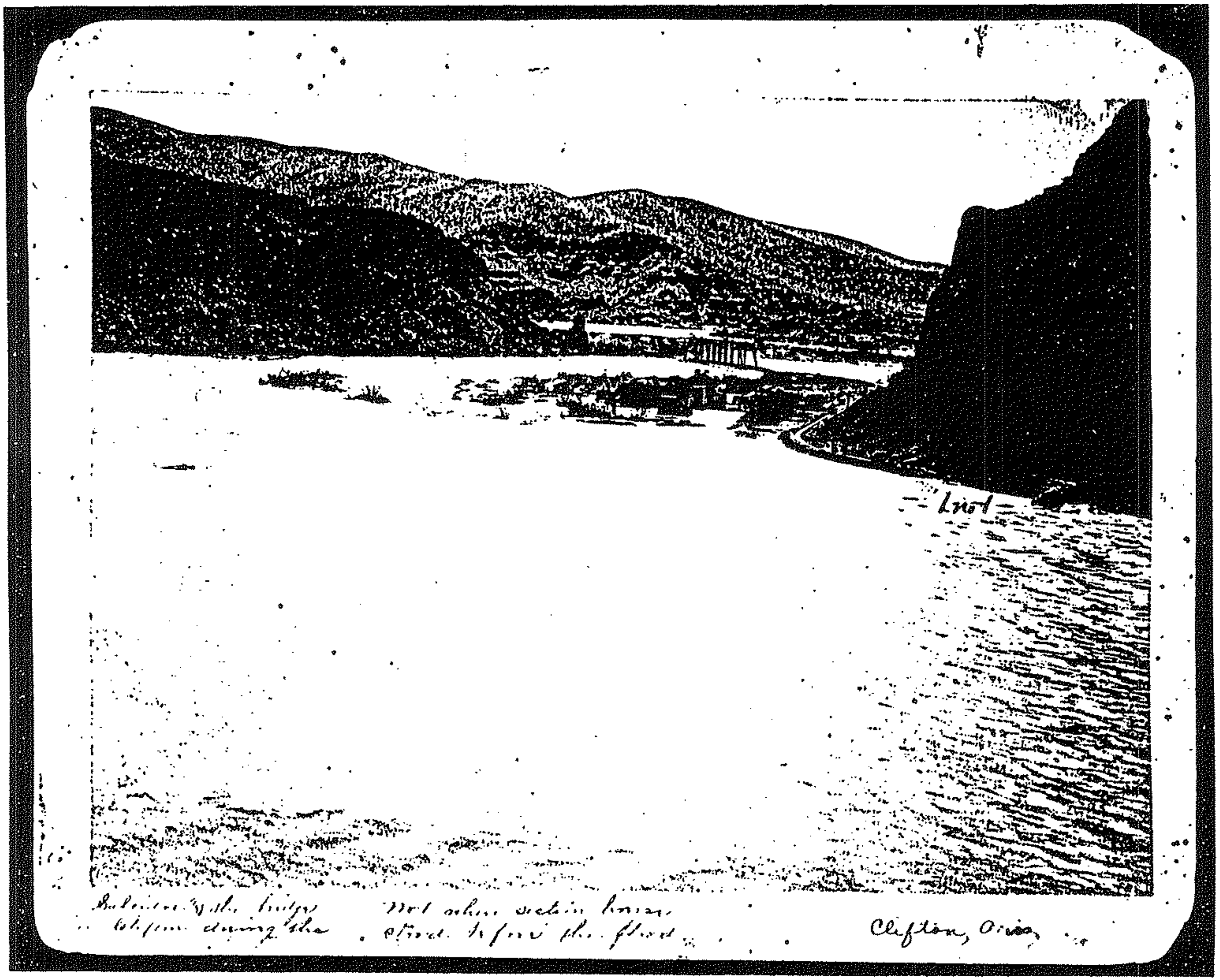
Railroad bridge in river (flood 1905

Railroad bridge in river, Clifton Flood 1905. #58651 Arizona Pioneers Historical Society, Tucson

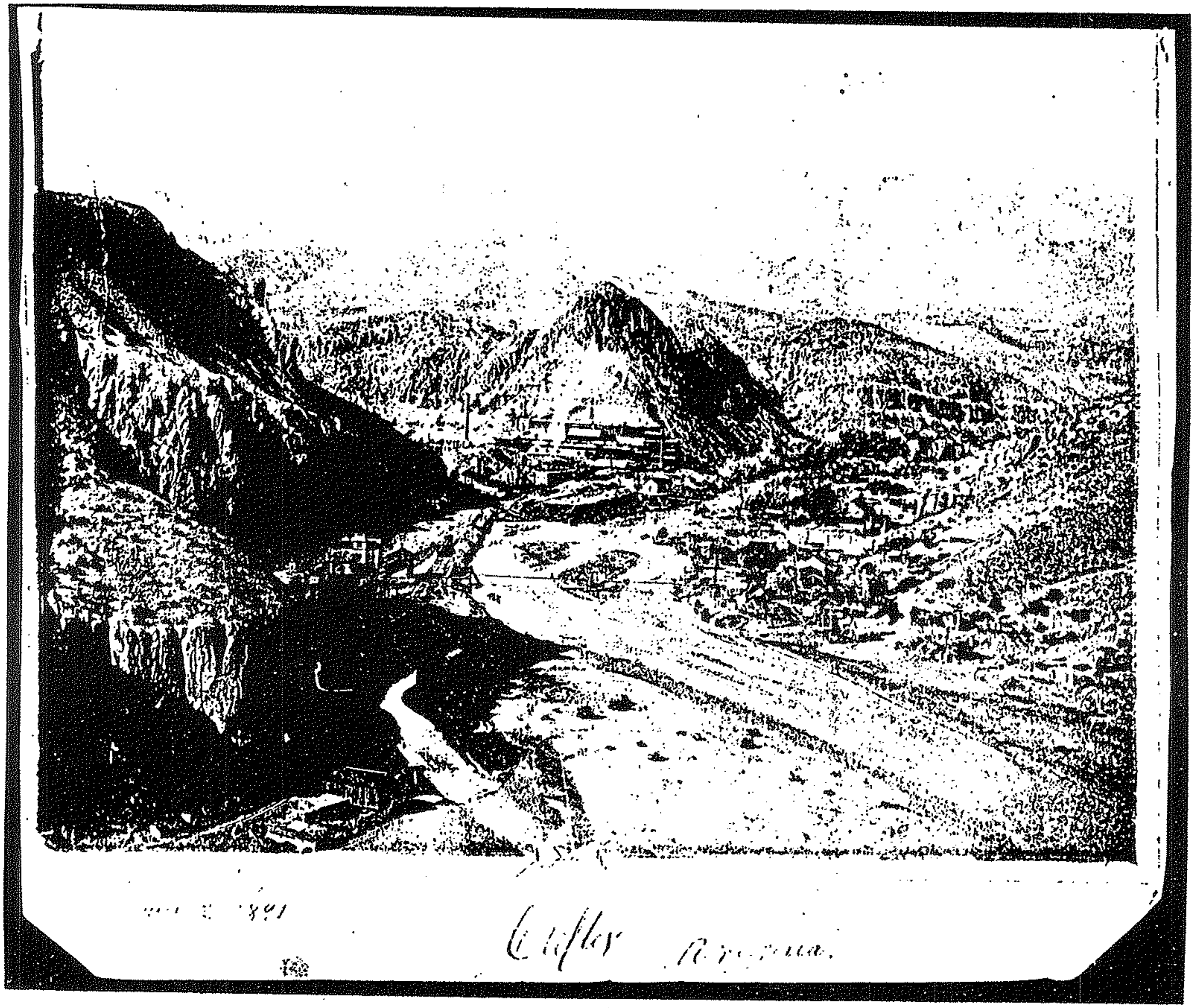


Water in front of row of houses Clifton 1905

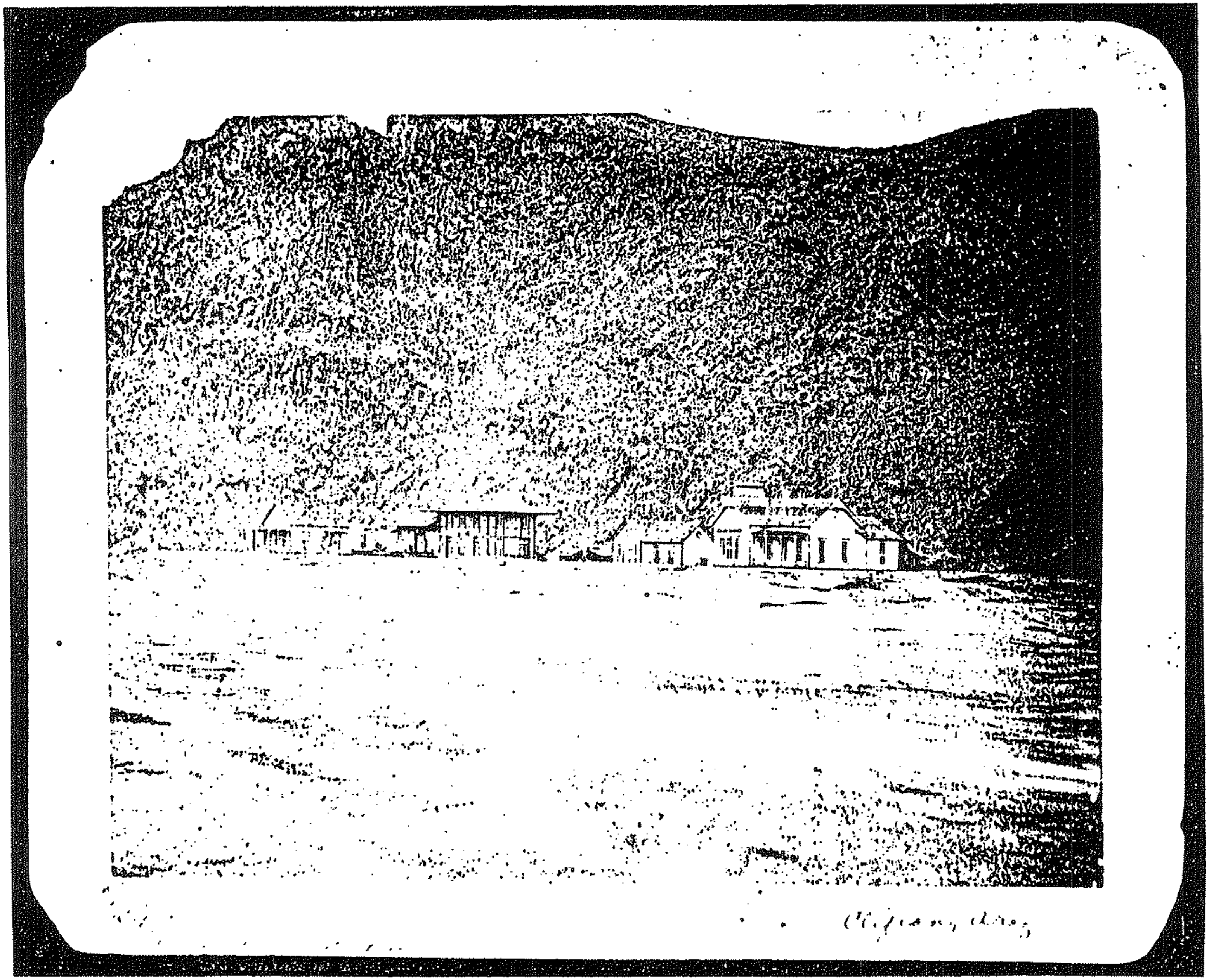
Water in front of row of houses. Clifton Flood 1905. #58652 Arizona Pioneers Historical Society, Tucson



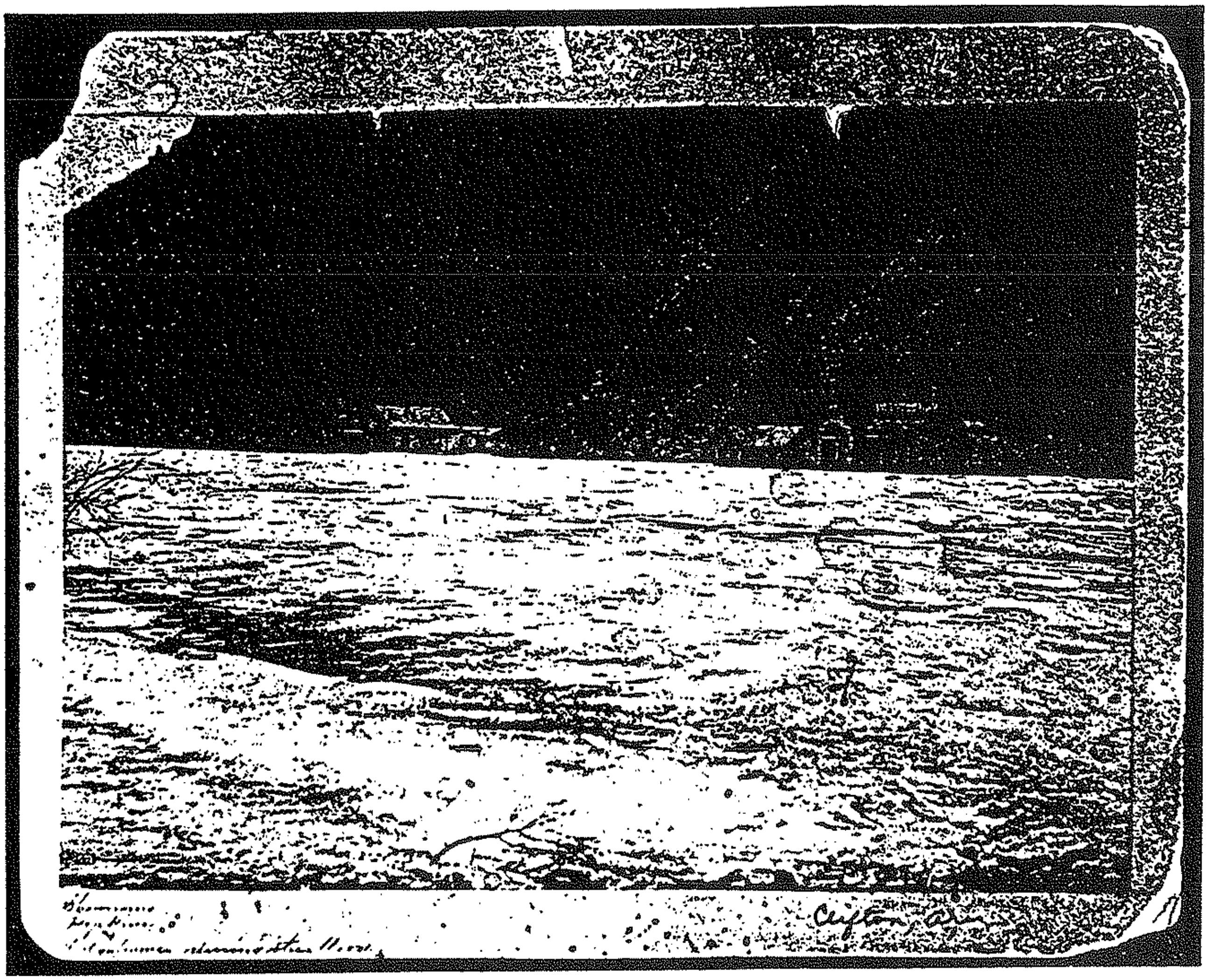
Flood at Clifton, Arizona, February 27, 1891. #2296 Arizona Pioneers Historical Society, Tucson



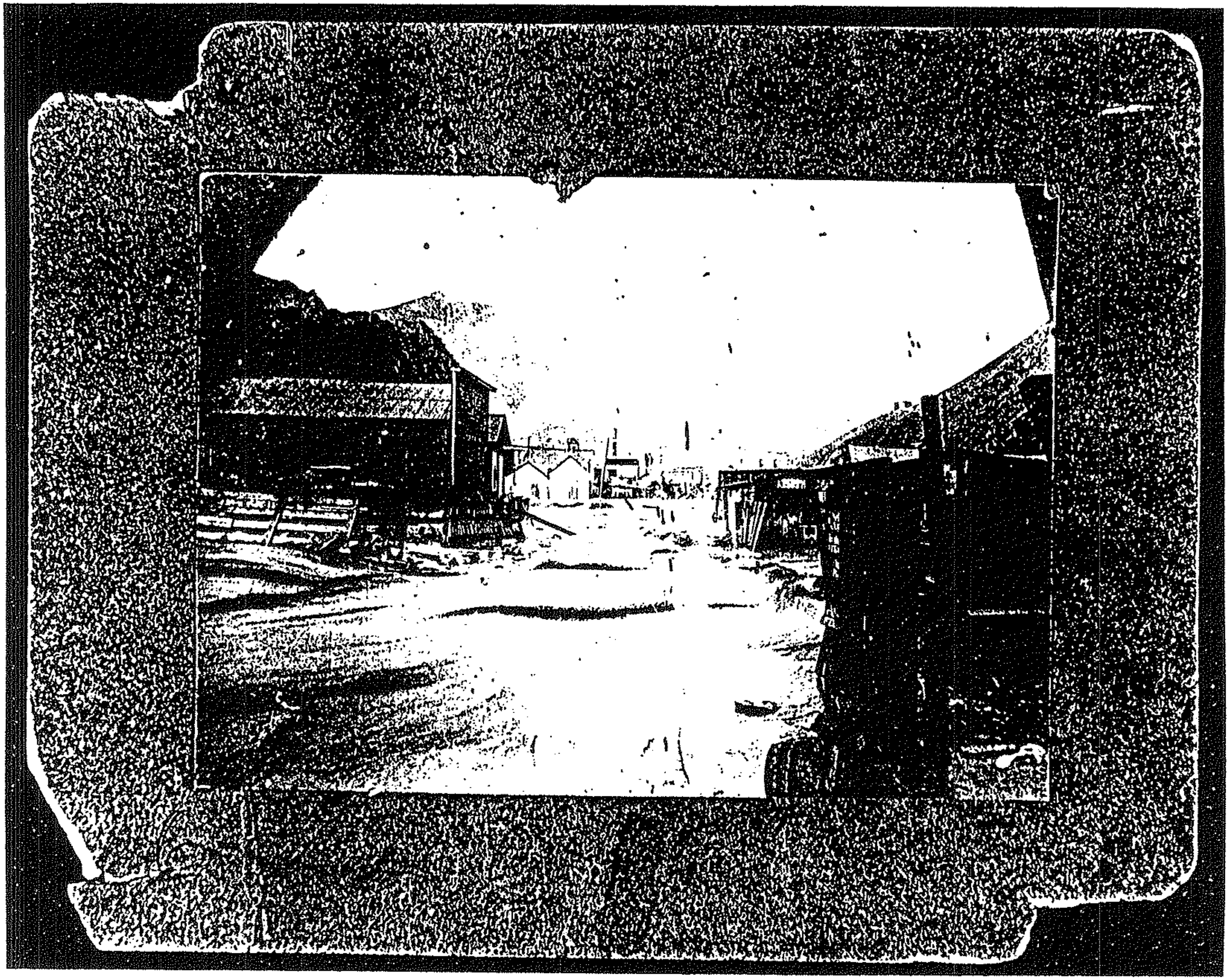
Clifton, Arizona, looking north up river, January 3, 1891. #2302 Arizona Pioneers Historical Society, Tucson



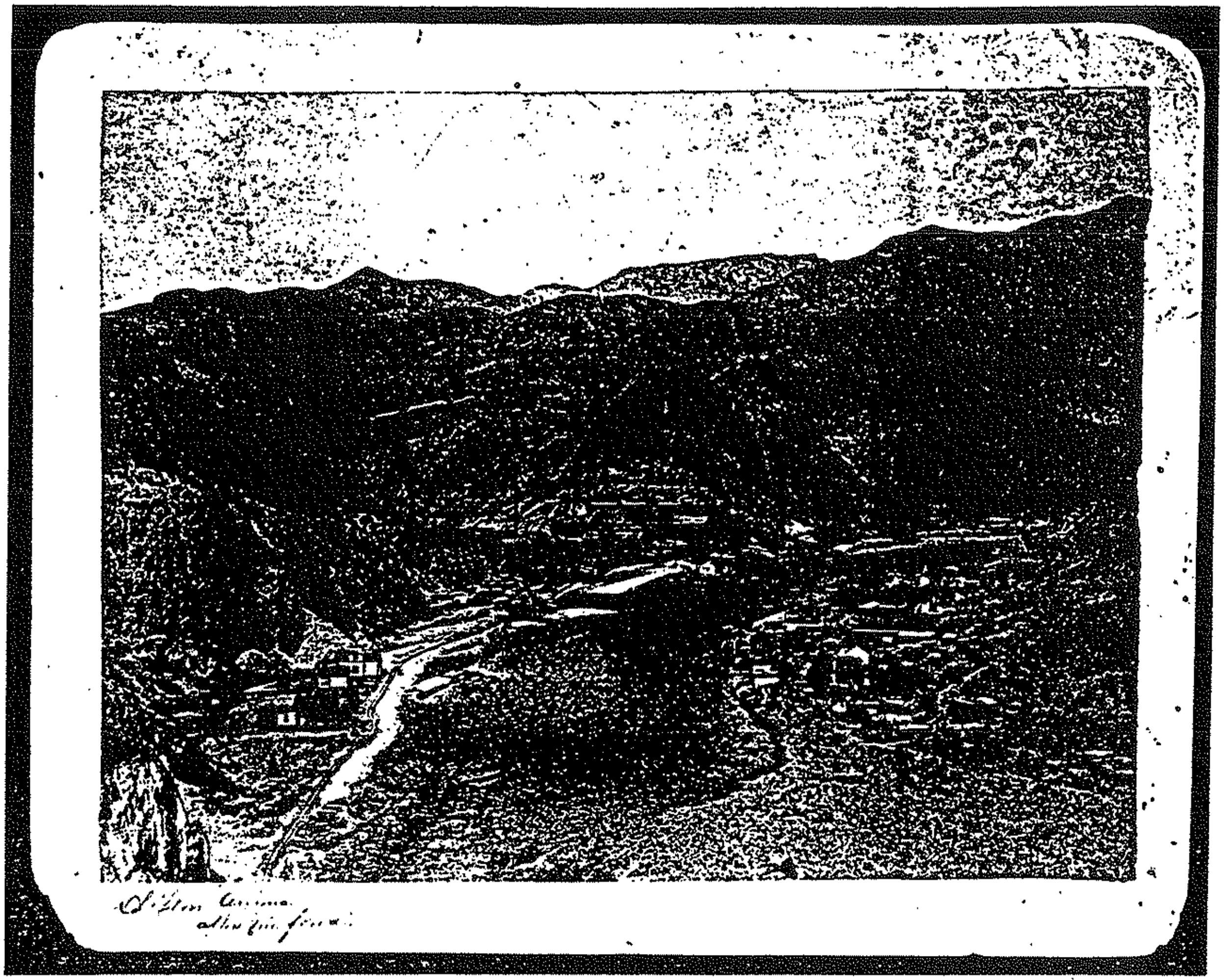
Clifton, Arizona, during the flood of February 27, 1891. #2303 Arizona Pioneers Historical Society, Tucson



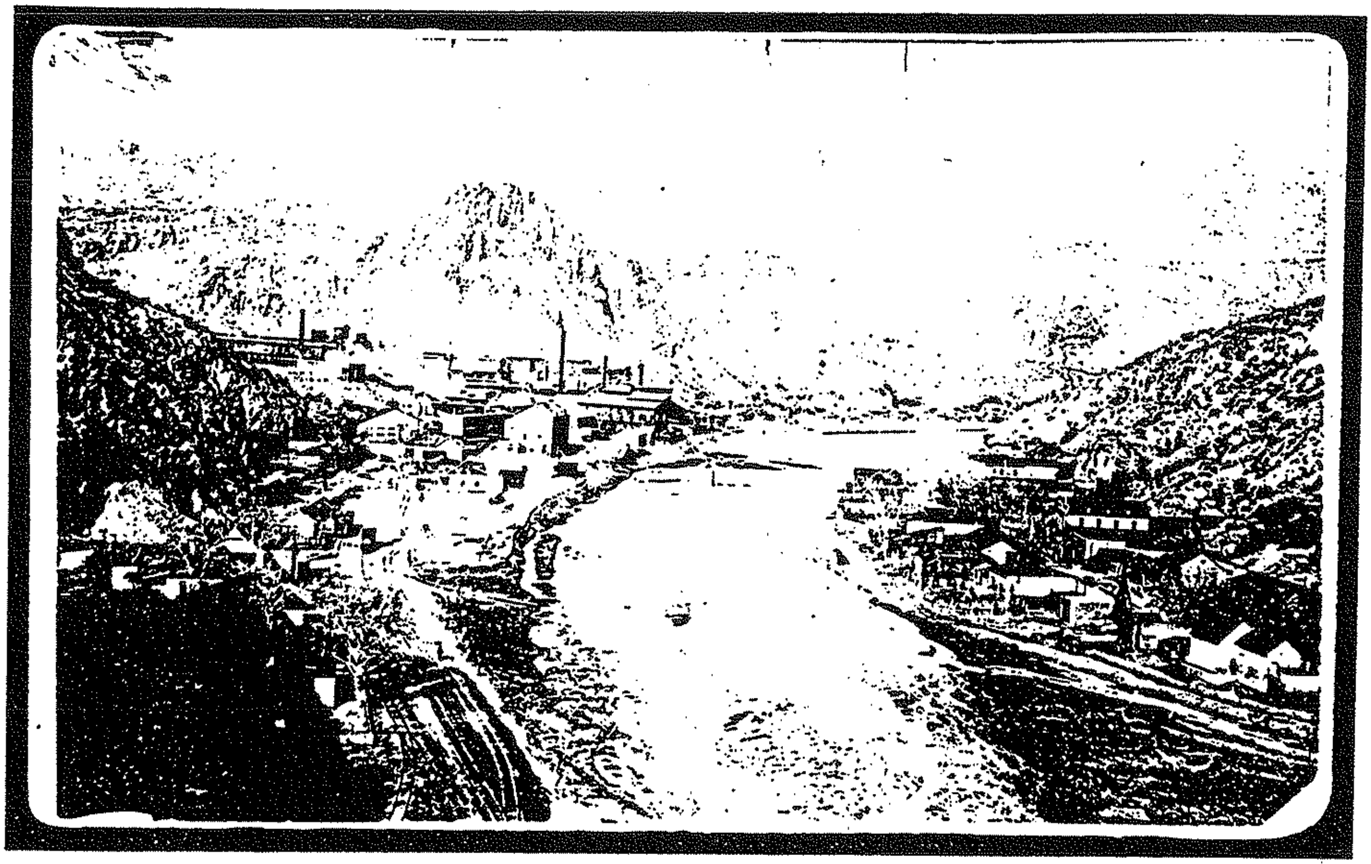
Clifton, Arizona, during the flood of February 27, 1891. #2304 Arizona Pioneers Historical Society, Tucson



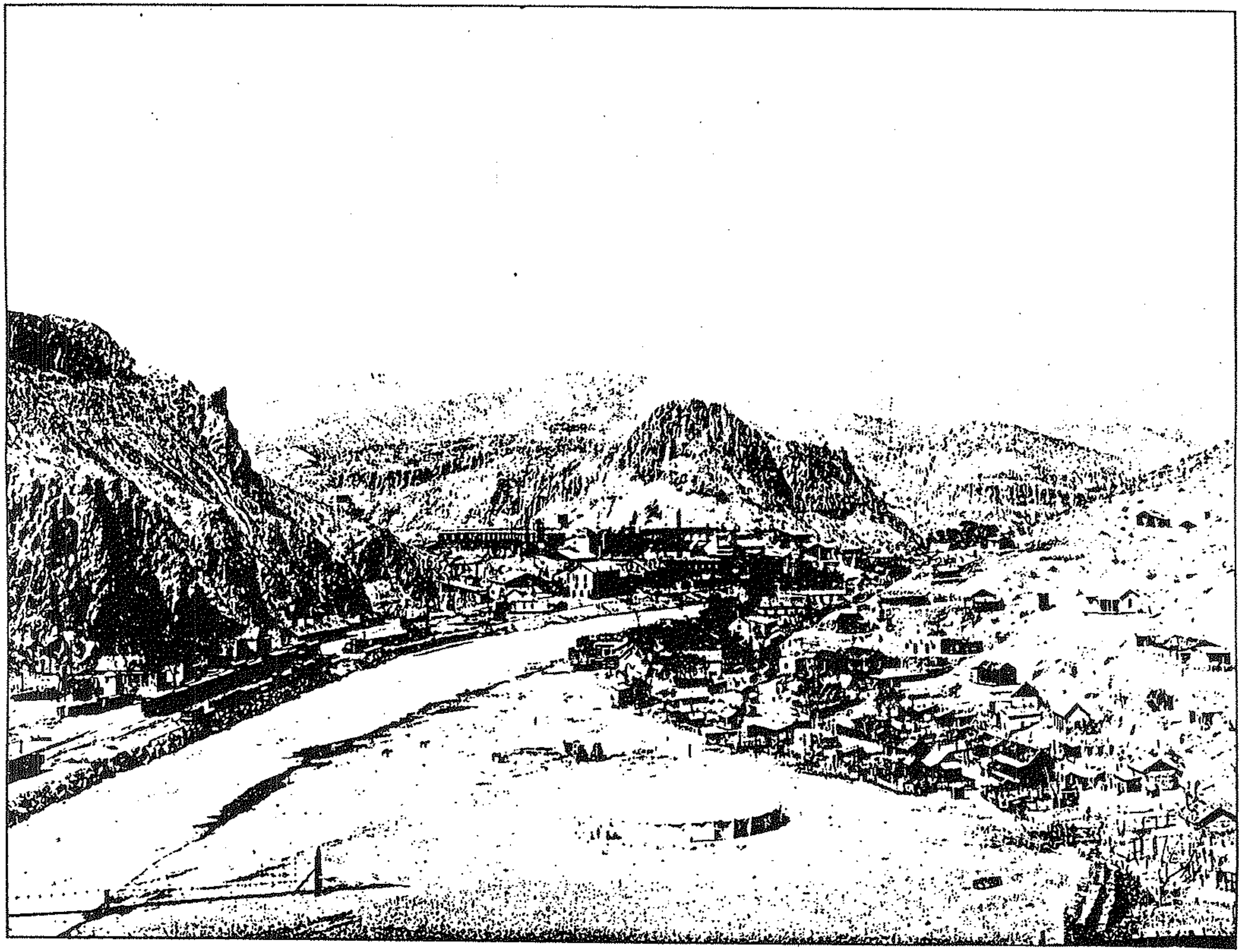
Flood in Clifton, Arizona, ca. 1903. #51028 Arizona Pioneers Historical Society, Tucson



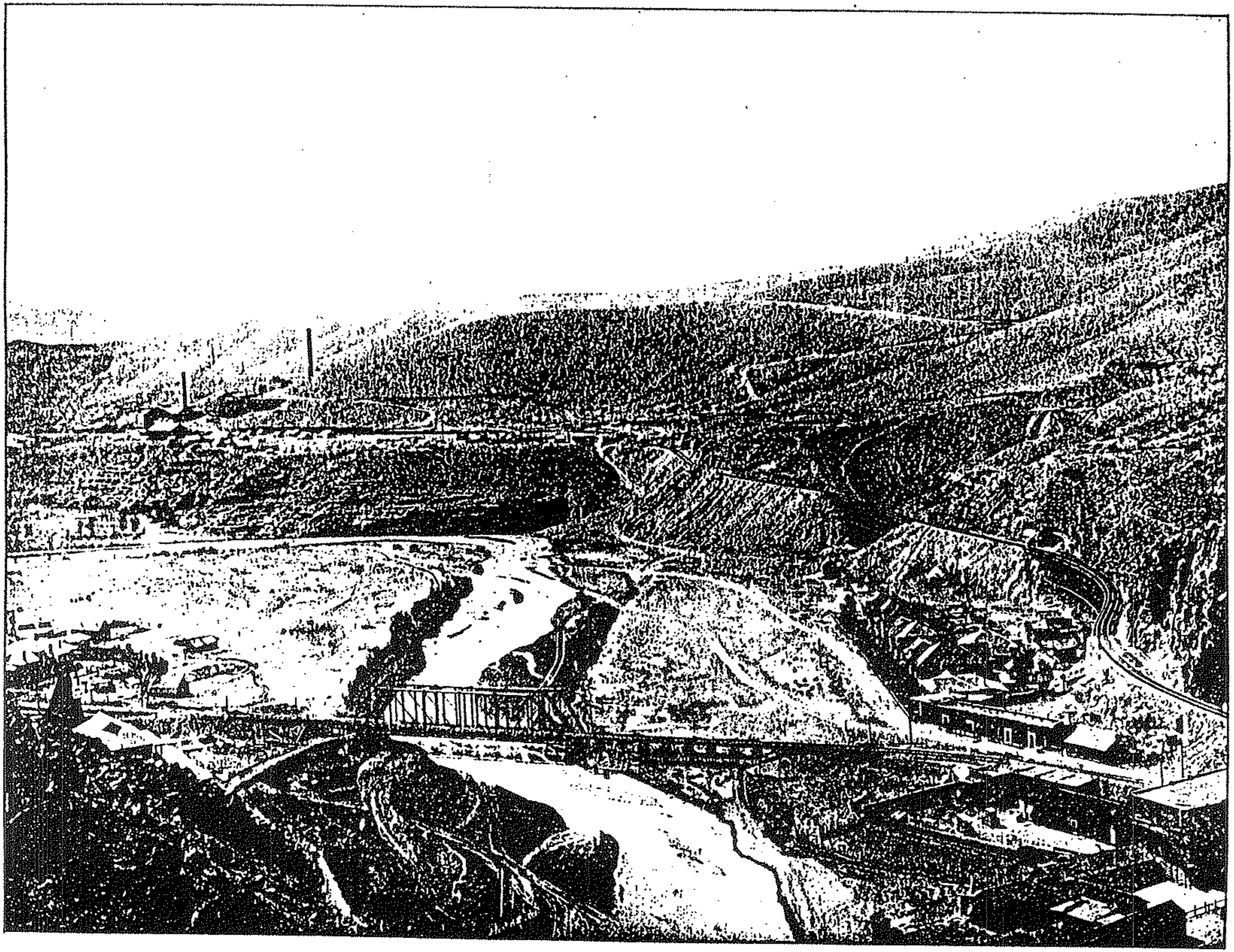
Clifton, Arizona, after the flood that occurred February 27, 1891. #2299 Arizona Pioneers Historical Society, Tucson



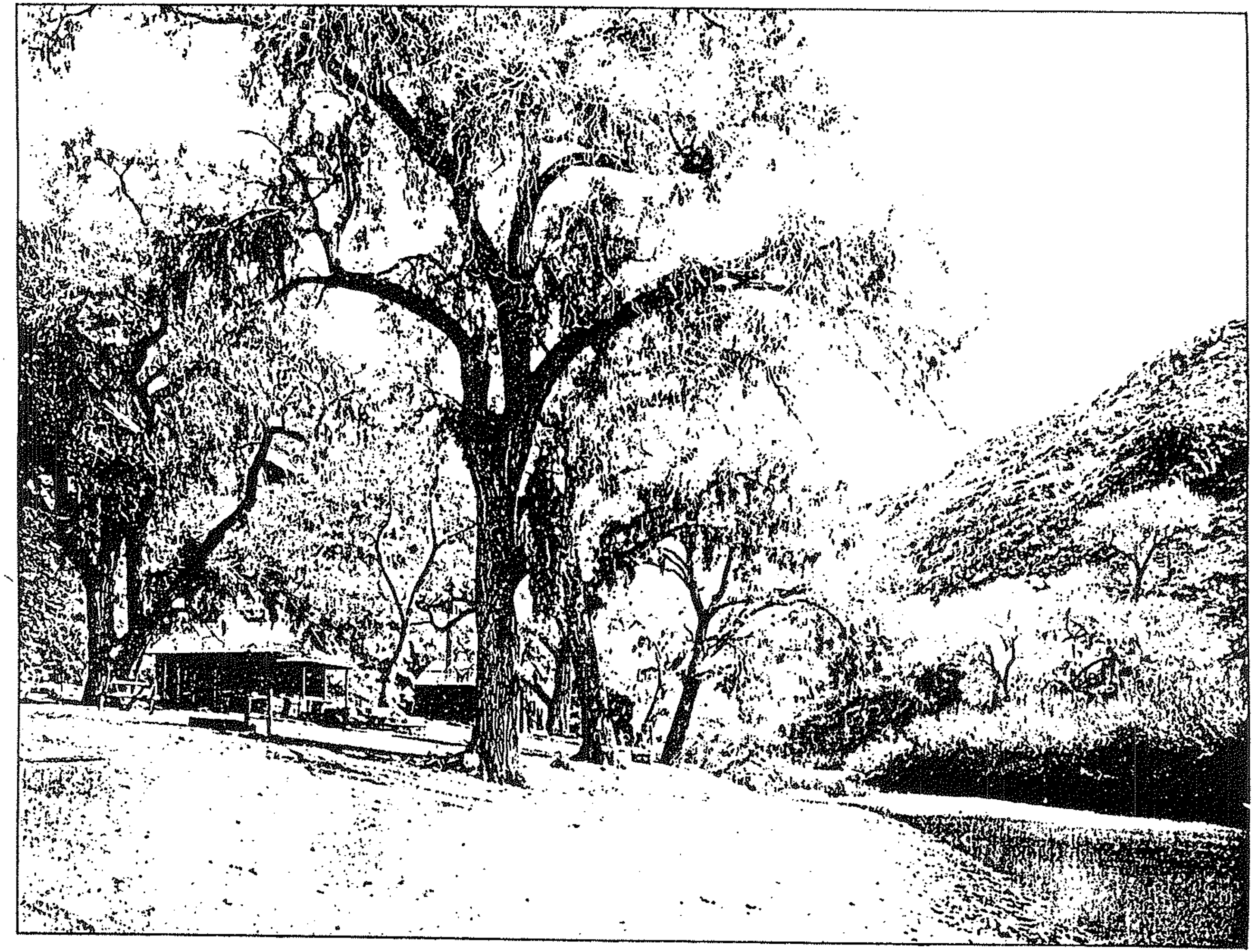
Clifton, an Arizona mining camp. #24960 Arizona Pioneers Historical Society, Tucson



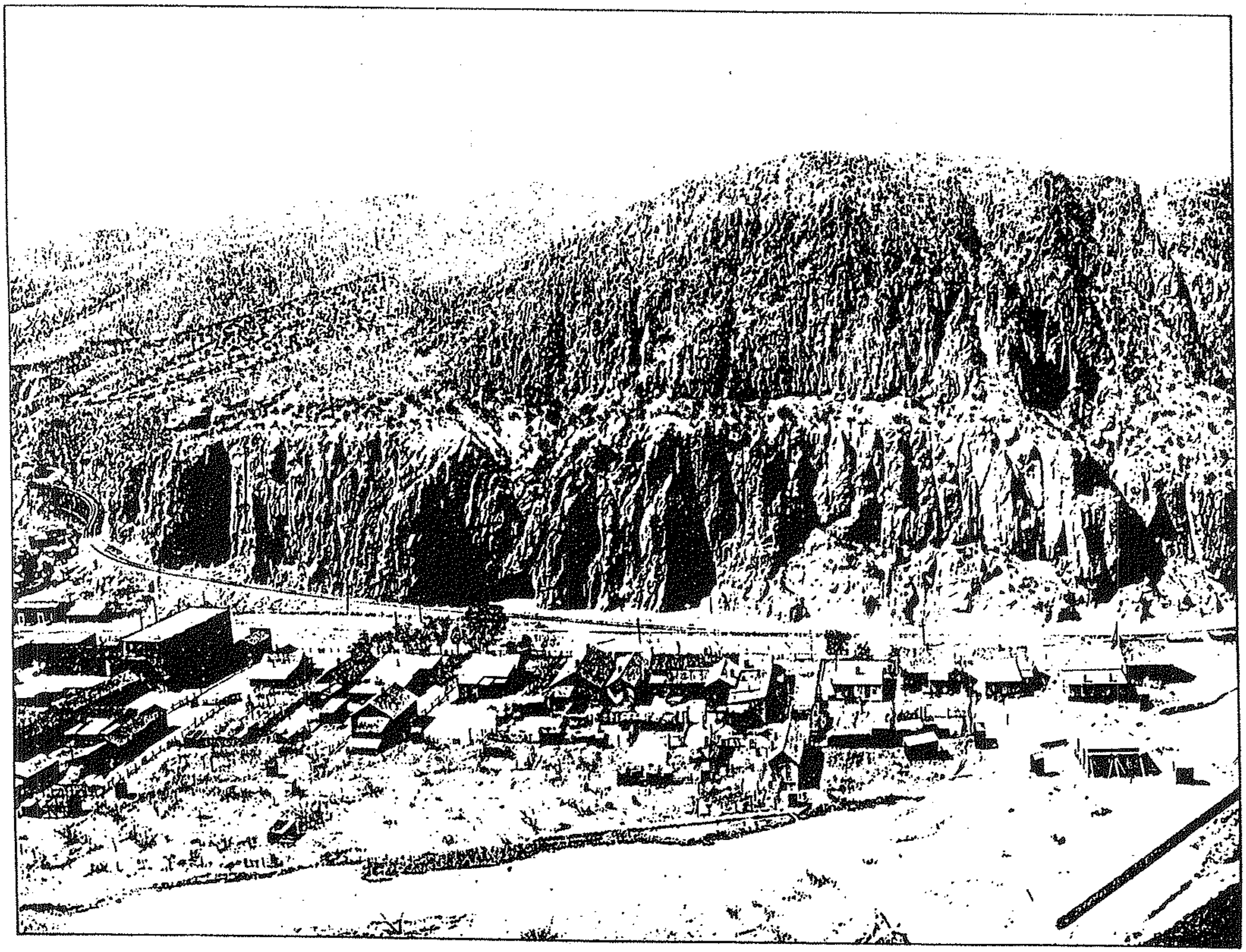
Clifton, Arizona, Looking North. Segal (n. d.)



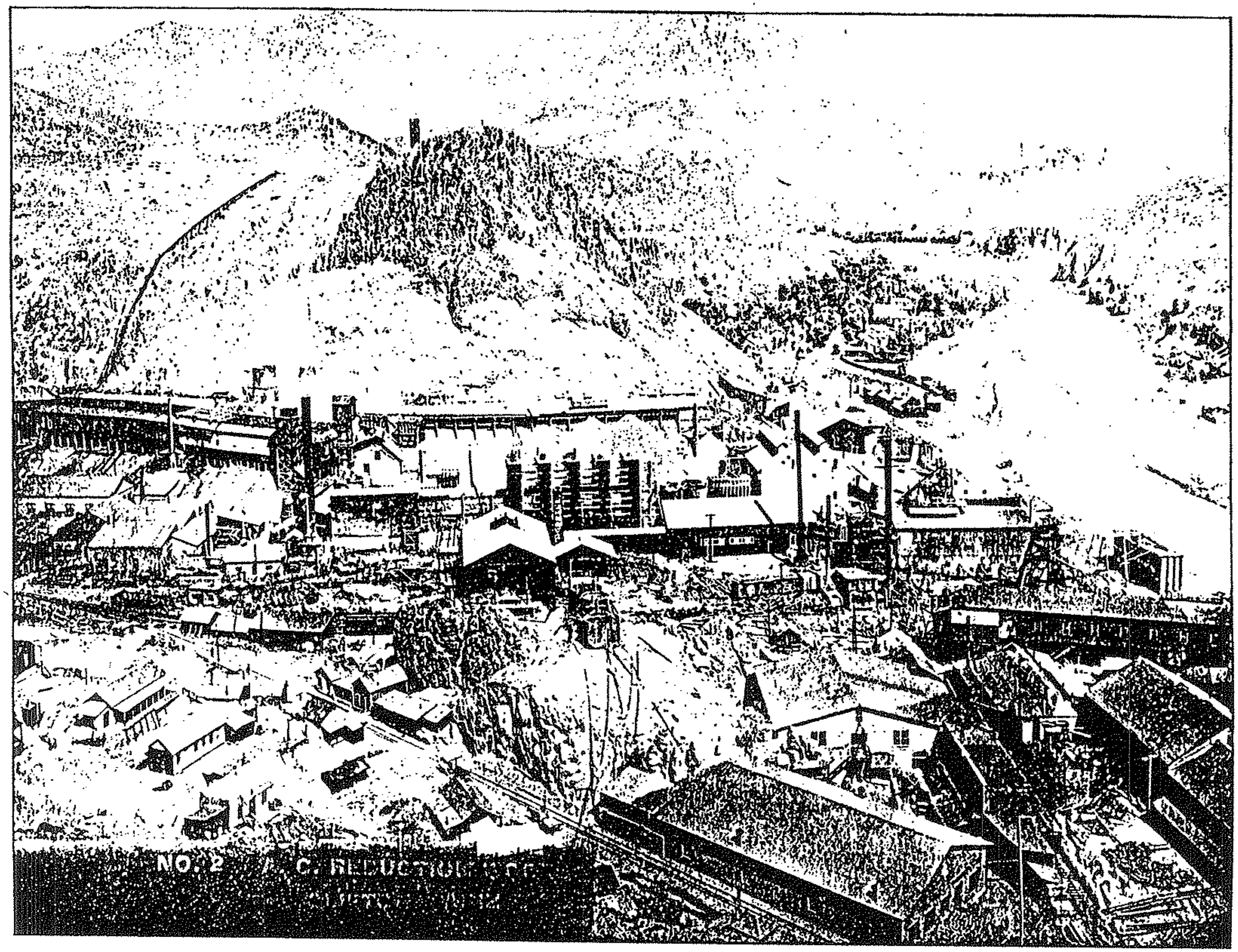
South Clifton, Shannon Works in the Distance, A. & N. M. Railway Bridge. Segal (n. d.)



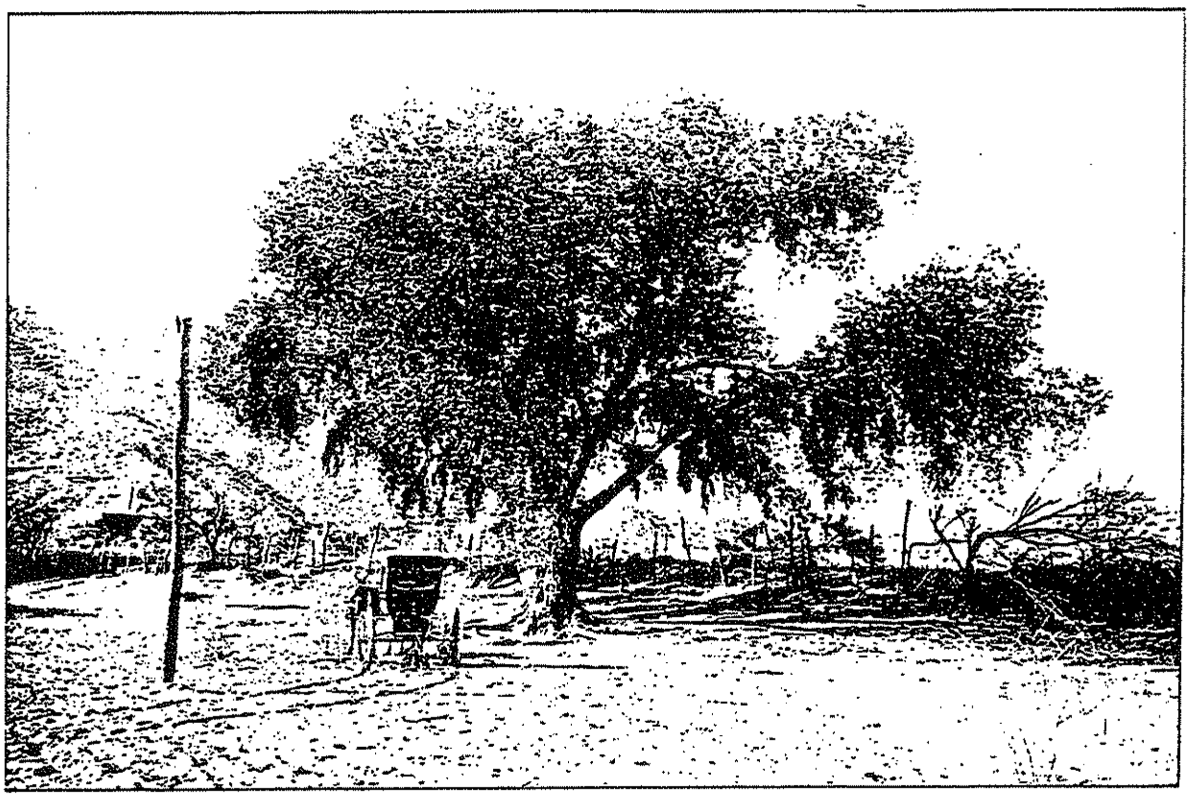
Cottonwood Trees on the 'Frisco. Segal (n. d.)



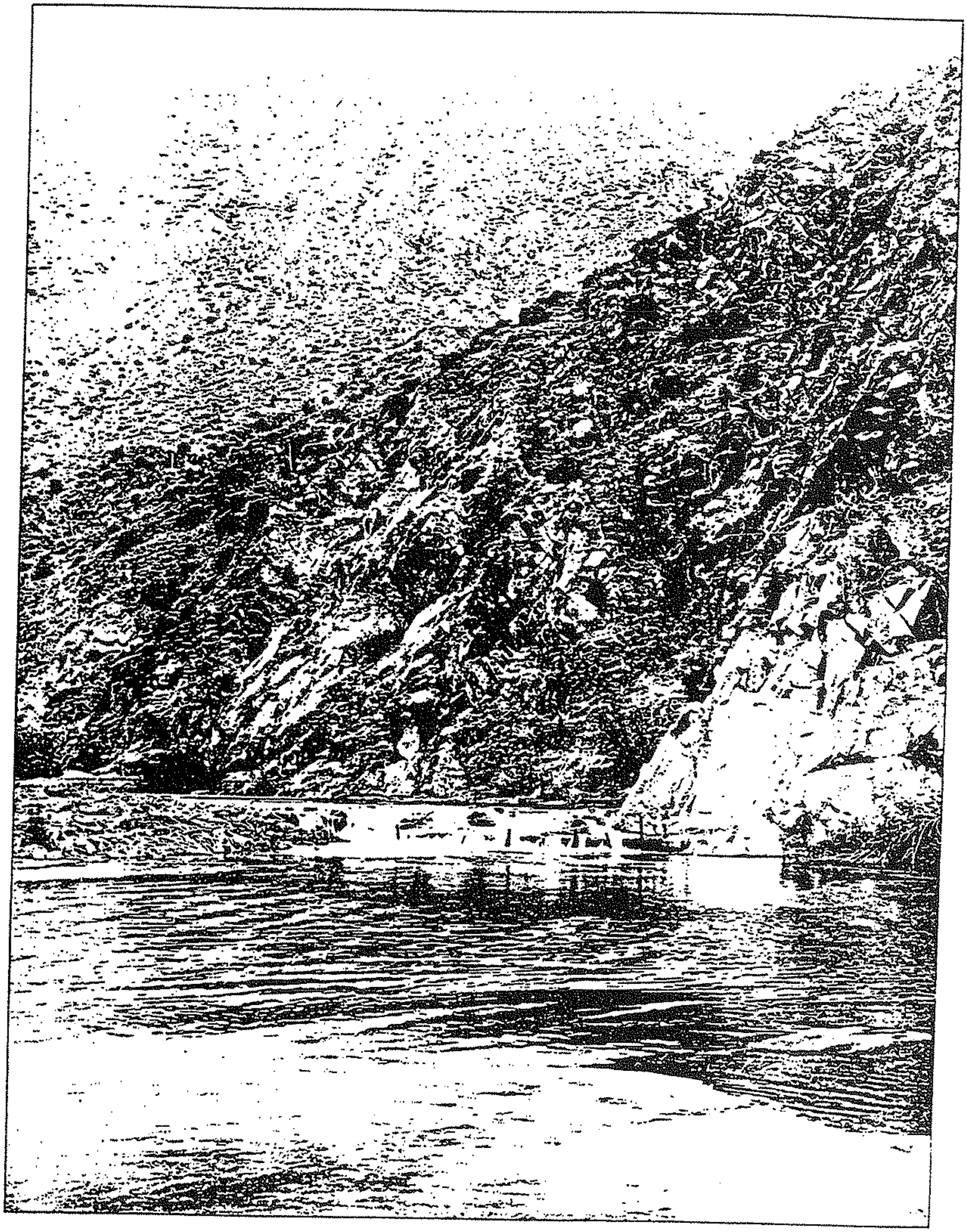
South Clifton. Segal (n. d.)



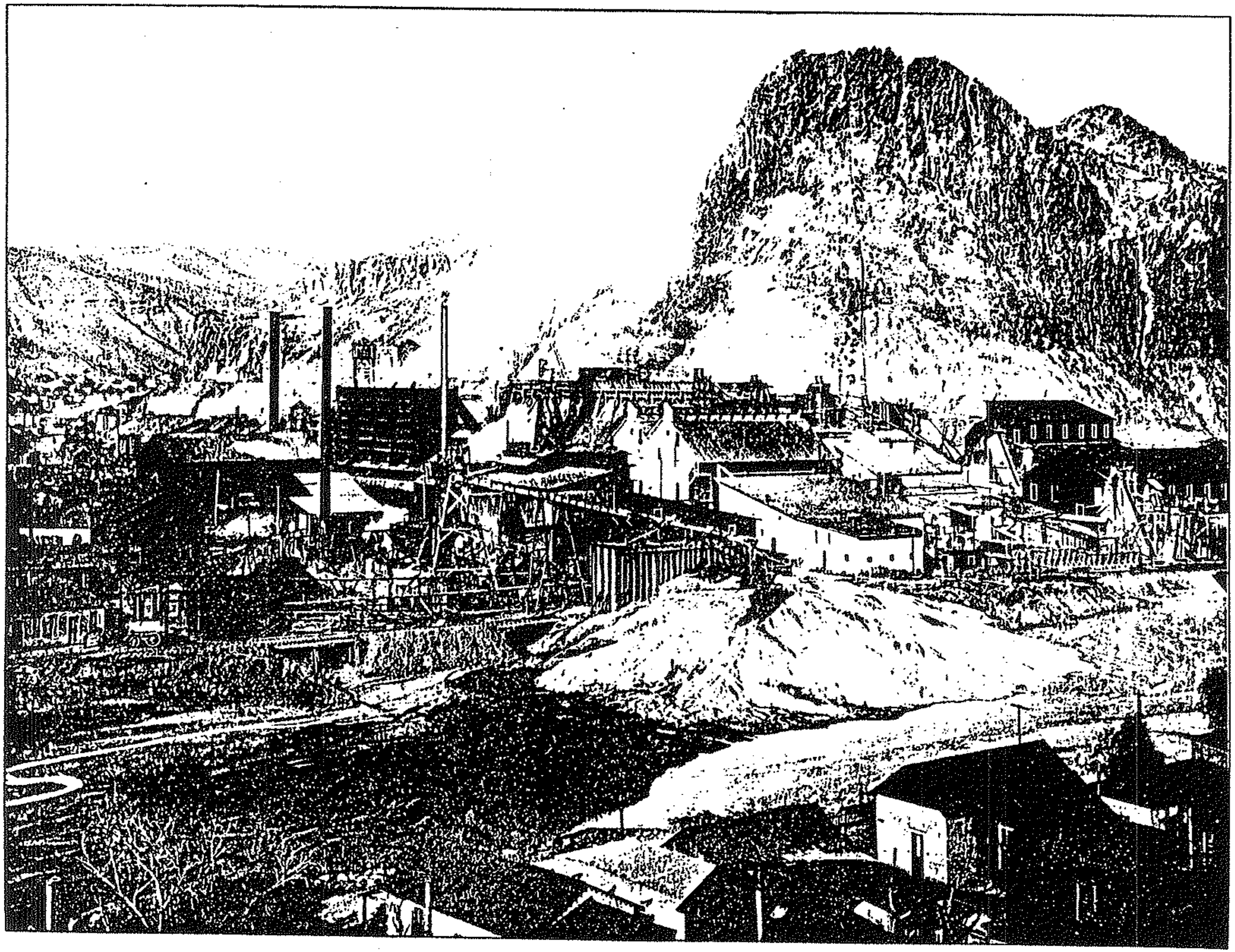
Arizona Copper Co.'s Reduction Works, Clifton, Arizona. Segal (n. d.)



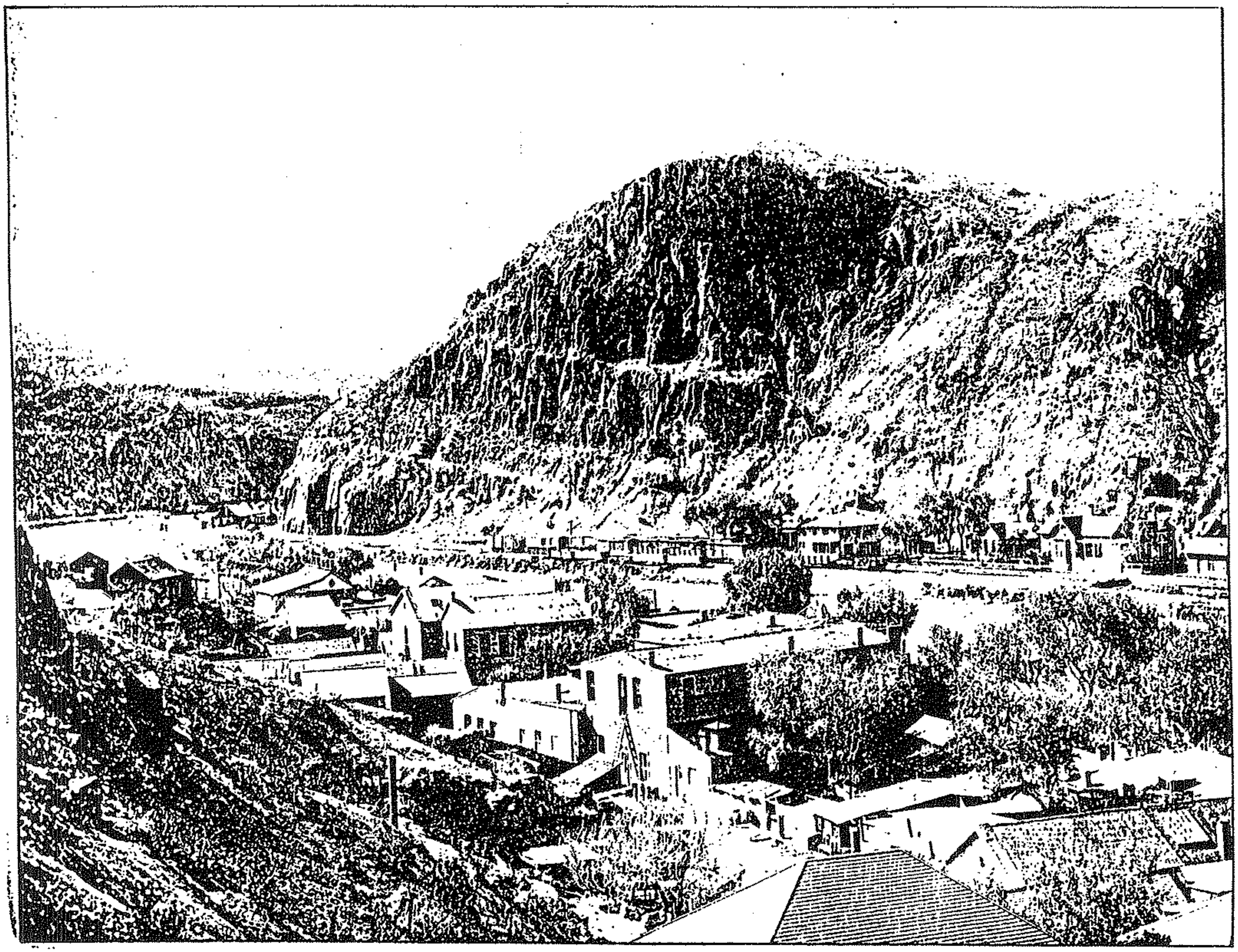
Scenery on the San Francisco Three Miles Above Clifton. Segal (n. d.)



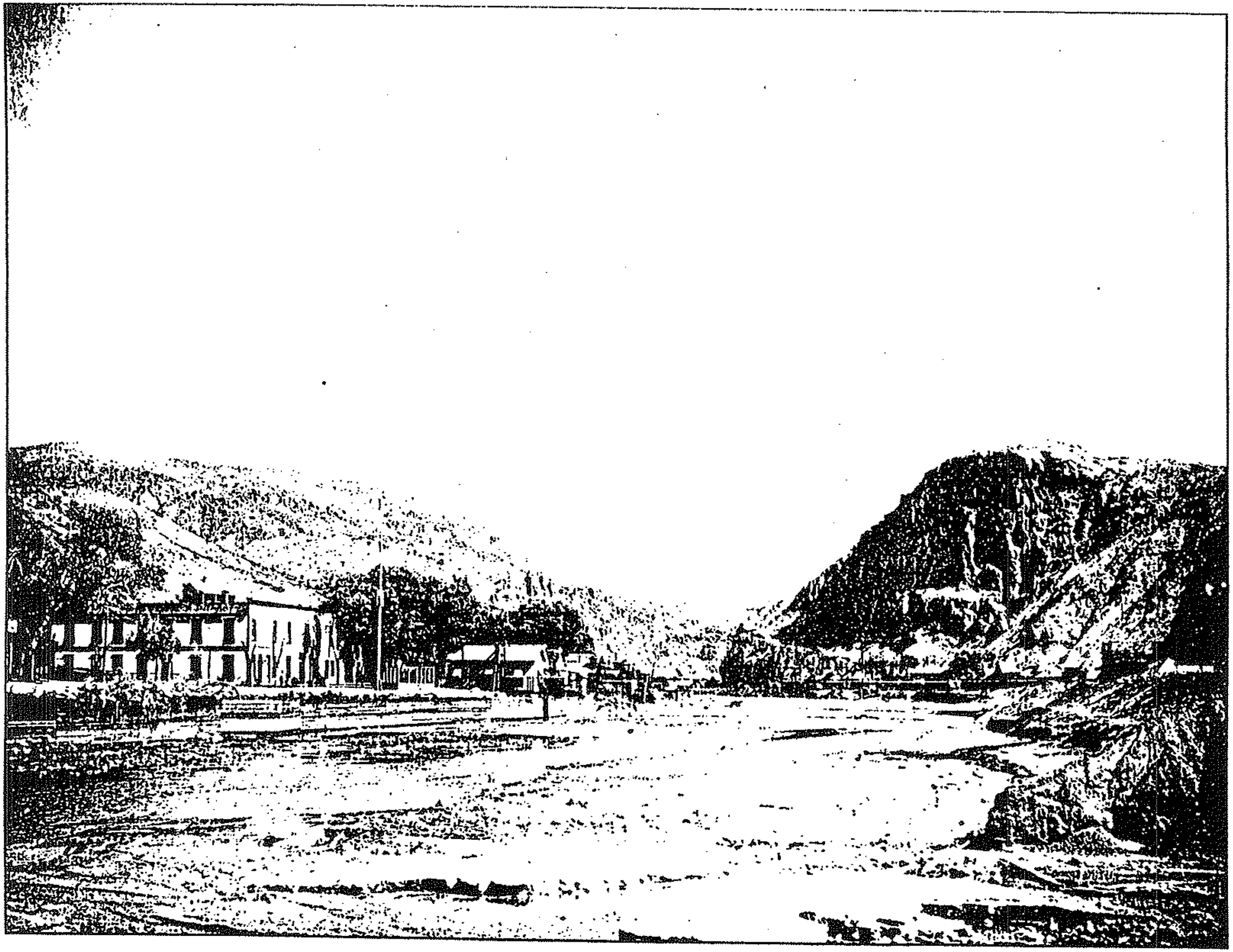
On the Frisco River, Three Miles Above Clifton. Segal (n. d.)



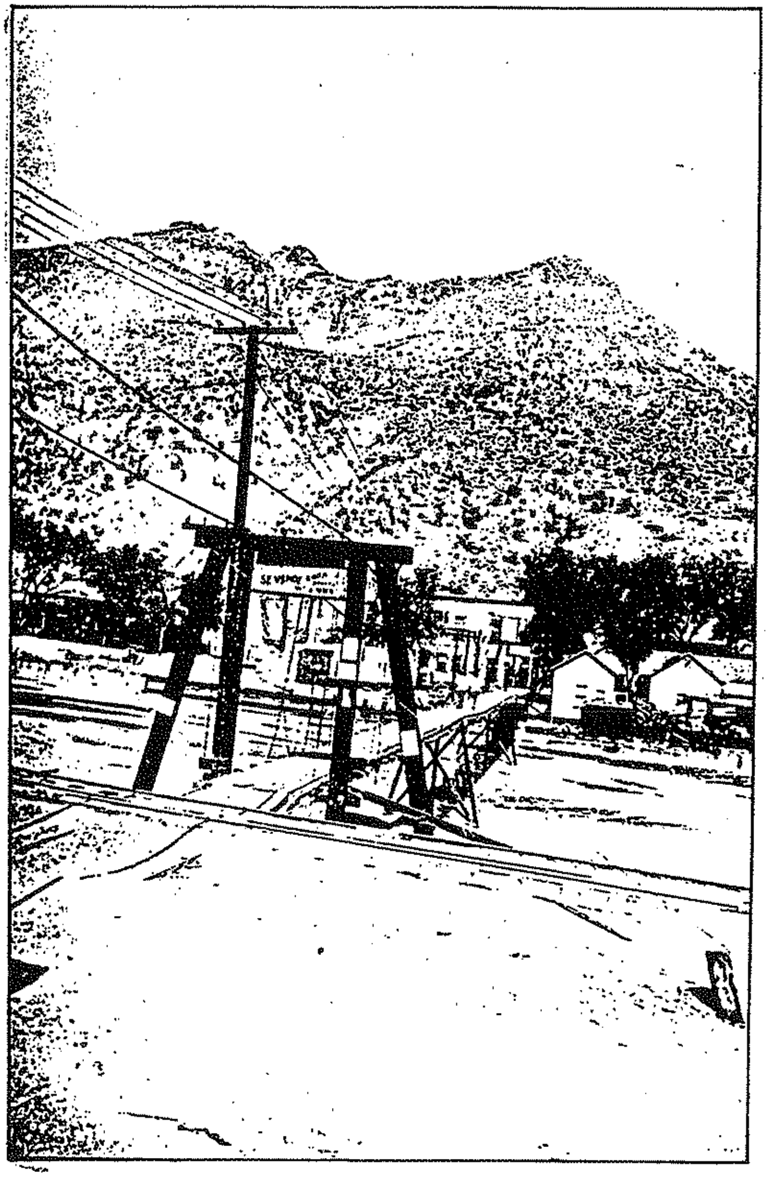
Birdseye View of the Arizona Copper Co.'s Reduction Plant, Clifton. Segal (n. d.)



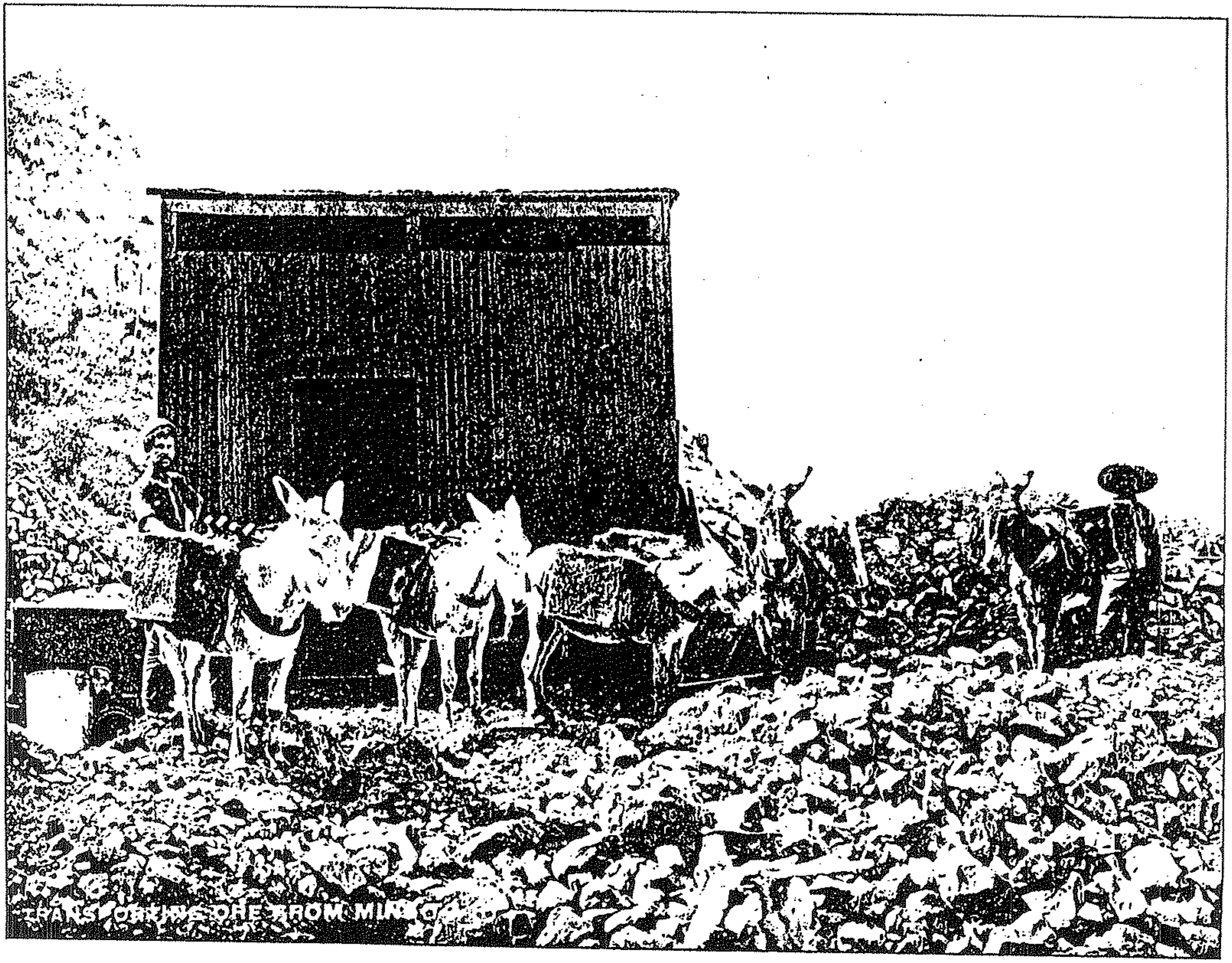
Portion of Clifton, Looking South. Segal (n. d.)



Clifton, Looking South. Segal (n. d.)



Foot Bridge, Clifton. Segal (n. d.)



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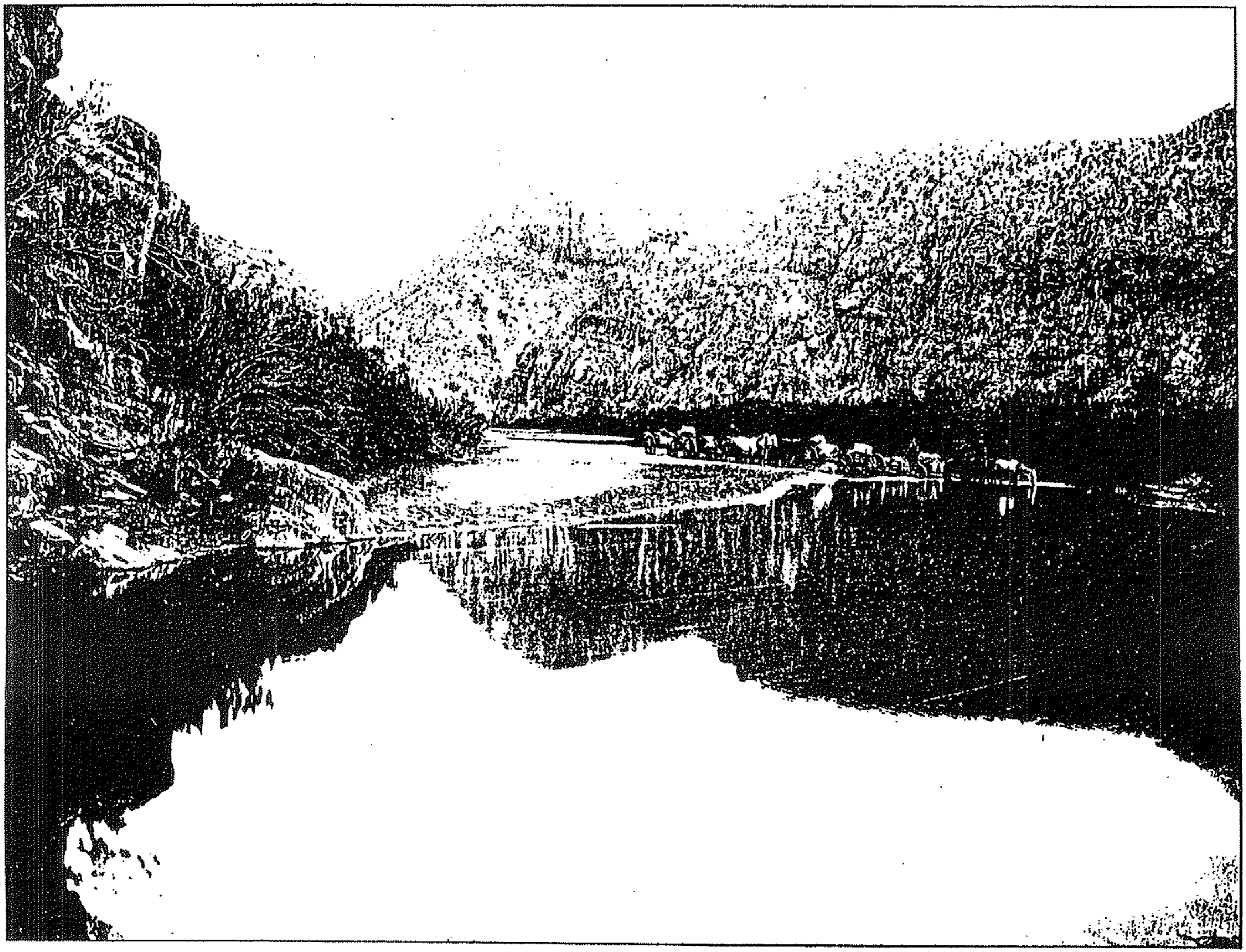
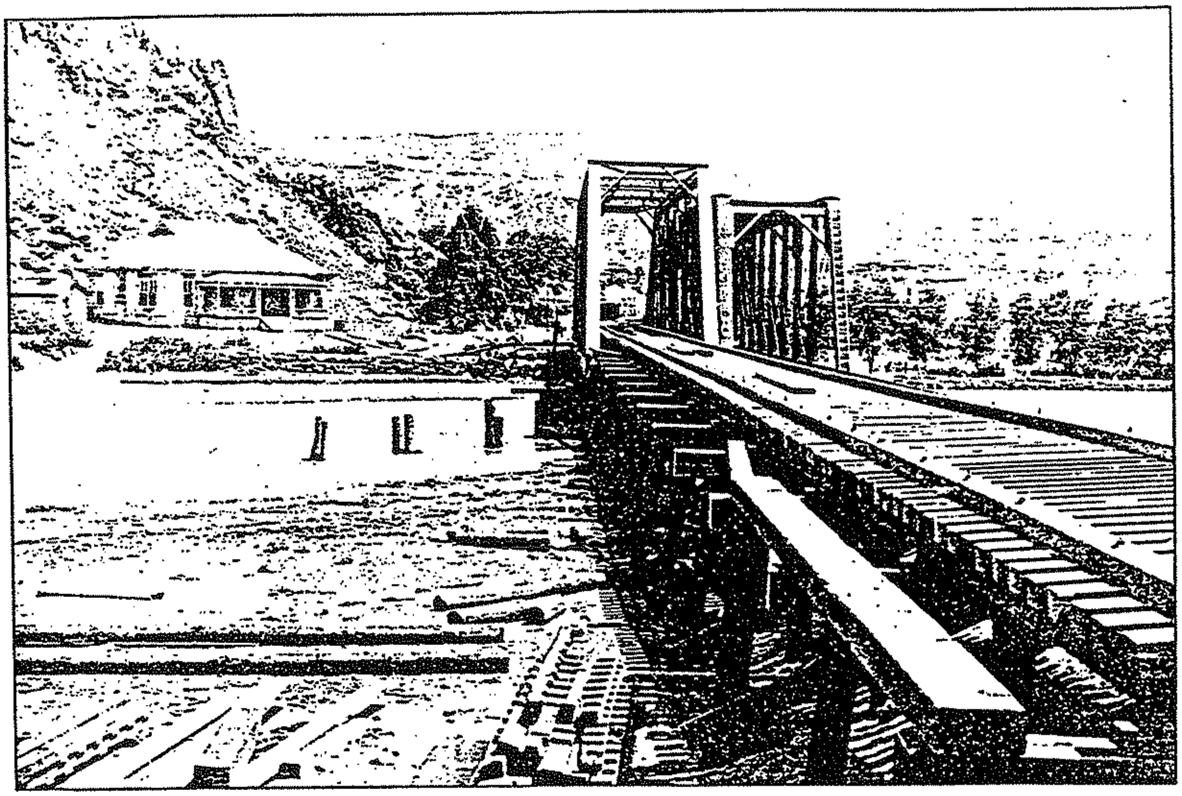
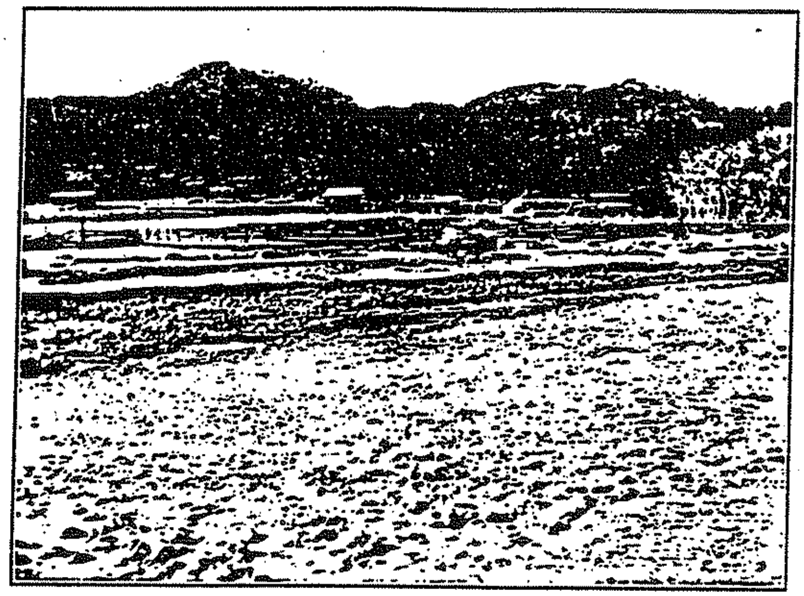


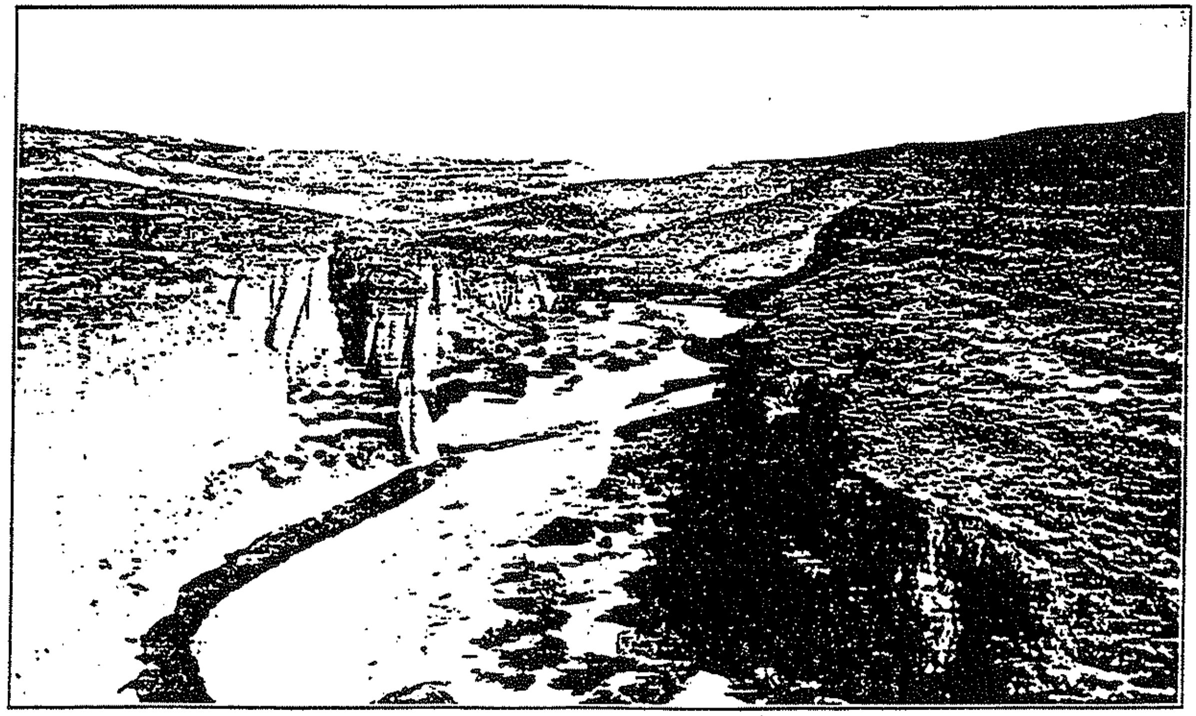
“To the Log Camp” Scenery on the ‘Frisco, Four Miles Above Clifton. Segal (n. d.)



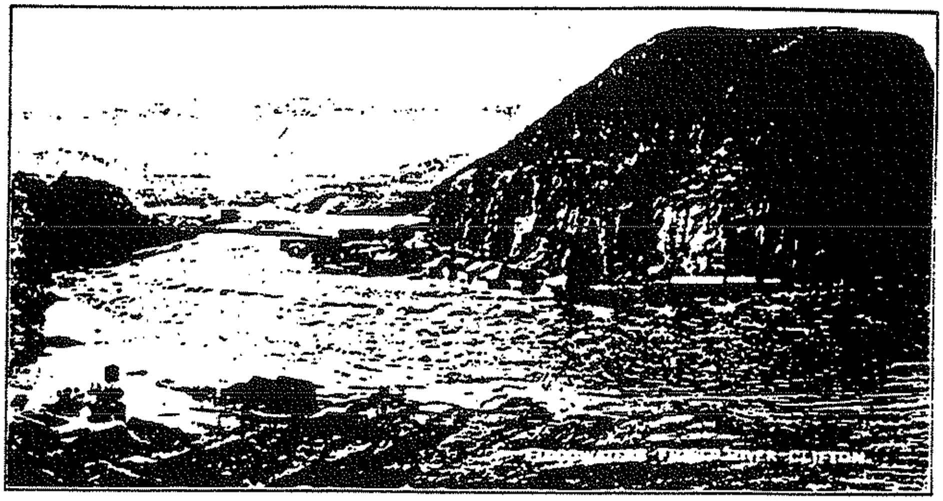
Railroad Bridge and Hospital at Clifton. Segal (n. d.)

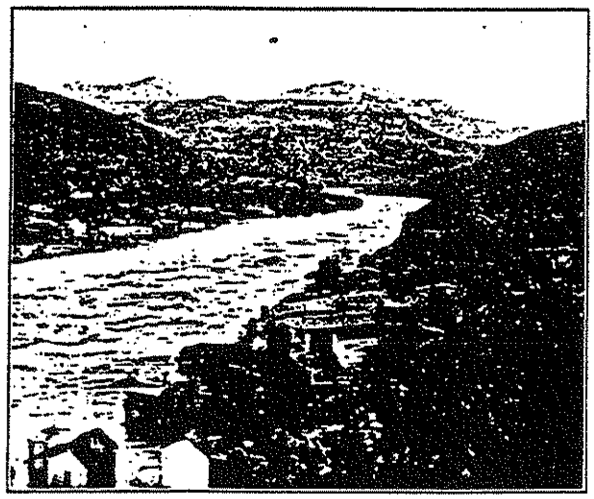


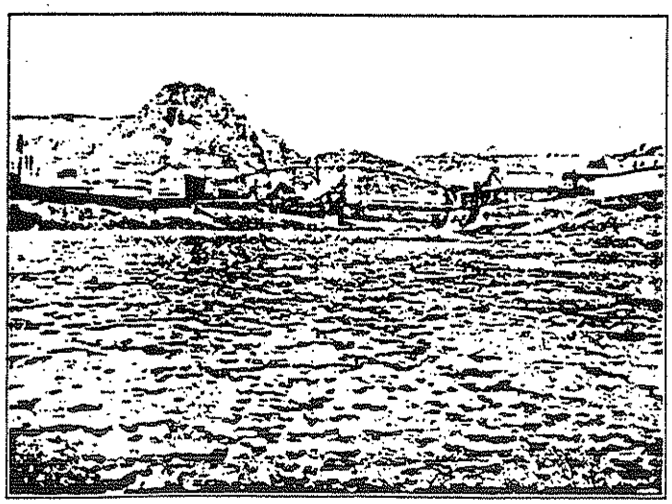
Upper Reaches. Olmstead 1919



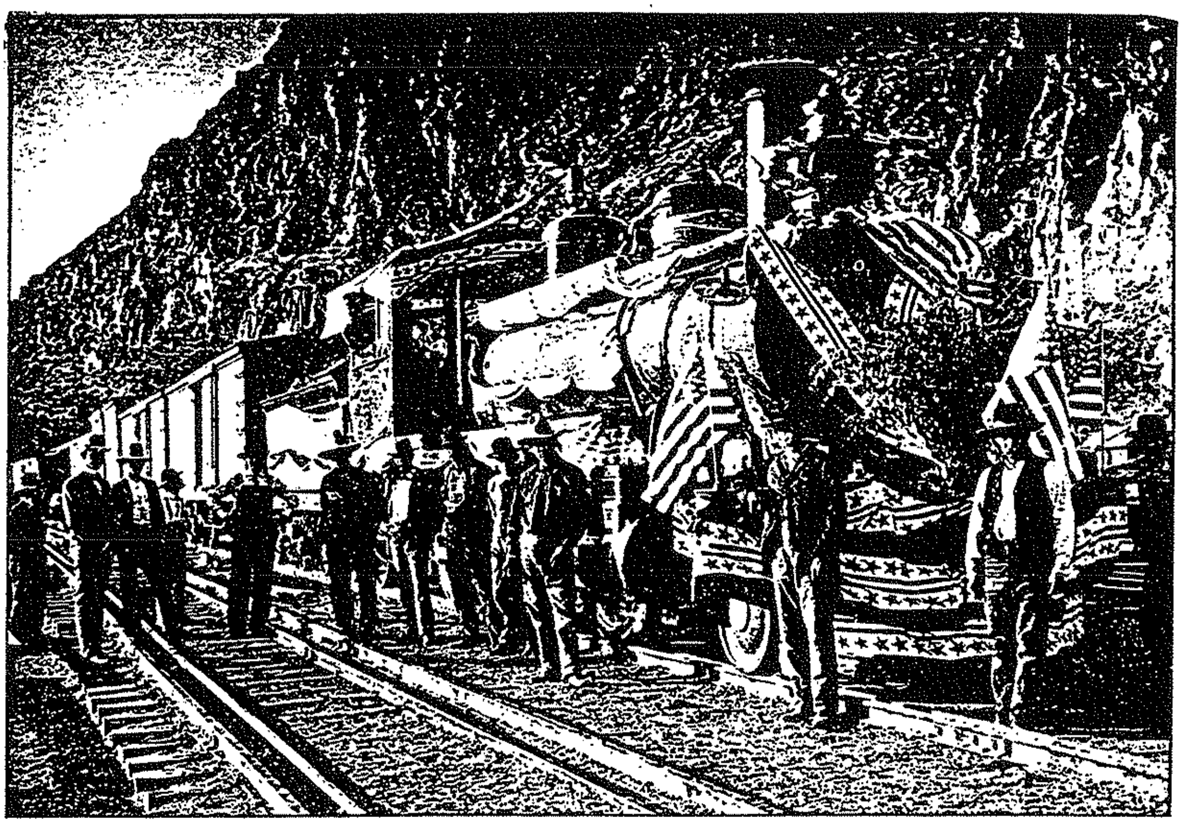
At Junction With Gila. Olmstead 1919



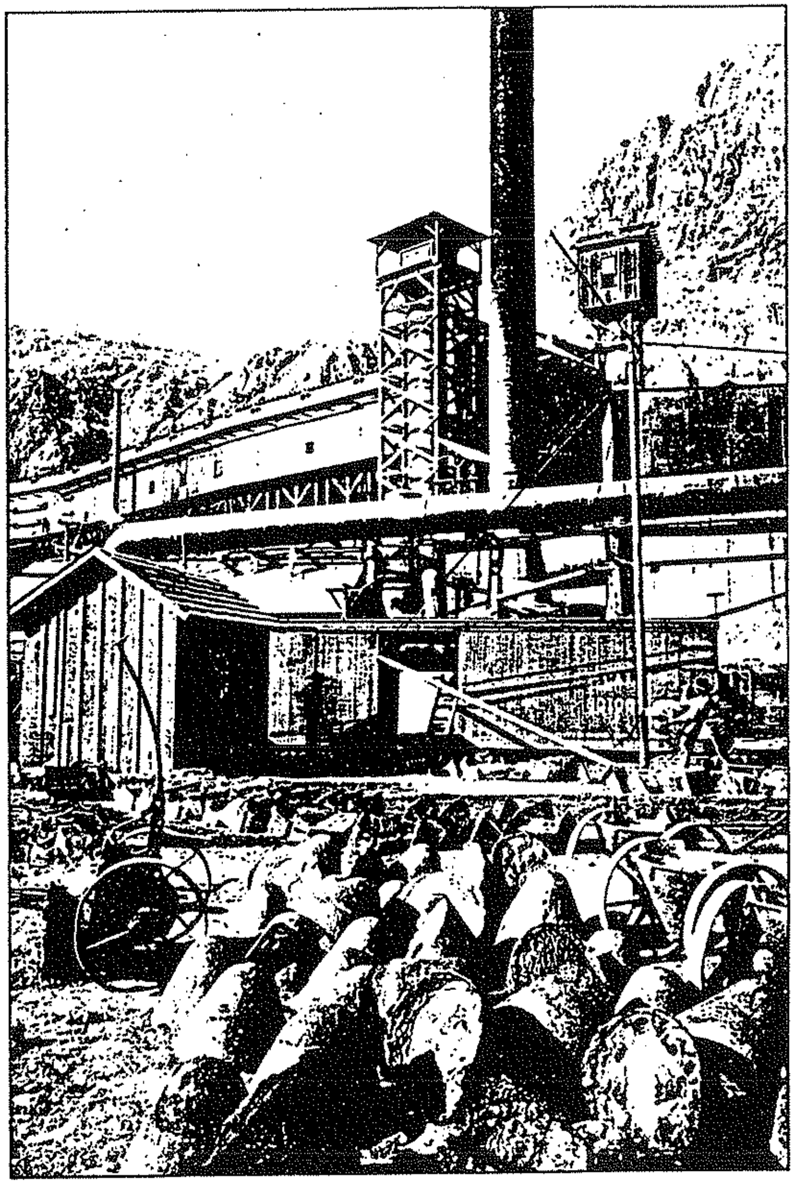




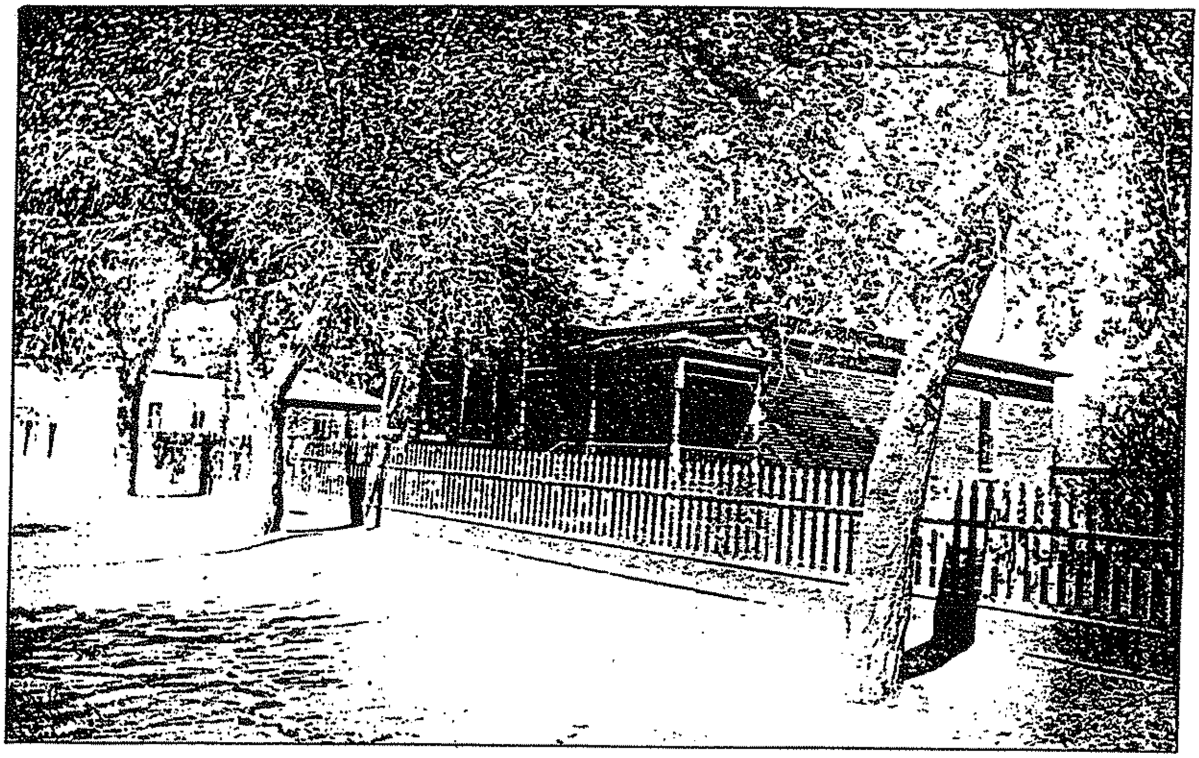
Scenes On San Francisco River At Clifton, Ariz. Olmstead 1919



First Standard Gauge Entering Clifton. Segal (n. d.)



Arizona Copper Co. Shipping Copper at Clifton. Segal (n. d.)



Residence of Jas. Smith. Esq., Clifton. Arizona. Segal (n. d.)

Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

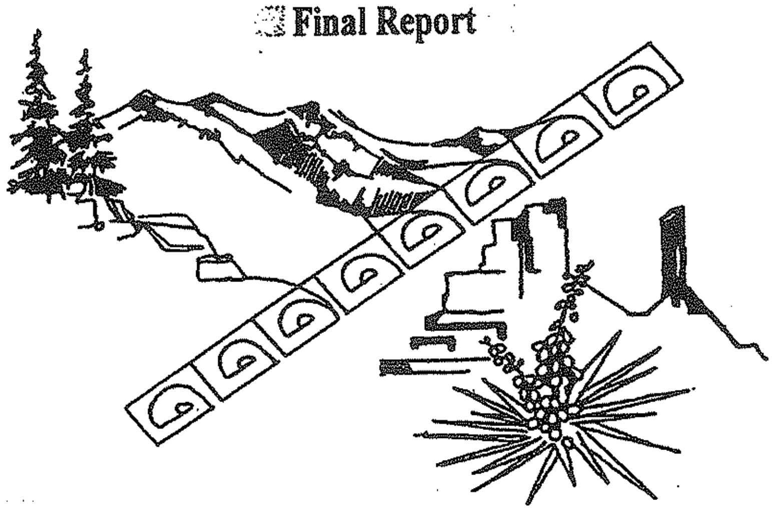
Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

Final Report



Prepared by

SFC Engineering Company

In Association With

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JE Fuller/Hydrology & Geomorphology, Inc.,

and

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Section 4

Geomorphology of the Upper Gila and San Francisco Rivers

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June 17, 1997

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Section 4:
Geomorphology of the Upper Gila and San Francisco Rivers

Introduction

This section describes the regional geology and fluvial geomorphology of the Upper Gila and San Francisco Rivers. The objectives of this section are to:

- Describe potential geologic impacts on streamflow and navigability.
- Describe channel changes, if any, that occurred since statehood.
- Provide a geologic context for discussion of historical stream conditions.
- Describe the location of the ordinary high watermark and ordinary low watermark.

Resources used to support this overview of the Upper Gila and San Francisco Rivers geology included summaries of regional geologic history, aerial photographs, field observations, and topographic maps.

Stream Reaches

The Upper Gila River study reach extends from Safford to the Arizona/New Mexico (Figure 1), a distance of approximately 73 miles. The San Francisco River study reach extends from its confluence with the Gila River to the Arizona/New Mexico border, a distance of about 45 miles. For the purposes of the geomorphic investigation, the Upper Gila and San Francisco Rivers will be considered in the following four stream reaches:

- Reach 1 - Gila River - Safford to Gila Box
- Reach 2 - Gila River - Gila Box
- Reach 3 - Gila River - Gila Box to New Mexico Border
- Reach 4 - San Francisco River - Gila River to New Mexico Border

The geomorphology of these four reaches is described in the following sections. Aerial

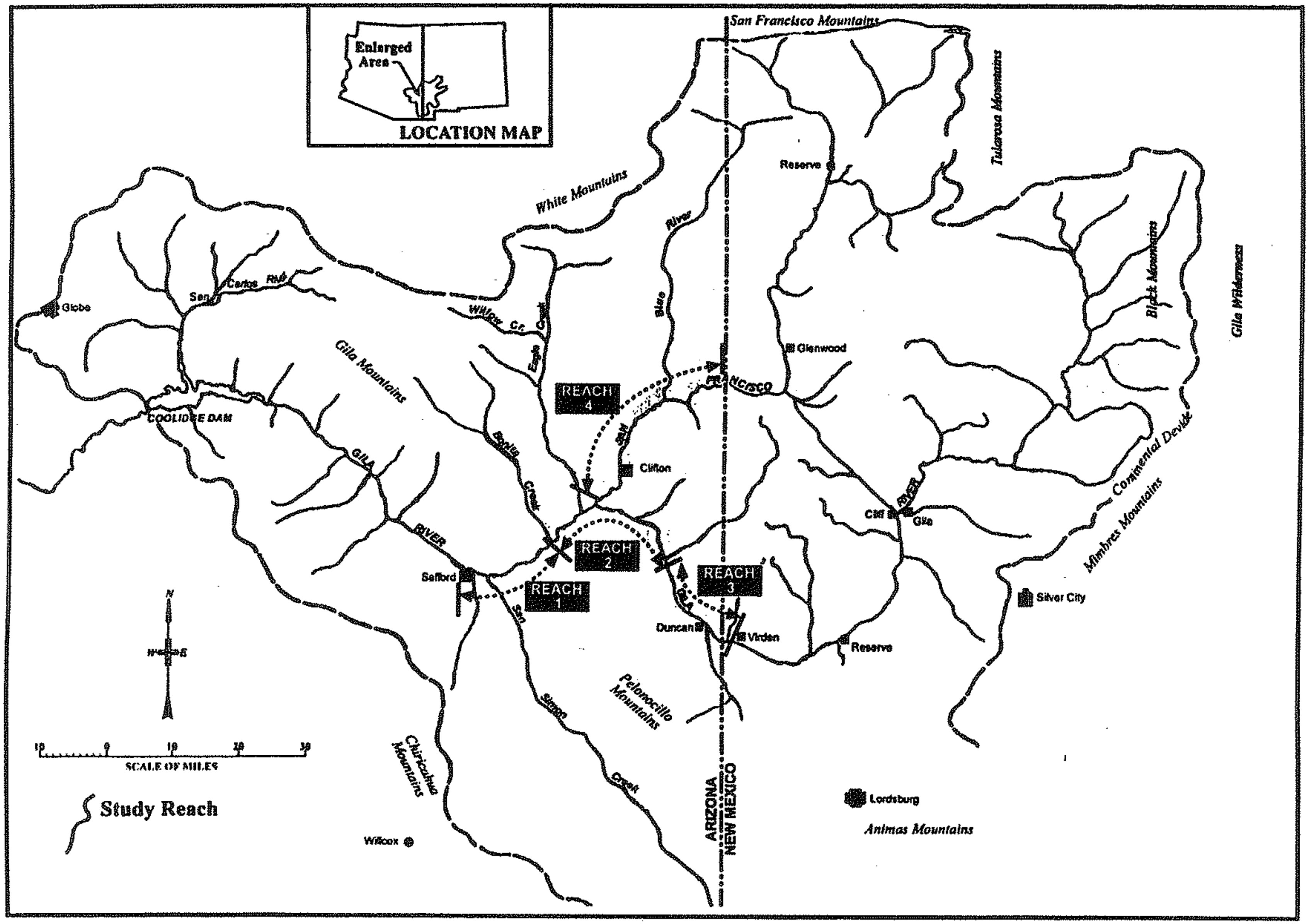

FIGURE 1

Study Reach Location Map

photographs taken in June 1997 of the study reaches are included in Appendix A.

Physiography

The 118-mile Upper Gila and San Francisco Rivers study reach is located within Graham and Greenlee Counties in eastern Arizona, although their watersheds include about 10,459 square miles of eastern Arizona and western New Mexico (Figure 1). The watershed ranges in elevation from about 2,885 feet at Safford to well over 10,000 feet in the peaks of New Mexico's Gila Wilderness and Arizona's White Mountains. The San Francisco River watershed is bounded by the Gila Mountains to the west, the San Francisco and White Mountains to the north, the Tularosa Mountains to the east, and the Gila River watershed to the south. The Upper Gila River watershed is bounded by the San Francisco River watershed and Gila Mountains to the west and north, the Black, Mimbres, and Animas Mountains to the east, and the San Pedro River watershed to the south and west. Major perennial tributaries to the upper watershed include the Blue River (San Francisco River), and Bonita Creek and Eagle Creek (Upper Gila River).

Vegetation in the study area is dominated by Sonoran and Chihuahuan Desert communities which include grasses, low shrubs, and saguaro cacti. Since the 1940's, the dominant riparian vegetation species has become tamarix, although previously some reaches were lined by cottonwood, seepwillow, and mesquite trees. The upper watersheds extend through several climatic-vegetation zones, including areas above the tree line on the highest peaks in the drainage area.

Historically, sources of runoff in the study reach included discharge from springs, snowmelt from higher elevation areas in the upper watershed, and direct runoff from precipitation. Long-term and/or historical streamflow records are available for the entire study reach. Historical and hydrologic data indicate that the Upper Gila and San Francisco Rivers were perennial in their ordinary and natural condition throughout the study area as of the time of statehood, as they are today. Table 1 summarizes some relevant streamflow statistics and flow characteristics for the study reach based on the hydrologic analysis summarized in Section 5 of this report.

Table 1 Upper Gila River and San Francisco River Streamflow Statistics and Flow Characteristics				
Frequency	Discharge (cfs)	Hydraulic Depth (ft)	Average Velocity (ft/sec)	Top Width (ft)
Gila River Near Virden, NM - Upstream End of Study Reach (Duncan Valley)				
90 % Flow	21	0.6	1.3	27
Median (50%) Flow	91	0.9	2.2	45
Mean Annual Flow	190	1.2	1.6	100
2-Year Flood	4,980	5.5	8.5	107
5-Year Flood	10,400	7.5	12.6	110
Gila River Nr. Clifton/Guthrie, AZ - Midpoint of Study Reach (Gila Box)				
90 % Flow	18	0.7	1.0	26
Median (50%) Flow	80	1	1.7	47
Mean Annual Flow	206	1.3	2.5	64
2-Year Flood	5,940	3.7	11.5	140
5-Year Flood	11,500	5.5	14	150
Gila River at Safford Valley, Near Solomon, AZ - Downstream End of Study Reach (Safford Valley)				
90 % Flow	62	0.8	0.5	144
Median (50%) Flow	174	1.3	0.9	146
Mean Annual Flow	433	1.9	1.5	150
2-Year Flood	9,400	6.7	8.8	160
5-Year Flood	22,900	11	11.6	180
San Francisco River at Clifton - Entire Study Reach				
90 % Flow	34	0.9	1.4	28
Median (50%) Flow	76	1.0	1.6	49
Mean Annual Flow	215	1.2	2.5	72
2-Year Flood	6,800	4.5	10.1	150
5-Year Flood	17,800	8.5	13.7	153

Geologic Setting

Arizona is comprised of two great geologic regions: the Colorado Plateau Province, and the Basin and Range Province, with a transition zone, or Central Mountain Province, dividing them (Figure 2). The Upper Gila and San Francisco Rivers primarily drain the Central Mountain Region which may be extended eastward to the Continental Divide in New Mexico. The Upper Gila River also drains a portion of the Basin and Range Province in southern Arizona and southwestern New Mexico. The Central Mountain Region is characterized by mountains of Precambrian igneous, metamorphic rocks, capped by remnants

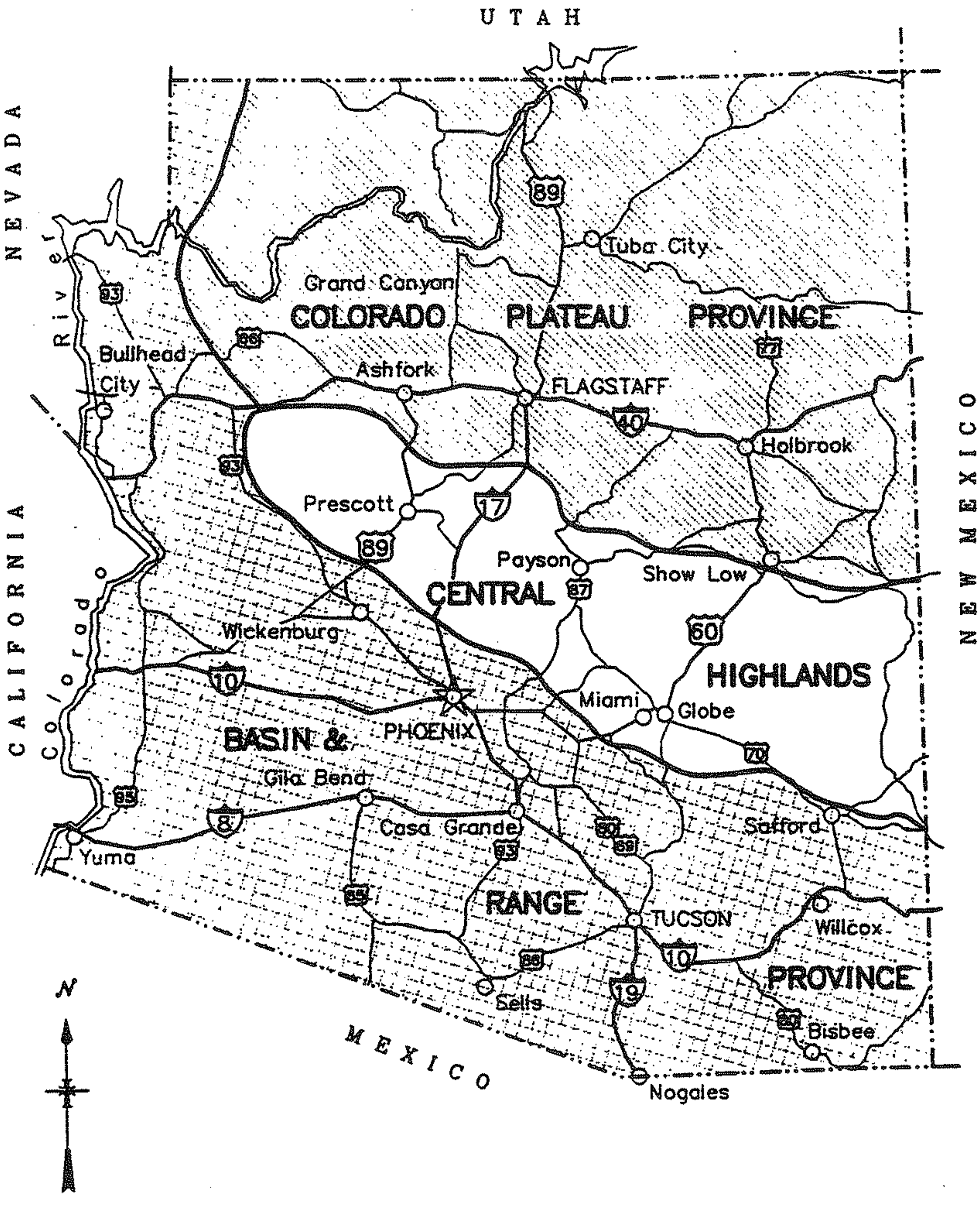

FIGURE 2

Physiographic Province Map

of Quaternary and Late Tertiary volcanics. Regional uplift of the entire state, including the Central Mountains, is thought to have occurred during the Laramide Orogeny in late Cretaceous/early Tertiary time (65 Ma[1]). Volcanic activity in the study area generally occurred about 29 million years before present (b.p.), during the Tertiary Period. The mountains of the transition zone generally experienced longer periods of erosion than the other physiographic provinces in Arizona, resulting in generally lower elevations than the mountains of the two other provinces (Nations and Stump, 1981). Central Mountain Region mountain ranges within Arizona in the Upper Gila and San Francisco Rivers basin include the Gila, White, and Peloncillo Mountains. These ranges consist primarily of Precambrian metamorphic and igneous rock with some more recent volcanics.

The Upper Gila and San Francisco Rivers study area is located mostly within relatively narrow canyons of the Central Mountain Province. Therefore, the geomorphology of most of the Upper Gila and San Francisco Rivers is controlled by bedrock cropping out in the bed or at the margins of these canyons. The average width of the canyons in Reaches 2 and 3 (Gila Box and San Francisco River) is about 500 feet, with very narrow floodplain terraces. In the latter reaches, moderate floods tend to fill the entire canyon bottom. In Reach 3, located between Duncan and Apache Grove, the canyon has an average width of about 2,000 feet, with floodplains that alternate from side to side, as the main channel meanders across the canyon bottom.

Reach 1, downstream of the Gila Box in the Safford Valley, is located within a deep alluvial valley at the margin of the Basin and Range Province. Here, the river flows in a broad valley more than a mile wide, and is subject to rapid shifting of the channel and floodplain geometry in response to floods. During sustained periods of low flow with no large floods, the channel has tended to narrow. The historical channel response to flooding in Reach 1 has been described by Burkham's (1972) classic paper on channel change on the Gila River in the Safford Valley.

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[1] My = 1,000,000 years; 1 Ma = 1 My before present; 1 ky = 1,000 years; 1 ka = 1 ky before present (North American Commission on Stratigraphic Nomenclature, 1983).

Geologic Impacts on Streamflow

Shallow bedrock is present within Reaches 2, 3, and 4 of the Upper Gila and San Francisco River study reaches. The bedrock geology of the study reach exerts the following controls on river conditions in the study reach in several ways:

- First, bedrock limits the potential for lateral movement of the stream channel and prevents significant modifications of the channel cross sections. The natural erosion rate of bedrock is slow enough to be considered insignificant within the historical period. Within the bedrock-confined canyons of the Gila Box reach and the San Francisco River, no significant changes in channel geomorphology were identified during the period since statehood. In these canyon reaches, the exact locations or geometry of specific pools and riffles may fluctuate in response to large floods, but the overall channel pattern and reach-averaged width/depth/velocity relationships probably remained essentially unchanged.

- Second, narrow bedrock canyons do not provide favorable environments for extensive agricultural operations. Therefore, irrigation diversions as of the time of statehood were typically small, with the total water requirements less than the total average flow of the river.

- Third, discharges from springs in bedrock aquifers constitute a significant source of the ordinary and natural streamflow. Discharge from springs provides a constant base flow, making the Upper Gila and San Francisco Rivers perennial gaining streams, with an average annual discharge ranging from about 190 cfs to 430 cfs on the Upper Gila River, and 215 cfs on the San Francisco River.

- Finally, the rugged terrain and remoteness of the bedrock canyons of the Upper Gila and San Francisco Rivers minimized the potential for human impacts on the watershed and channel as of the time of statehood. Few towns and no large cities were located on the Upper Gila and San Francisco Rivers. Therefore, despite early exploration of the region relative to the rest of Arizona, transportation routes, including ferries, roads and railroads, almost completely avoided the Upper Gila and San Francisco Rivers. The few transportation routes in the study area are described in Section 3 of this report.

Channel Geomorphology

Descriptions of Historical River Conditions. The early explorers and residents of Arizona record river conditions in the Upper Gila and San Francisco Rivers that are similar to the conditions that may be observed today. These historical accounts, provided elsewhere in this report, describe steep, bedrock canyons with broad flat sandy channels that filled the canyon bottoms, and perennial flow. Early explorers were able to travel on foot or horseback down the river channels during low flow periods. Historical accounts of boating the Upper Gila and San Francisco Rivers describe easy travel in small, low draft boats, with minor rapids. No physical or anecdotal evidence was identified that suggests that the geomorphology of the Upper Gila and San Francisco Rivers has significantly changed during the period since statehood, except for the few bridge crossings that have been constructed. No detailed maps that had a scale sufficient to facilitate comparison with recent maps were identified during the course of the literature search.

Existing Conditions. In its current condition, the Upper Gila and San Francisco Rivers are slightly sinuous, moderately steep, mountain streams entrenched in moderately deep canyons. The channel bed generally consists of alluvial material with short boulder/cobble riffles that form rapids at low to moderate discharges. Bedrock crops out locally in the bed and banks of Reaches 2, 3, and 4. The channel slope of the Gila River averages about 0.002 ft./ft. (0.2 percent). The channel slope of the San Francisco River averages about 0.004 ft./ft. (0.4 percent). The average sinuosity of both rivers is about 1.1, although the canyons themselves follow a somewhat sinuous path, with the low flow channels meandering within them. The channel margins are composed of bedrock and geologically older alluvial terraces, with inset terraces formed in low energy slackwater zones. A summary of some geomorphic characteristics of the four reaches of the Upper Gila and San Francisco Rivers are provided in Tables 2 to 5. Plots of longitudinal profile and canyon width are shown in Figures 3 and 4. Figures 5 to 8 show portions of current USGS topographic maps for Reaches 1 to 4, respectively, to illustrate typical channel and canyon geometry.

Table 2
Stream Classification Data for Reach 1: Gila River - Safford to Gila Box

Category	Classification/Description
Stream Size	Wide (> 500 ft.)
Flow Habit	Naturally perennial, intermittent due to diversions
Flood Characteristics	Flashy, Short Duration, High Losses
Bed Material	Alluvium (sand & gravel)
Valley Setting	Low Relief (< 100 ft.)
Drainage Network	Dendritic
Floodplains	Wide (> 10x channel width)
Incision	Not Incised
Channel Boundaries	Alluvial (channel abuts older terrace at right near Safford)
Width/Depth Ratio	High (> 100)
Bank Vegetation	Sparse, less than 50% Cover
Channel Slope	Moderately steep (S_o = 0.0025 ft./ft.)
Sinuosity	Sinuous low flow channel (S > 1.1), Straight flood channel (S < 1.06)
Braiding	Generally braided at high flows, locally braided at low flow
Anabranching	Not anabranched
Channel Width	Random Variation

Table modeled after FHWA, 1991.

Table 3

Stream Classification Data for Reach 2: Gila River Box

Category	Classification/Description
Stream Size	Medium (100-500 ft.)
Flow Habit	Perennial
Flood Characteristics	Flashy, Short Duration, High Losses
Bed Material	Alluvium (sand & gravel), with some bedrock outcrop & control
Valley Setting	Moderate Relief (100-1000 ft.)
Drainage Network	Dendritic
Floodplains	Little or none (< 2x channel width)
Incision	Not Incised
Channel Boundaries	Mostly bedrock (low flow channel abuts minor alluvial surfaces)
Width/Depth Ratio	Moderate (10-100)
Bank Vegetation	Moderate, approx. 50% cover
Channel Slope	Moderately steep (S_o = 0.0022 ft./ft.)
Sinuosity	Sinuous low flow channel (S > 1.1), Straighter flood channel
Braiding	Locally braided at low flow, not braided at high flow
Anabranching	Not anabranched
Channel Width	Random variation, some widening at bends

Table modeled after FHWA, 1991.

Table 4

Stream Classification Data for Reach 3: Gila River - Gila Box to Duncan

Category	Classification/Description
Stream Size	Medium (100-500 ft.)
Flow Habit	Perennial, infrequently dry locally due to irrigation diversions
Flood Characteristics	Flashy, Short Duration, High Losses
Bed Material	Alluvium (sand & gravel), with minor bedrock control
Valley Setting	Low Relief (< 100 ft.)
Drainage Network	Dendritic
Floodplains	Narrow (2-10 x channel width)
Incision	Possible minor incision since statehood
Channel Boundaries	Mostly alluvial (low flow channel abuts bedrock in short canyons)
Width/Depth Ratio	Moderate (10-100)
Bank Vegetation	Moderate (> 50% cover)
Channel Slope	Moderately steep (S_o = 0.0019 ft./ft.)
Sinuosity	Sinuous low flow channel (S > 1.1), Straighter flood channel
Braiding	Moderately braided at low flow, less braided at higher flow
Anabranching	Not anabranched
Channel Width	Random variation, some widening at bends

Table modeled after FHWA, 1991.

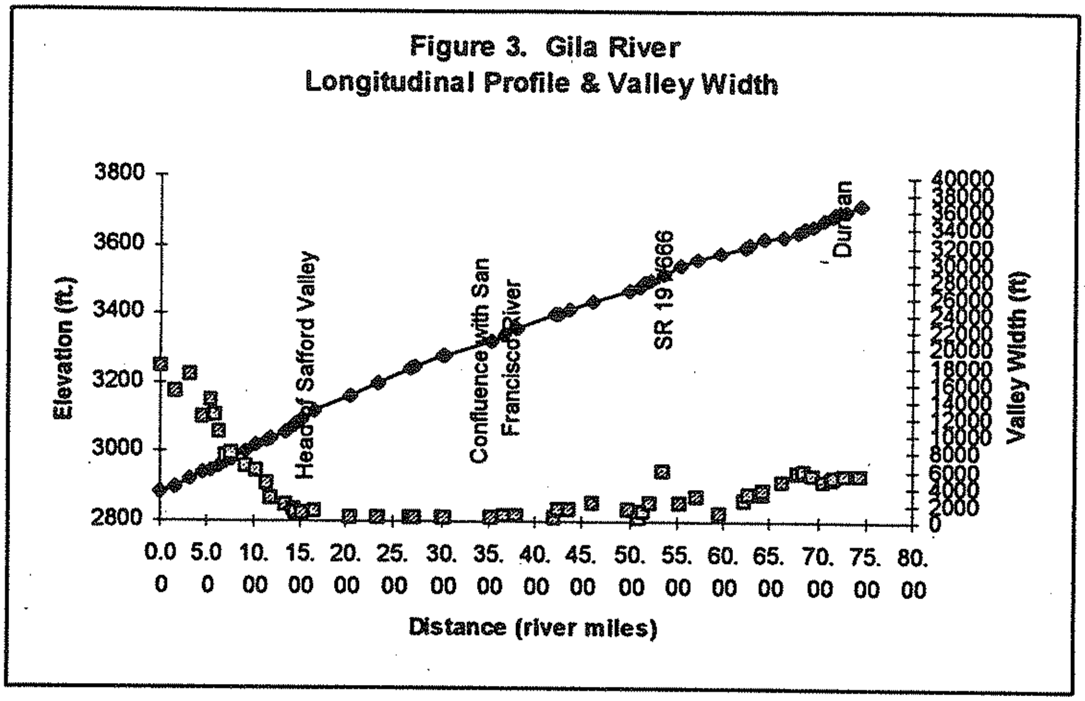


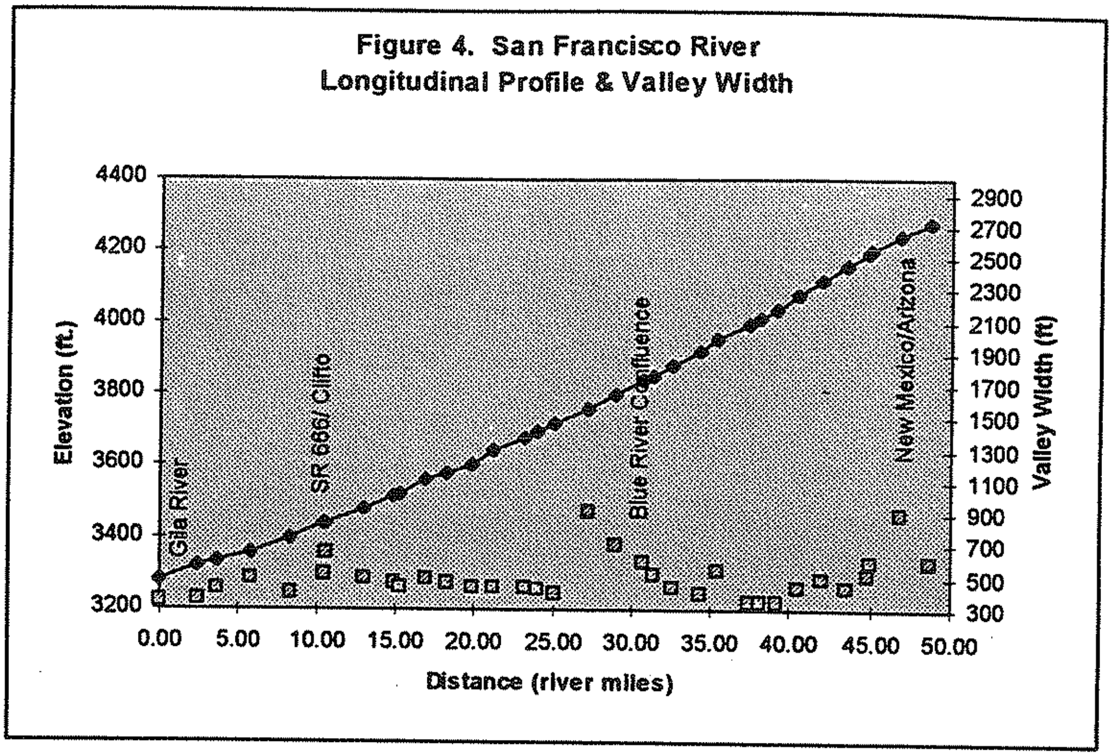
Figure 3. Gila River
Longitudinal Profile & Valley Width
Elevation (ft.)
3800
3600
3400
3200
3000
2800
Valley Width (ft)
Head of Safford Valley
Confluence with San Francisco River
SR 191/666
Duncan
Distance (river miles)

Table 5

Stream Classification Data for Reach 4: San Francisco River

Category	Classification/Description
Stream Size	Medium (100-500 ft.)
Flow Habit	Perennial, may be intermittent in drought years
Flood Characteristics	Flashy, Short Duration, High Losses
Bed Material	Alluvium (sand & gravel), with some bedrock outcrop & control
Valley Setting	Moderate Relief (100-1000 ft.)
Drainage Network	Dendritic
Floodplains	Little or none (< 2x channel width)
Incision	Not Incised
Channel Boundaries	Mostly bedrock (low flow channel abuts minor alluvial surfaces)
Width/Depth Ratio	Moderate (10-100)
Bank Vegetation	Moderate, approx. 50% cover
Channel Slope	Moderately steep (S_o = 0.0022 ft./ft.)
Sinuosity	Sinuous low flow channel (S > 1.1), Straighter flood channel
Braiding	Locally braided at low flow, not braided at high flow
Anabranching	Not anabranched
Channel Width	Random variation, some widening at bends

Table modeled after FHWA, 1991.



In general, the geomorphology of the Upper Gila and San Francisco Rivers reflects the bedrock geology of the reach. The minor changes in channel geomorphology that can occur, typically occur during the largest floods. During large floods, there is sufficient energy to erode channel bed sediments, including the boulders that form the riffles, and the vegetated terraces along the margins of the channel. The low flow channel is inset within a wider flow path that includes alternating unvegetated, gravelly point bars. A definitive increase in vegetative density and a slope break generally marks the boundary between the active flood channel and floodplain. Streambank riparian vegetation, if it occurs along the channel, grows predominantly on the margins of the point bars and the floodplain terraces. While the point bars, riffles and terrace margins are subject to erosion during large floods, the net changes in overall channel characteristics typically are minor for an extended river reach. That is, erosion of a bar or riffle in one location generally is balanced by deposition elsewhere in the reach. The overall stream characteristics are preserved, although the exact channel dimensions at any given location may change with time.

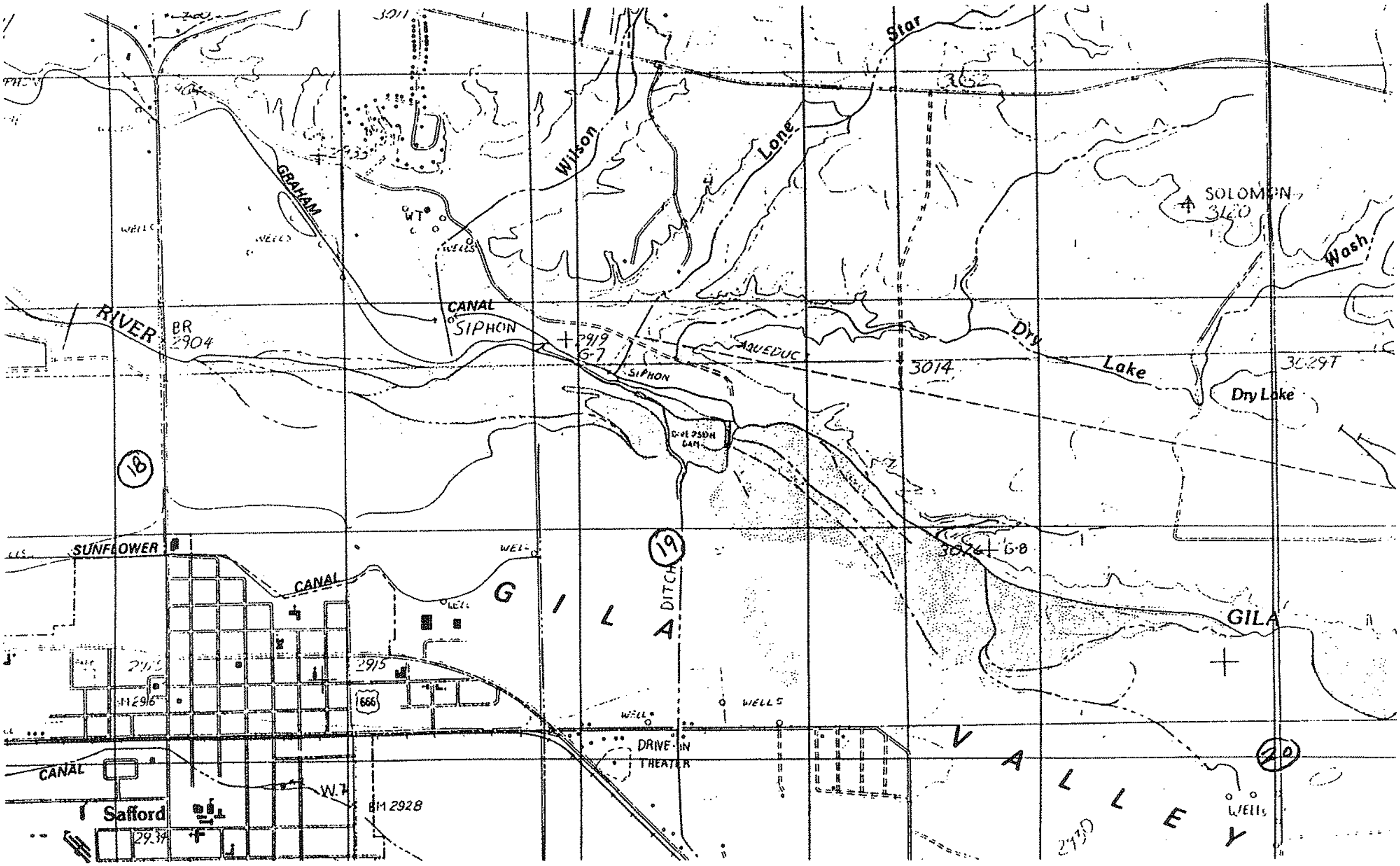


FIGURE 5

Reach 1 topo map
(Source: USGS 7.5' Quad, Safford, AZ, 1985)

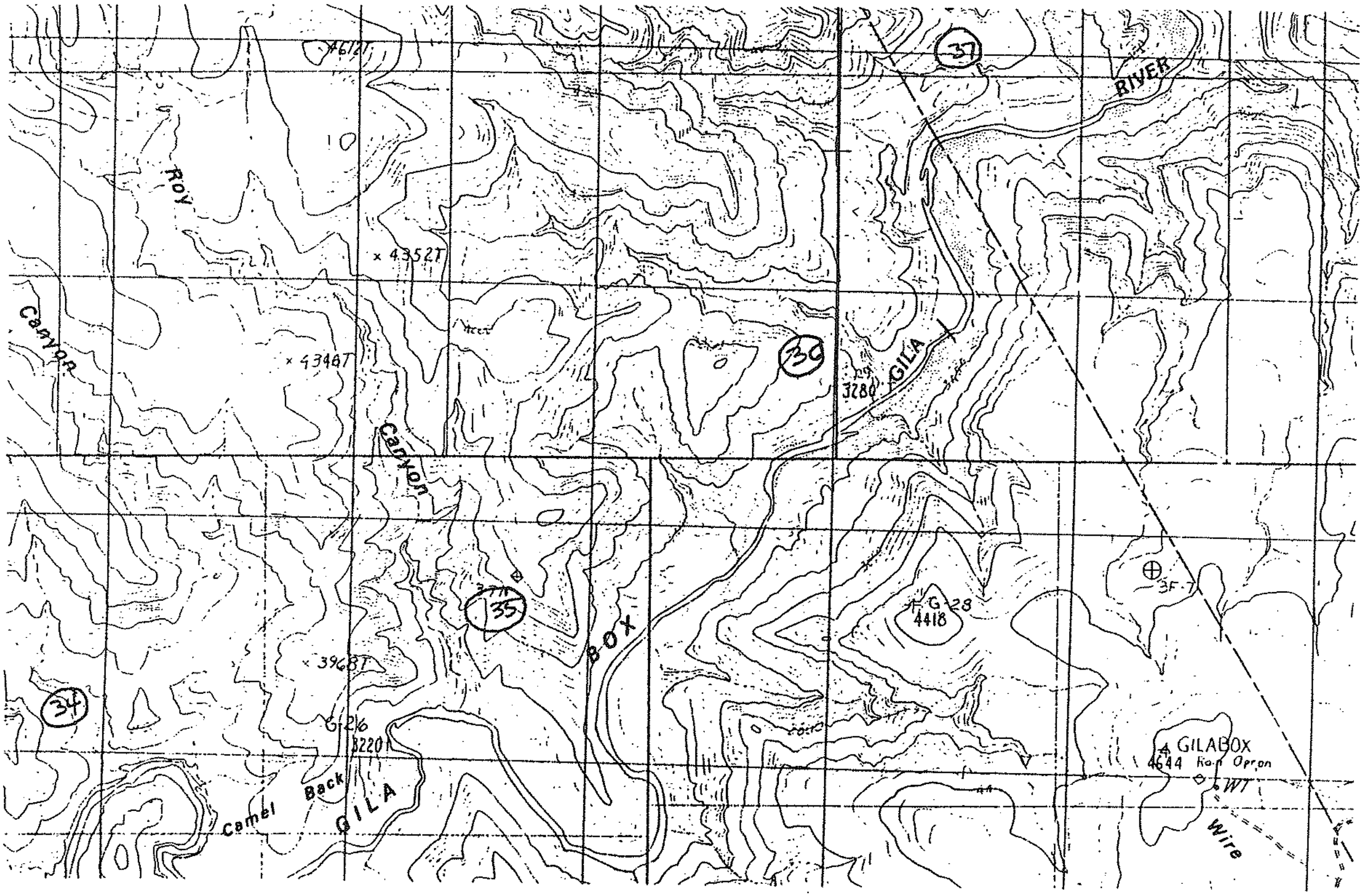


FIGURE 6

Reach 2 topo map
(Source: USGS 7.5' Quad, Safford, AZ, 1985)

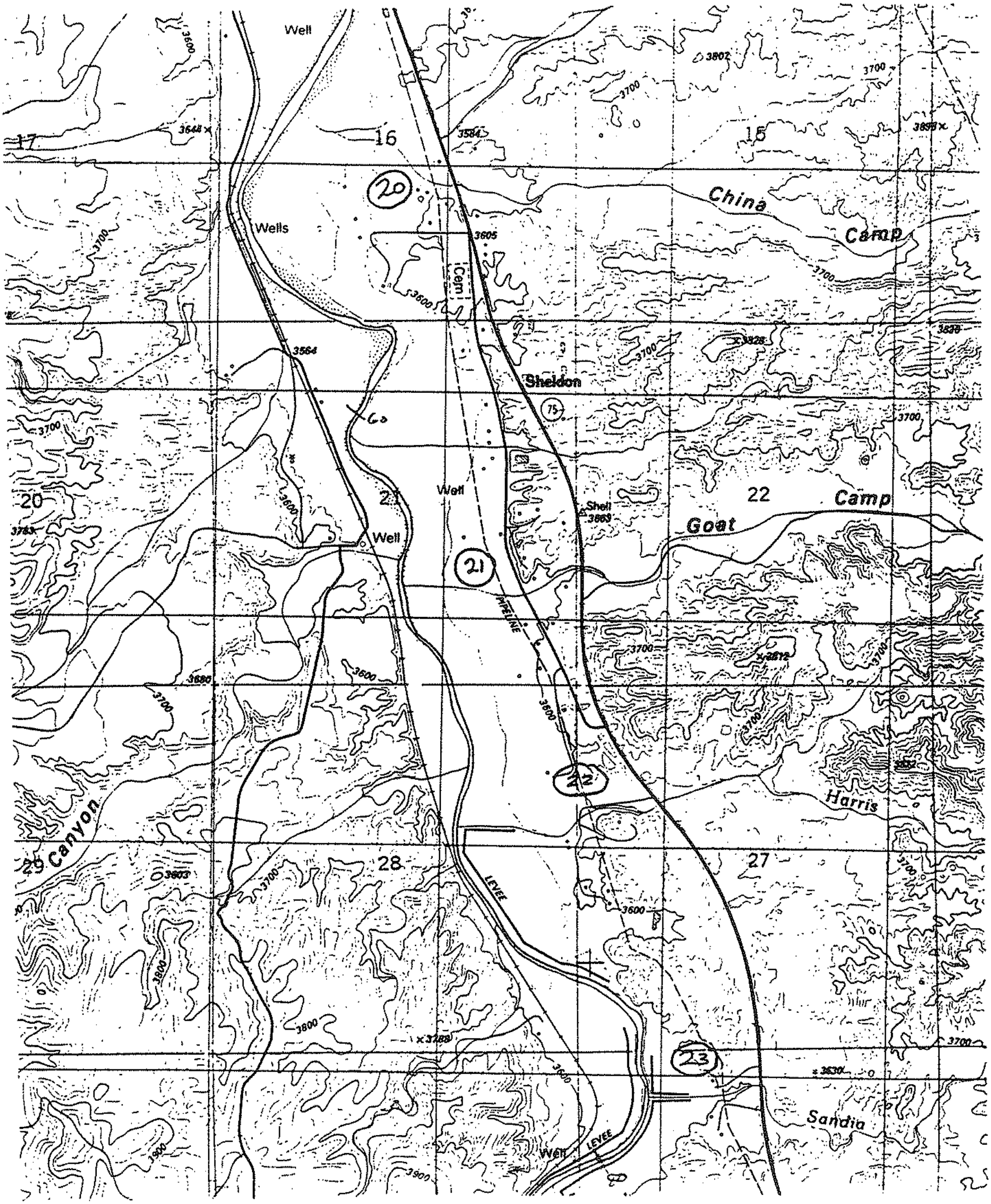


FIGURE 7

Reach 3 topo map
(Source: USGS 7.5' Quad, Sheldon, AZ, 1986)

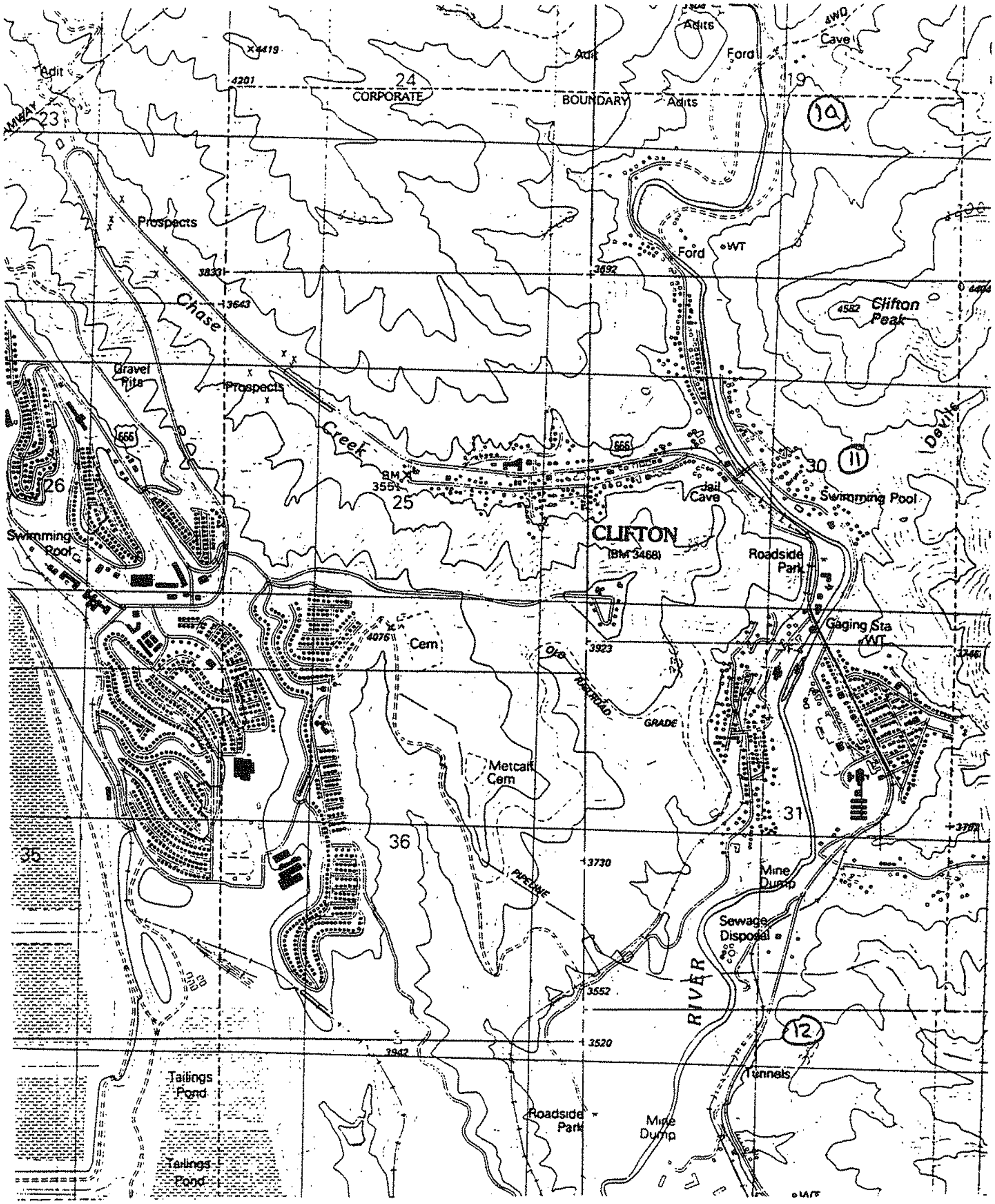


FIGURE 8

Reach 4 topo map

(Source: USGS 7.5' Quad, Clifton, AZ, 1989)

In the alluvial portions of Reach 1, large floods flow across the broader geologic floodplain and have the potential to cut new channels within the active channel area. The active channel area is not deeply inset within the geologic floodplain and the banks are poorly defined. However, like the erosion and deposition in the canyon reaches, any local changes in low flow channel geometry are generally balanced when considered from a reach-wide perspective.

Historical evidence of systematic channel change along the Upper Gila and San Francisco Rivers is lacking. Few detailed maps are available for the study area. The oldest historical maps identified during the literature search/agency contact phase of the project were prepared by the USGS during the 1930's. These maps cover the Upper Gila and San Francisco Rivers upstream of the Safford Valley, and have a contour interval of 40 feet. Comparison with the USGS topographic quadrangle maps for the study area, which were based on topographic data obtained from 1950-1960, indicate that only minor changes in channel position occurred during this period. Older USGS topographic maps for the area, dated 1915, have a contour interval of 100 feet, which did not allow detailed evaluation of channel change.

Ordinary High Watermark

Methodologies for defining the ordinary high watermark are not rigorously defined, due to the complexity and variability of streams and rivers. In practice, the ordinary high watermark is identified by a marked change in vegetation or soil characteristics between the channel bottom and the overbank area. Occasionally, this change is accompanied by a break in slope between the flat bottom of the active channel and a steep or vertical bank. At one time, some state and federal agencies recommended using the floodplain limits of the 20-year flood to map the ordinary high watermark. The 20-year floodplain limit is generally not used in Arizona at the present time, and was not used for this study.

For the stream navigability studies, House Bill 2594 (1991) defined the ordinary high watermark as:

...the line on the shore of a watercourse established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation or the presence of litter or debris, or by other appropriate means that consider the characteristics of the surrounding areas. Ordinary high watermark does not mean the line reached by unusual floods.

In Reach 1, the Gila River from Safford to the Gila Box, the ordinary high watermark would be defined by the widest flow channel within the braided river corridor. The ordinary high watermark has changed substantially since the time of statehood in this reach, as the river widens and narrows in response to flow conditions (Burkham, 1972). In general, the existing ordinary high watermark can be delineated by following the brown stippled floodplain symbols shown on the USGS topographic maps, and by undefined soils units as mapped by the Soil Conservation Service.

In Reach 2, the Gila Box, lacking evidence to the contrary, it is assumed that the existing river conditions are substantially unchanged from river conditions as of the time of statehood. Therefore, the character of ordinary high watermarks observed in the field probably are very similar to the ordinary high watermarks at statehood. In the narrow bedrock canyons of Reach 2, the canyon walls form the limits of the ordinary high watermark. In the flats, and in areas of larger bars or other alluvial deposits, there are generally readily-identified vertical cut banks that form the ordinary high watermark. Although the exact position of the ordinary high watermark may have shifted within these wider channel sections, the overall character of the stream, and therefore the ordinary high watermark, are probably unchanged since statehood.

In Reach 3, in the Duncan Valley from New Mexico to Apache Grove, the ordinary high watermark is defined by the onset of denser floodplain vegetation, a slope break at the margin of the active channel or point bar deposits, and by the beginning of agricultural land use. Comparison of the historical and the most current USGS topographic maps indicate that the channel corridor defined by the ordinary high watermarks has been relatively stable in the recent past. Like Reach 2, the ordinary high watermark can be identified in the field by the location of vertical cut banks, the onset of riparian vegetation such as mesquite bosques, and presence of fine-grained soil materials in direct contrast to the very coarse active channel sediments.

In Reach 4, the San Francisco River, lacking evidence to the contrary, it is assumed that the existing river conditions are substantially unchanged from river conditions as of the time of statehood. Therefore, the character of ordinary high watermarks observed in the field probably are very similar to the ordinary high watermarks at statehood. In the narrow bedrock canyons of Reach 4, the canyon walls form the limits of the ordinary high watermark. In areas with moderately large bars or other alluvial deposits, there are generally readily-identified vertical cut banks that form the ordinary high watermark. Although the exact position of the ordinary high watermark may have shifted within these wider channel sections, the overall character of the stream, and therefore the ordinary high watermark, are probably unchanged since statehood.

Ordinary high watermarks were estimated from the most recent 7.5 minute USGS topographic maps using the break in slope at the main channel indicated by the contour lines, and by other information shown on the topographic maps. If the State makes any future claim to the bed of the Upper Gila and San Francisco Rivers based on the ordinary high watermark, more detailed topographic mapping and/or field survey techniques should be used. Ordinary high water flow rates, according to information presented elsewhere, probably ranged from about 200 to 400 cfs on the Gila River, and about 200 cfs on the San Francisco River, flow rates which would fill the channels of the Upper Gila and San Francisco Rivers. In general, the ordinary high watermark area follows the blue and stippled zone along the main channels shown on the USGS topographic maps.

Maps of the ordinary high watermark were prepared for the entire study reach using the USGS topographic maps, and have been entered in the GIS database provided with this report.

Ordinary Low Watermark

A.R.S. §§37-1101 to 1156 (H.B. 2589) limited the State's claim to navigable watercourses to the land within the ordinary low watermark. The ordinary low watermark is defined in HB 2589 as:

> *...the line on the banks of a watercourse created when the water recedes at its regularly recurring lowest stage in normal years without reference to unusual droughts.*

The ordinary low watermark may be difficult to identify on Arizona rivers, since low water typically does not leave a permanent mark on the stream banks. However, in practice and in other States, the ordinary low water is generally identified in conjunction with delineation of the high watermark, or is defined on the basis of site-specific or hydrologic characteristics. Unlike high watermarks, low watermarks are more ephemeral and may be erased by subsequent high flows. Case histories for application of a low watermark standard in Arizona are lacking.

The following general statements can be made in regard to delineation of the ordinary low watermark for the Upper Gila and San Francisco Rivers:

- The Upper Gila and San Francisco Rivers are perennial streams. Therefore, ordinary low watermarks presumably exist for the study reach. It was assumed for purposes of delineating the ordinary low watermark that no unusual drought conditions currently exist, or existed at the time the USGS topographic maps were prepared.

- Within the narrow bedrock canyon portions of the Upper Gila and San Francisco Rivers, there is very little difference in land area between the ordinary high watermark and the ordinary low watermark, especially at the scale of mapping used for this study. This land area between the two watermarks generally consists of narrow bouldery channel bars and sandy deposits devoid of vegetation.

- For the purposes of this study, the limits of the blue river symbol on the USGS topographic map may be taken as the limits of the ordinary low watermark. Should a claim of ownership based on the ordinary low watermark be made by the state, a more detailed delineation is recommended using detailed topographic mapping and/or field survey.

Where the ordinary low watermarks are measurably different from the ordinary high watermarks, they were shown on the GIS database mapping provided with this report.

Summary

Review of the geology of the Upper Gila and San Francisco Rivers indicates that the channel geomorphology is substantially unchanged from its condition at or before statehood. Most of the Upper Gila and San Francisco Rivers is formed within bedrock canyons. Bedrock along the channel margins in these canyons precludes significant movement of the river channel or other channel changes. In addition, the bedrock geology of the Upper Gila and San Francisco Rivers area made access to the river difficult during the period around statehood, prevented development of extensive irrigation systems, and prevented the development of large population centers near the river.

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1981 *Geology of Arizona.* Kendall/Hunt Publishing Co., Dubuque, IA, 221 p.

APPENDIX A

Aerial Photographs of the Upper Gila and San Francisco Rivers (June, 1997)

Originals on File at Arizona State Land Department, Drainage and Engineering Section

Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

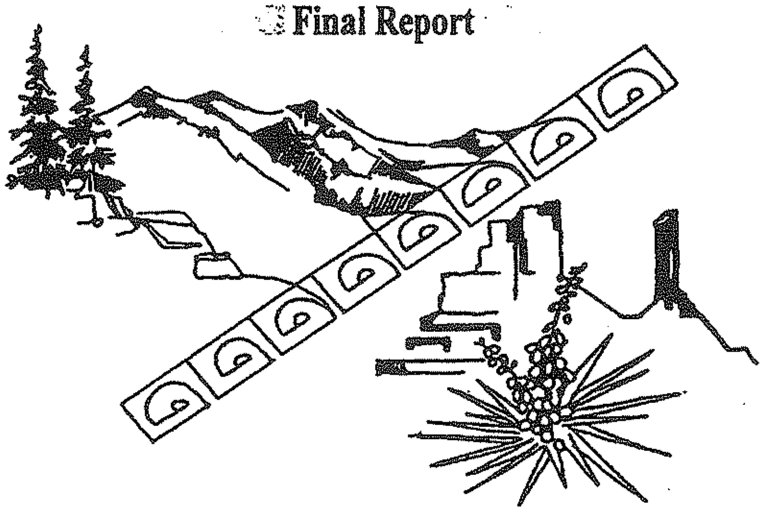
Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

Final Report



Prepared by

SFC Engineering Company

In Association With

George V. Sabol Consulting Engineers, Inc.

JE Fuller/Hydrology & Geomorphology, Inc.,

and

SWCA, Inc. Environmental Consultants

Section 5

Hydrology of the Upper Gila and San Francisco Rivers

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June 17, 1997

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Section 5:
Hydrology of the Upper Salt River

Introduction

The objective of this section is to document and evaluate the "ordinary and natural discharge" of the Upper Gila and San Francisco Rivers as of the time of statehood. While these rivers do not have major dams within the study reach, there are numerous irrigation diversions and at least one small reservoir near the headwaters. Therefore, the ordinary and natural hydrologic condition depends on which changes are considered non-natural. To assure that the range in potentially "natural" conditions is presented, this section of the report summarizes information that describes the hydrology of the Upper Salt River for the following time periods:

- Pre-Settlement - Flow conditions for the period leading up to statehood
- Statehood - Flow conditions in 1912, the year of Arizona statehood
- Post-Statehood - Long-term flow conditions, including the period after 1912

For stream conditions during each of these time periods, estimates of monthly and annual flow rates, anecdotal information regarding the appearance and character of the stream, and flood data will be summarized. Hydraulic rating curves relating discharge to stream depth, width, and velocity for existing and historical river conditions will also be presented.

Stream Reaches

For the purposes of the hydrologic analysis, the Upper Gila River will be considered as a single stream reach. Likewise, the San Francisco River will be considered a single hydrologic stream reach. While the geomorphology and historical use of these streams vary somewhat within the study area, hydrologic conditions vary gradually without well-defined break points, and can therefore be considered as single hydrologic units. Therefore, the stream reaches described in this section include the following:

- Gila River - Safford to Arizona/ New Mexico border near Duncan
- San Francisco River - Gila River confluence to Arizona/ New Mexico border

Data Sources

The records of the U.S. Geological Survey (USGS) are the primary source of hydrologic data for the Upper Gila and San Francisco Rivers study reach summarized in this report. These data include daily discharge values, peak flow values, and some limited irrigation diversion discharge values. Available published USGS water resources data were gathered from the Arizona State Land Department Library in Phoenix, Arizona, from the USGS Water Resources Division Library in Tucson, Arizona, and from the government documents library at Arizona State University. Additional irrigation diversion data were obtained from the Gila Water Commissioner's office in Safford, Arizona. Table 1 below lists the key existing and historical USGS stream gauges along with some basic watershed characteristics for the study reach associated with each gauge location.

The USGS routinely measures discharge values at established stream gauges in order to track shifts in the stage-discharge rating curves attributable to shifting channel geometry. These discharge measurements were performed by hand, by either wading into the stream with a velocity meter or by lowering the velocity meter from a bridge or a cable-car. Early published discharge measurements (usually before 1910) included stream width and flow area along with gauge height and discharge. Although generally unpublished, stream width and flow area data have always been recorded in the notes of the surveyor or gauge operator. Much of these data for the stream gauges located in these study reaches were gathered by accessing the USGS national archives through the USGS Water Resources division in Tucson.

Table 1. Upper Gila River Navigability Study USGS Stream Gauges in the Upper Gila River Watersheds					
Gauge	USGS ID #	Drainage Area (sq. miles)	Elevation of Station (ft above MSL)	Slope of Reach (ft/ft)	Earliest Record
Gila River					
Gila River Near Red Rock, NM	09431500	2,829	4090	.0015	1904
Gila River Near Virden, NM	09432000	3,203	3,875	.0025	1914
Gila River Near Clifton/Guthrie, AZ	09442000	4,010	3,336	.0019	1910
Gila River at Head of Safford Valley, Near Solomon, AZ	09448500	7,896	3,060	.0031	1914
Gila River at Safford, AZ	09458500	10,459	2,890	.0020	1940
San Francisco River					
San Francisco River at Alma, NM		1,540	4850	.0038	1904
San Francisco River at Glenwood, NM	09444000	1,653	4560	.0038	1927
San Francisco River at Clifton	09444500	2,766*	3,436	.0032	1910**

Notes: * 2 square miles is noncontributing
** some earlier data are available starting 1891

Hydrologic Setting

Climate

The climate of the Upper Gila River and San Francisco River watersheds varies dramatically with elevation, although the climate along the rivers themselves is relatively uniform over the length of the study reaches. During the dry transition seasons of late spring and early fall, daily temperatures alone can fluctuate as much as 40 degrees (Fahrenheit). The lower regions of the Gila River near Safford experience hot summers with daytime high temperatures in 100's. Winters are generally mild in these areas with occasional lows in the teens (10-20°F) after winter storms. The upper elevations of the Gila and San Francisco River watersheds experience alpine conditions. Summer daytime high temperatures in the higher elevations above 8,000 feet in elevation rarely exceed the 80's. Winter low temperatures can drop below zero during severe winter storms.

Table 2 **Climatic Data for the Upper Gila River and San Francisco River Watersheds**				
Average Annual Statistics	Safford 1900-1973 Elev.=2,934 ft.	Clifton 1906-1988 Elev.=3,468 ft.	Duncan 1901-1982 Elev.=3,650 ft.	Alpine 1904-1982 Elev.=8,020 ft.
Precipitation (in.)	8.82	12.69	9.92	20.61
Max. Temperature	80.8	80.99	77.8	61.6
Min. Temperature	46.8	51.62	40.4	25.5
				Source: (Sellers, 1985)

Table 3 **Seasonal Variation in Precipitation (Inches) and Temperature (°F) for the Upper Gila River and San Francisco River Watersheds**				
Average Annual Statistics	Safford 1900-1973 Elev.=2,934 ft.	Clifton 1906-1988 Elev.=3,468 ft.	Duncan 1901-1982 Elev.=3,650 ft.	Alpine 1904-1982 Elev.=8,020 ft.
January	0.58	0.96	0.78	1.48
February	0.57	0.96	0.69	1.29
March	0.67	0.79	0.58	1.38
April	0.23	0.35	0.21	0.75
May	0.08	0.30	0.21	0.56
June	0.20	0.39	0.29	0.73
July	1.91	2.14	1.77	3.72
August	1.57	2.31	1.94	3.77
September	1.05	1.59	1.15	2.27
October	0.67	1.01	0.89	1.99
November	0.51	0.66	0.50	1.16
December	0.77	1.18	0.91	1.51
Annual	8.82	12.63	9.92	20.61
				Source: (Sellers, 1985)

Upper Gila River

The Gila River at Safford, Arizona drains an area of approximately 10,459 square miles, not including the Animas River Basin, which is a closed basin. The Gila River headwaters are in the expansive Gila Wilderness in Western New Mexico. The highest point in the basin is Whitewater Baldy, at an elevation of 10,895 feet above mean sea level. Principle tributaries to the Gila River in Arizona include the San Francisco River near Clifton, Eagle Creek near Clifton, Bonita Creek near the head of the Safford Valley, and the San Simon River near Safford. The Gila river flows through Greenlee and Graham Counties on its way to Safford in Graham County. In Greenlee County, the Gila river flows through the agricultural communities of Duncan, York, and Guthrie. In Graham County, the river flows through the Gila Box Riparian National Conservation Area upstream of Solomon and the Safford Valley.

In Arizona, agricultural centers are located along the Gila River near Duncan and in the Safford Valley. In these reaches with agriculture, the river is wider than the canyon reaches and is more prone to channel alignment changes. A number of irrigation canals divert river water to nearby agricultural fields. Of the 64 river miles between the Arizona/New Mexico State line and Safford, approximately 26 river miles are through relatively narrow bedrock canyons, where the channel alignment has been relatively stable compared to the reaches with agricultural uses in the floodplain. Historical stream gauge data for the Upper Gila River are available at stations at Red Rock, New Mexico; near Virden, New Mexico; at Guthrie, Arizona; near Clifton, Arizona; at the Head of the Safford Valley, Arizona; and at Safford, Arizona.

Table 4 Gila River Drainage Area Summary	
River Reach	Drainage Area (square miles)
Near Redrock, New Mexico (28 river miles upstream from state line)	2,860
Near Virden, New Mexico (15 river miles upstream from state line)	3,203
To Arizona/ New Mexico State Line	3,363
Above San Francisco River Confluence (34 river miles downstream -	4,046
(San Francisco River total drainage area)	(2,804)
To head of Safford Valley, near Solomon (47 river miles downstream	7,896
At Safford (64 miles downstream from state line)	10,459

San Francisco River

The San Francisco River drains an area of approximately 2,804 square miles (see Figure-1). The largest tributary to the San Francisco River is the Blue River, which has for its headwaters the eastern highlands of Arizona, including the Blue Range. The San Francisco River begins in Arizona on the southern flanks of Escudilla Mountain (elevation 10,912 feet) near Alpine, Arizona. The river then flows east into New Mexico where it drains a large portion of that state's western uplands which include several peaks over 9,000 feet in elevation and a few over 10,000 feet in elevation. The San Francisco River joins the Gila River approximately 11 river miles to the south of the town of Clifton, Arizona.

Two locations on the San Francisco River have reliable recorded historic gauge data: Clifton, Arizona and a reach including Alma and Glenwood, New Mexico. Between Alma/Glenwood, New Mexico and Clifton, Arizona (the only two locations with gauge records on the San Francisco River), the largest tributary to the San Francisco River (and its largest tributary overall) is the Blue River. Therefore, the best representative flow data for the San Francisco River upstream of the Blue River is that data collected at Alma and Glenwood, New Mexico. Likewise, the best available data for the San Francisco River between the Blue River confluence and Clifton are from the Clifton gauge. The following table (Table 5) summarizes drainage area data for the San Francisco River.

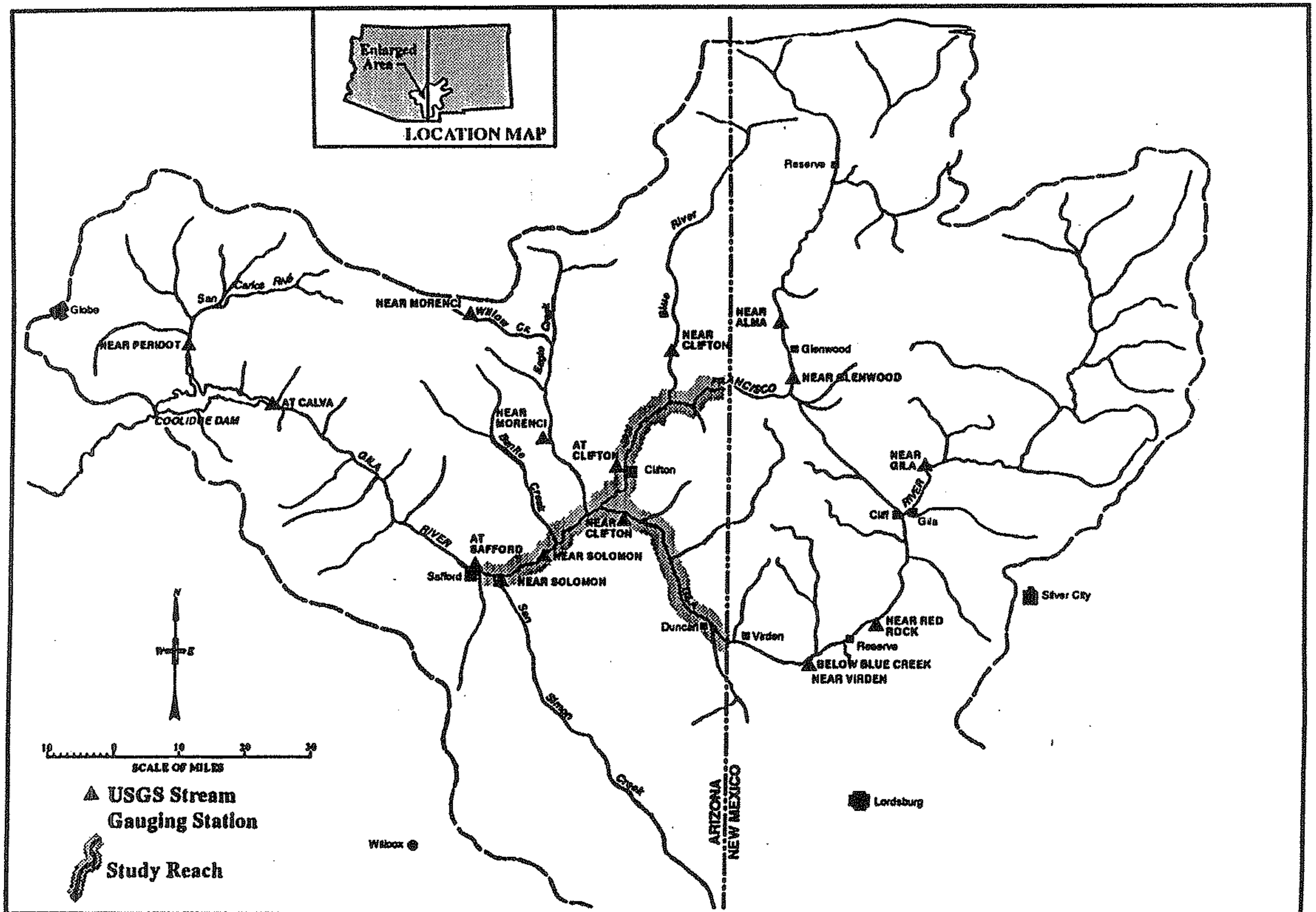


FIGURE 1

Study Reach Location Map

Table 5 San Francisco River Drainage Area Summary	
River Reach	Drainage Area (square miles)
To Alma, New Mexico (27 river miles upstream from state line)	1,540
To Arizona/New Mexico State Line	1,917
Above Blue River Confluence (13 river miles downstream from state	2,037
(Blue River total drainage area)	(624)
To Clifton (34 river miles downstream from state line)	2,765
Confluence with Gila River (45 miles downstream from state line)	2,804

Diversions

Other than irrigation diversion structures, the Upper Gila River and the San Francisco River are unregulated and free-flowing. However, early records indicate that significant irrigation diversions were in place well before statehood. Early accounts of irrigation diversions indicate that as early as 1899 there were 17 diversions from the Gila River in the Duncan Valley (i.e., a 10 mile reach of the Gila River extending upstream from Duncan, Arizona) and 28 diversions in the Solomonsville Valley (Safford Valley) (USGS, 1901).

The Montezuma Ditch, the earliest constructed canal in the Safford Valley (according to USGS records), was built in 1874. It is interesting to note that discharge measurements taken April 15, 1899 in the Safford Valley indicate that the Gila River was flowing at 237 cfs near the head of the valley, 0.0 cfs was measured that same day downstream of several of the diversions, and only 32.8 cfs was flowing below Ft. Thomas downstream from all diversions at the western end of the valley. Also, on that day, the Montezuma Ditch was carrying 101 cfs (USGS, 1901). Therefore, it may be assumed that it was not unusual for irrigation diversions to completely drain the river during some months of low flow.

Early accounts of irrigation diversions on the San Francisco River note diversions at Luna, New Mexico (one diversion), and a few miles above Frisco, New Mexico (two diversions) as early as April, 1899. Two diversions from the San Francisco River near Clifton are also described; one for the purpose of irrigation is described as "a small ditch 1¾ miles above the bridge" (the gauge location), and a second diversion located 1½ miles above Clifton diverts “about 14 second-feet (cfs)” for power development for the Arizona Copper Company. This later diversion is returned to the San Francisco river above the gauging station. A USGS gauge description sketch dated only as 1911, notes the presence of a “series of small reservoirs” in the overbank areas of the San Francisco River downstream of the Clifton railroad bridge (USGS, 1901).

A sketch by the USGS, dated April 13, 1911, of the Arizona Copper Company's diversion dam located just upstream of Clifton on the San Francisco River shows the crest of the diversion dam to be 118.5 feet wide, with a concrete apron which measures 22 feet parallel to the direction of flow, and intake works which account for another 44.6 feet, including an eight-foot wide crib screen (USGS, 1911). Notes on the sketch indicate that there is “no free overfall” below the apron of the dam, and that the crest is constructed of a “4”x 4” plank”. The early sketch also shows the depth of flow over the diversion dam to be 0.6 feet above the crest on April 13, 1911, with a published discharge measurement at the dam on this date of 225 cfs. No other descriptions of other canal head works were found for the canals located in other reaches of the San Francisco River and the Upper Gila River. However, the details discussed above for a canal which is reported to have flowed fairly constantly at 14 cfs, provides a glimpse of what one head works looked like near the turn of the century, and perhaps an idea of what other head works may have been like for the larger canals located elsewhere on the Gila River. A copy of the head works sketch is provided in the Appendix A.

Accurate historic diversion data prior to 1936 is not readily available in part because there was no mandate for such data to be recorded. The Gila Water Commissioner started recording accurate records in 1936. An annual summary of diversions starting in 1936 for the Upper Gila River is shown in Table 6.

Table 6				
Year	River	Diversion	River Flow:	Diversion
1936	90	39	217	132
1937	206	40	418	161
1938	87	23	164	98
1939	94	34	172	79
1940	146	40	303	100
1941	435	34	915	151
1942	111	36	222	172
1943	71	32	151	122
1944	80	27	151	128
1945	109	28	220	149
1946	53	14	116	70
1947	45	10	100	52
1948	86	9	148	40
1949	303	25	569	168
1950	49	18	87	69
1951	33	3	79	26
1952	140	20	324	129
1953	46	8	83	39
1954	89	13	190	80
1955	67	13	170	86
1956	24	8	49	43
1957	121	11	225	70
1958	205	19	473	147
1959	74	11	179	80
1960	138	15	285	111
1961	73	8	159	36
1962	211	21	410	135
1963	130	20	273	101
1964	69	12	142	70
1965	161	18	395	93
1966	209	23	433	133
1967	115	16	259	90
1968	314	26	656	152
1969	62	15	122	89
1970	53	15	110	96
1971	89	5	181	39
1972	255	12	506	67
1973	314	20	671	125
1974	59	13	115	80
1975	220	16	342	109
1976	88	18	147	94
1977	66	9	132	31
1978	330	13	848	75
1979	287	16	750	106
1980	135	23	445	122

Table 6				
Year	River	Diversion	River Flow:	Diversion
1981	62	18	150	110
1982	131	24	270	118
1983	374	22	1149	127
1984	198	24	460	135
1985	370	21	740	134
1986	186	24	324	149
1987	121	26	334	138
1988	257	23	445	138
1989	68	18	120	94
1990	78	10	170	69
1991	340	20	681	126
1992	377	20	801	124
1993	518	22	1558	119
1994	230	23	345	108
1995	262	22	506	109
1996	117	16	194	95
Average	161	19	350	102
Source: Gila Water Commissioner				

The Gila River Decree (Globe Equity No. 59), the first formal water adjudication decree for this study reach, was entered in the U.S. District Court on June 29, 1935 (BuRec, 1974). The Gila River Decree governs the use of the Gila River from the head of the Duncan-Virden Valley to San Carlos Reservoir. Under the decree, the discharge of the Gila River in the governed reach is fully appropriated. It is the job of the Gila Water Commissioner to apportion flow to water users in the Safford and Duncan-Virden Valleys when there is flow in the Gila River. When river flows are insufficient to meet the entire demand, water rights are exercised by senior priority.

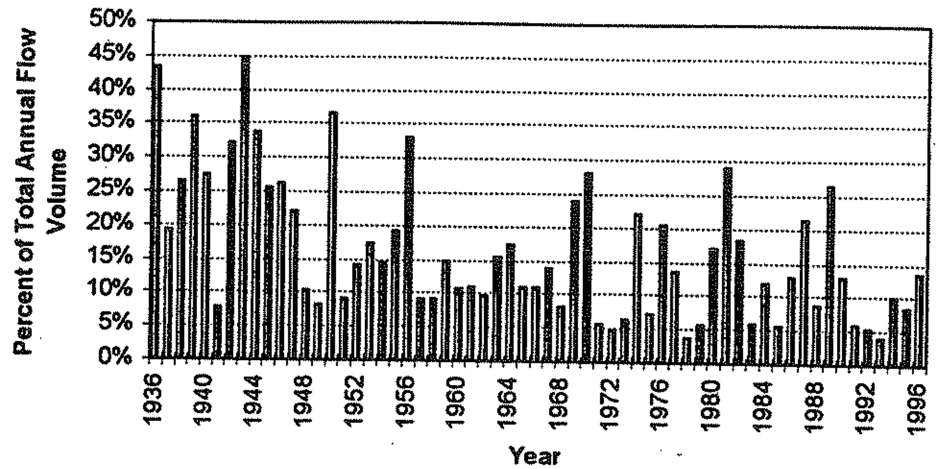
The Gila River Decree limits the rate of diversion to one cubic foot per second for each 80 acres. The decree also limits the total diversion to 6 acre feet per acre per irrigation season (January 1 to December 31). Overall, water is distributed according to arable acreage as follows:

Duncan-Virden Valley			
New Mexico		2860.10 acres	
Arizona		5201.25 acres	
	Subtotal	8061.35 acres	
Safford Valley		32512.40 acres	
Total		40573.75 acres	Source: (BuRec, 1974)

Applying the six acre-feet-per-acre rule to the total allowable acreage yields 243,443 acre feet annually, almost twice the average combined diversions from the Upper Gila River as shown in Table 6, but less than the long-term average flow volume of the Gila River at Safford.

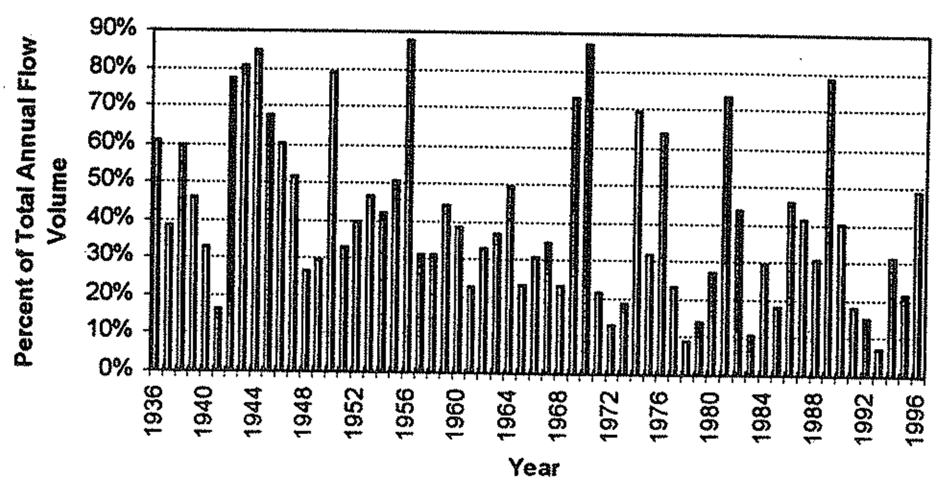
An indication of the long-term trend of irrigation use is the percentage of Gila River flow used for irrigation. The following two charts show the long-term trend of irrigation diversions as a percentage of the annual discharge of the Upper Gila River in two locations: (1) the Duncan Valley, and (2) the Safford Valley.

Figure 2. Duncan Valley Diversions as a Percent of Annual Discharge at Gila River near Virden



Basic Data Source: (Gila Water Commissioner, 1996)

Figure 3. Safford Valley Diversions as a Percent of Annual Discharge at Gila River near Solomon



Basic Data Source: (Gila Water Commissioner, 1996)

Both Figure 2 and 3 indicate a general trend of decreased volume of irrigation diversions from the Upper Gila River over the last 60 years. This trend could be attributable to several factors including:

- more efficient diversion, distribution, and irrigation practices
- later decrees changing the allowable total diversions
- decreasing arable acreage
- changing crop types
- increased use of groundwater supplies.

A later court decision, the Arizona v. California, et. al. Decree, was entered by the United States Supreme Court on March 9, 1964 (BuRec, 1974). This decree set allowable water uses for, among other areas in the Upper Gila River Basin, land along the San Francisco River in New Mexico. Under the decree, the total consumptive use for the San Francisco River in New Mexico (i.e., from Luna to the Glenwood area) at 31,870 acre feet during any period of 10 consecutive years, or 4,112 acre-feet during any one year. These limits included both irrigation diversions and groundwater pumping.

Summary

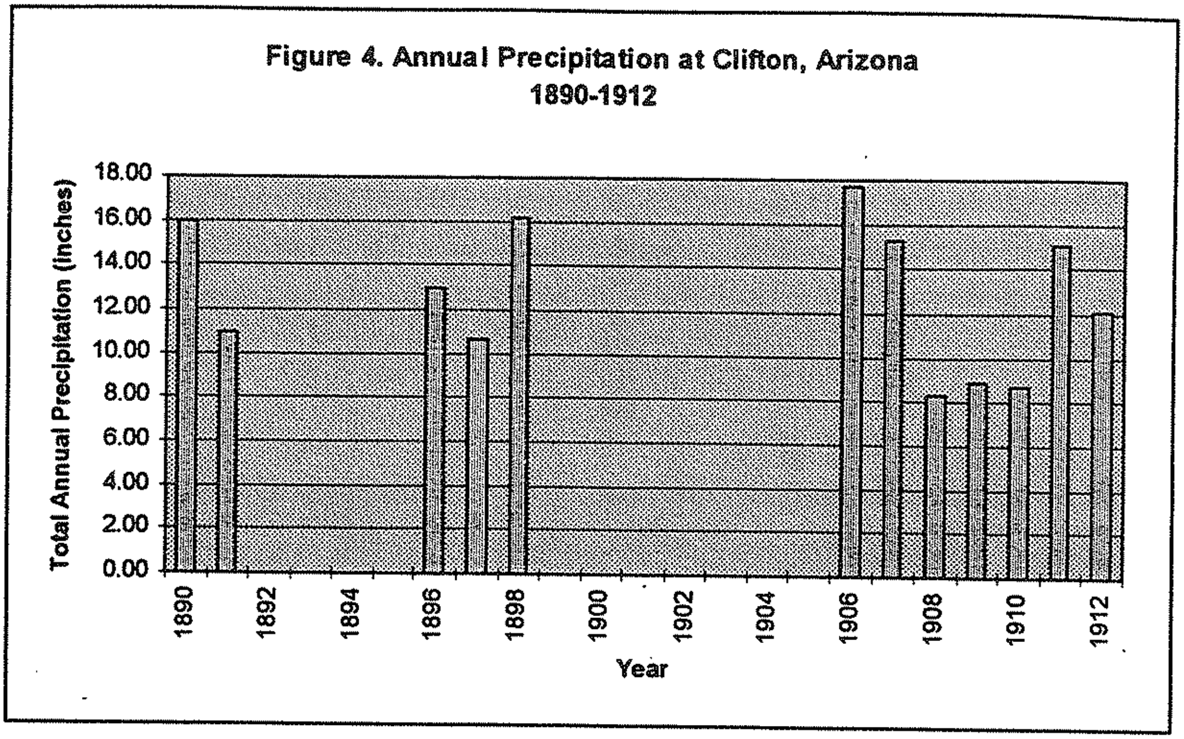
Since well before statehood, large scale irrigation diversions from the Gila River were taking place in the Duncan-Virden Valley and the Safford Valley. The combined capacity of all these early diversion canals and ditches was enough to divert all the flow from the Gila River during the peak irrigation season (which coincides with seasonal low river flow rates) in reaches with irrigated agriculture. The Montezuma Canal, located in the Safford Valley, could divert at least 101 cfs, or about 50 percent of the long-term average annual flow. Long-term records kept continuously since 1936 indicate a general decrease in the total annual diversion volumes taken from the Gila River. This information suggests that diversions from the Gila River as of the time of statehood were probably on the same order of magnitude, but slightly greater than today, since there were no formal court decrees limiting use.

Available diversion data for the San Francisco River are sparse, consisting of a few spot measurements recorded in early Bureau of Reclamation/USGS reconnaissance reports published in USGS Water Supply Papers. It may be assumed that irrigation diversions (i.e., water rights) were most likely not substantial, given the limits placed on consumptive use on lands adjacent to the San Francisco River in New Mexico in the Arizona v. California Decree. However, even small diversions from the San Francisco River could have had a measurable impact, given the typical low average flow rates during seasons when high irrigation demand coincides with seasonal low flow.

Pre-Statehood Hydrology

Hydrologic data for the period prior to Arizona statehood, are available from direct measurements made by the USGS and the Bureau of Reclamation, which were published in annual summaries of stream gauging records. In addition, comparison of pre-statehood and long-term precipitation records at Clifton indicate that modern streamflow records presented later in this report are probably representative of conditions as of the time of statehood, if an adjustment for irrigation diversions can be made.

Available pre-statehood precipitation records for Clifton, Arizona starting in 1890 are shown in Figure 4 below (USGS, 1900, Sellers, 1985). The long-term annual average precipitation at Clifton is 12.63 inches (Sellers, 1985). From 1906 to 1912 the annual precipitation totals at Clifton varied greatly, like most stations in the arid west, from a high of 17.73 in 1906 to a low of 8.67 in 1910 (the record for 1908 is missing five months worth of data). Note that the precipitation total during 1912 (12.13 inches) falls near the long-term average of 12.63 inches. The average annual precipitation at Clifton for the period from 1906 through 1912 was 12.32 inches.



No other annual precipitation data were readily available for the years immediately preceding the year of statehood (1912) in and around the upper Gila River basin for which meaningful data could be compared for long-term trends.

Upper Gila River

Early Gauge Measurements. The first discharge measurements on the Upper Gila River were recorded by the USGS on March 22, 1899, during a reconnaissance trip through the Upper Gila River basin by Cyrus C. Babb (USGS, 1901). On that day, according to Babb's report, the discharge was measured on 17 canals in the Duncan Valley as well as on the main channel of the river itself. It is noted that the Upper Gila River was flowing at 160 cfs above the head of the Telles, or uppermost, canal located in the Duncan Valley. Also noted in this report was that the total diversion rate into the ditches was 86 cfs on that day, and that the discharge in the river in Duncan below all of the diversions was 104 cfs "showing a gain of 30 second-feet [cfs] in a distance of about 15 miles." In addition, Babb was able to determine from local records or some other source that:

"Gila River at Duncan has been dry on two occasions within the last twenty-five

years. These droughts occurred, one in June, 1896, and the other in June, 1897. During August, 1897, occurred the greatest flood within the same period. The water flooded the town of Duncan, rising 8 feet above the river bed."

On a return trip, Babb notes:

> *"On May 15, 1899, at the time of a second visit to Duncan, the river was discharging only 10 second-feet, having dropped from 104 second feet since April 30 [March 30?]."*

During the same reconnaissance trip in the spring of 1899, Babb recorded discharge measurements and some background information for 28 canals in the vicinity of Solomonsville in the present day Safford Valley. The earliest constructed canal, as noted by Babb, was the Central ditch, reportedly constructed in 1874. Thirteen large ditches are noted together with their lengths and associated irrigated land. These thirteen ditches have a combined length of 81 miles, and carry water to an estimated 41,000 acres.

Pre-statehood records from individual stream gauges on the Upper Gila River are described in the following paragraphs.

Gila River near Virden New Mexico. No data are available for the Gila River near Virden prior to statehood.

Gila River at Redrock, New Mexico. The gauge near Redrock, New Mexico "was originally established May 14, 1908, at the mouth of the Middle Box Canyon of the Gila, about 2 miles east of the Redrock post office, New Mexico. On July 16, 1909, it was moved about one-eighth mile upstream in the canyon." (USGS, 1910). The gauge was located about 20 river miles upstream of the Arizona border. From 1908 through 1910, 22 discharge measurements were taken which included flow width and area data. Since no rating curves were readily available for this gauge site, the width/area data were used to estimate hydraulic depth and average velocity for the purpose of determining the low flow stream channel characteristics for the period prior to statehood.

Discharge measurements were made during low flows between 29 cfs and 398 cfs. The hydraulic depths range from 0.7 feet to 1.6 feet, the average velocity ranges from 0.7 feet per second (fps) to 3.1 fps, and flow widths varied from 22 feet to 154 feet. Note that the greatest hydraulic depth for a discharge measurement occurred at a discharge of only 91 cfs, the lowest hydraulic depth occurred at a discharge of 101 cfs. The smallest width and greatest average velocity occurred at a discharge of 84 cfs, and the greatest width occurred at a discharge of 398 cfs. These data suggest that the channel at the Redrock gauge site was mobile, prone to horizontal and vertical shifting even at low flows.

Table 7
Month Streamflow Statistics for Gila River near Red Rock, New Mexico
November 1908-December 1910 (all data prior to statehood)

Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	106	74	151
February	143	78	247
March	387	135	675
April	214	126	424
May	134	114	180
June	46	24	111
July	79	26	199
August	176	90	238
September	150	54	597
October	74	59	86
November	98	68	197
December	122	74	133
Annual	144	77	270

The average monthly discharge data for the Red Rock gauge shown in Table 7 fall within the range of the low-flow discharge measurements discussed above. Therefore, it can be said that the average monthly hydraulic depth and the average flow width for all months during the period of record prior to statehood at this gauge site falls between 0.7 foot deep and 1.6 feet deep and between 22 feet wide and 154 feet wide.

Gila River near Guthrie, Arizona. This gauge station was officially established on November 6, 1910. The gauge is located approximately 500 feet upstream from the Guthrie railroad bridge in Section 3, Township 6 south, Range 30 east (USGS, 1911). For the period prior to statehood, only three discharge measurements are recorded which include flow width and area data, from which channel characteristics can be estimated for this reach of the river. These measurements were taken between October and December 1910, and range in discharge from 63 cfs to 92 cfs. The flow depths varied from 2.0 to 2.9 feet deep, and the widths varied from 31 feet to 32 feet wide (see Table 8 below). Flow measurements for the remaining months during the pre-statehood period were made, although no width/depth data are preserved in the published USGS records.

Table 8
Month Streamflow Statistics for Gila River near Guthrie, Arizona
November 1910-December 1912 (all data including the year of statehood)

Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	143	63	450
February	103	50	150
March	580	88	1160*
April	238	95	445
May	55	29	101
June	37	5	134
July	447	7	3260*
August	162	47	365
September	223	49	1193
October	240	64	1023
November	114	79	183
December	94	74	113
Annual	203	54	715

Notes: * One month of one year only

No other pre-statehood data are recorded for the Upper Gila River in, or reasonably close to, the study reach.

Summary. No pre-statehood flow data are available for the lower portion of the study reach near Safford. The limited amount of pre-statehood flow data available indicate that the average discharge for the years immediately prior to statehood at approximately the middle of the study reach at Guthrie was 203 cfs, and probably was between 203 cfs and 144 cfs at the upper portion of the study reach near Duncan (see Table 9 below).

Table 9
Annual Streamflow Statistics for the Upper Gila River
Pre-Statehood

Location	Average Annual Discharge (cfs)	Average Annual Min. Discharge (cfs)	Average Annual Max. Discharge (cfs)
Red Rock, NM	144	77	270
Guthrie, AZ	203	54	715

At Guthrie, monthly average and monthly average minimum discharges typically were lowest during the month of June with 37 cfs and 5 cfs respectively. Likewise, at Red Rock the monthly average and monthly average minimum discharges for the month of June prior to statehood were 46 cfs and 24 cfs respectively. June 1896 and 1897 were reportedly the only two occasions when the Gila River near Duncan went dry for the period of 25 years prior to 1899 (USGS, 1901). A discharge of 0.0 cfs was also noted to have taken place on the Upper Gila River at least once during April 1899 as a result of irrigation diversions in the Safford Valley.

The greatest flood of memory on the Upper Gila River in the Duncan area for the period 25 years prior to 1899 occurred August, 1897. No flow rate was recorded for the pre-1899 event, but the town of Duncan was flooded and the flow depth was reported to be eight feet (USGS, 1901). Annual average maximum flow rates prior to statehood were about 715 cfs at Guthrie, and probably between 270 and 715 cfs in the Duncan area at the upstream end of the study reach. The largest recorded pre-statehood monthly maximum discharge of 3,260 cfs at Guthrie, Arizona was during July 1911. The month with the greatest monthly average maximum discharge at Red Rock, New Mexico was March (675 cfs).

San Francisco River

Early Gauge Measurements. The first discharge measurement on the San Francisco River recorded by the USGS was taken on April 5, 1899 during a reconnaissance trip through the upper Gila River basin by Cyrus C. Babb (USGS, 1901). On that day, 94 cfs was measured approximately 7 miles upstream of Clifton. The first regular measurements of the San Francisco River occurred at a station officially established near Alma, New Mexico, approximately 27 miles upstream of the Arizona/ New Mexico border, on October 18, 1904. Some limited data are available for this gauge site starting in August, 1904. This gauge was discontinued February 24, 1914. The gauge consisted of a vertical staff gauge which was read daily by a local resident. The gauge site was moved approximately one mile downstream during August 1912 (USGS, 1905-1914).

The drainage area at Alma is 1540 square miles, approximately 55 percent of the San Francisco River Basin. For the period between 1904 and 1912, the longest period with no flow was from May 1st through July 22nd 1910 (83 consecutive days), and a total of 130 non-consecutive days of no recorded flow from April 25th through September 16th of that year. The year 1910 was the driest year on record between 1890 and 1912, with a total annual flow volume of about 10 percent of the long-term average.

Some irrigation diversions from the San Francisco River were noted during the Babb reconnaissance trip (USGS, 1901). The following is recorded in the 21st Annual Report of the USGS, 1899-1900:

> *"At Luna, New Mexico, the valley is about 5 miles long, and has been occupied within the last few years by a Mormon colony, which diverts water by means of a canal heading in Arizona, 12 miles above the town. In April, 1899, this canal was carrying 8 second-feet, which was all the water in the river at the point of diversion."*
>
> *"In Luna Valley there are about 1,000 acres under cultivation."*
>
> *"A few miles above Frisco the canyon again opens into a narrow valley which is*

somewhat settled. A certain amount of water is collected in the canyon, but is diverted again, by means of two canals, for the irrigation of this section."

Luna is located approximately 77 river miles upstream of the Arizona/New Mexico State line, and Frisco is located upstream of the Arizona/New Mexico State line near the entrance to the San Francisco River canyon.

San Francisco River at Alma. The Alma stream gauge was maintained by the USGS until January 1914, with gaps in the data occurring December, 1904, the entire year of 1908 and April, 1911 - July 1912. Data available includes daily gauge heights and the corresponding daily discharge values based on periodic discharge measurements. Some of the published discharge measurements recorded for this gauge include the cross-sectional area and the flow width (see USGS, 1910). The average monthly discharges for this gauge for the period before statehood (February 14, 1912) are shown in Table 10 below. Also shown in Table 10 are estimates of the maximum flow depth for each month's mean flow value.

Table 10
Month Streamflow Statistics for San Francisco River near Alma, New Mexico 1904-1911 (all data prior to statehood)

Month	Average	Average	Average	Estimated
January	245	43	2001	0.8
February	339	110	1498	0.8
March	508	103	1430	1.1
April	393	171	719	1.2
May	84	45	187	0.6
June	13	2.4	31	1.7
July	40	2	502	0.5
August	125	15	931	0.7
September	86	17	712	0.7
October	35	19	132	0.5
November	68	27	201	0.7
December	158	31	942	0.8
Annual	175	45	774	0.8

Estimating the maximum channel depths was possible for this gauge site due to the frequency of days with no flow (usually between May and August), and because the records clearly indicate at what gauge height zero flow occurs. For periods experiencing no channel bed elevation changes, the zero-flow height was subtracted from the total recorded gauge height to estimate the maximum stream flow depth (i.e., the deepest portion of the stream). To avoid errors due to channel bed elevation changes resulting from high flows, the zero-flow gauge height was only applied to data bracketed on both sides by zero or near-zero gauge height readings, and for periods with an absence of large flow events which are likely to contribute to a bed elevation shift.

The maximum stream depth estimates were compared to estimates based on extrapolation of rating curves based on discharge measurements (see section on rating curves), and to discharge measurements which included hydraulic geometry data (i.e., flow area and width). The average hydraulic depth based on the hydraulic geometry data usually fell just below the maximum depth estimate, showing that the maximum depth estimate is in the expected range (i.e., greater than the hydraulic depth), and showing that the deepest part of the low-flow channel may not have been significantly deeper than the rest of the low-flow channel during periods of low flow.

San Francisco River at Clifton. The San Francisco River at Clifton gauge site was established by the USGS October 23, 1910 (USGS 1910). For the period of record before statehood, the gauge was alternately operated at two locations in Clifton due to the reported shifting nature of the channel. The main location (i.e., the location used most during the entire gauging record), is "at the highway bridge at Clifton ....about 5 miles above the mouth of the river". At the time the gauge was established, it is reported that "water is diverted for irrigation by a small ditch 1¾ miles above the bridge." Additionally, it was noted along with the 1910 data, that "about 14 second-feet is diverted for power development, but the water used at the power plant is returned to the river above the [gauge] station." The latter diversion takes place at the dam.

When accurate measurements could not be taken at the bridge, measurements were taken at a gauge at the dam. The gauge at the dam was established January 16, 1911 (USGS, 1911), and was used as necessary until June 30, 1912. After that time, the gauge site was maintained at the highway bridge and alternately at the railroad bridge in Clifton. Until May 15, 1914, the gauge consisted of a vertical staff gauge or a chain gauge attached to either the highway bridge or the railroad bridge. Usually, a common vertical reference mark was used to keep the datum of the gauges consistent. Because of the frequent gauge location changes, however, and since there are some inconsistent datum shifts, the record is difficult to decipher with respect to absolute flow depth. The average monthly discharges for this gauge for the period before statehood are shown in Table 11 below.

Table 11
Monthly Streamflow Statistics for San Francisco River at Clifton, Arizona
October 1910-February 1912 (all data prior to statehood)

Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	223*	100*	470*
February	115	82	168
March	1130*	145*	6200*
April			
May			
June			
July	269*	56*	1120*
August	87*	50*	145*
September	185*	50*	1060*
October	289	84	1888
November	102	75	155
December	79	58	103
Annual	275	78	1257

Notes: * Record is for one month of one year only. Other averages are based on two year record. No data available for some months.

Table 12 below presents estimated maximum flow depths based on the monthly average flow for the three months which had sufficient detail in the data record.

Table 12 Discharge Data for San Francisco River at Clifton, Arizona October 1910-December 1910				
	Average	Minimum	Maximum	Estimated
October	109	175	68	0.7-1.3
November	99	200	45	0.7-1.3
December	54	100	25	1.2

Summary. Pre-statehood hydrologic data for the San Francisco River indicate that the average annual flow rate increased from about 175 cfs to 275 cfs within the study reach. The average flow depth in the river was probably about one foot, with flow widths averaging about 20 to 30 feet. Annual high flows over 500 cfs typically occurred during late winter to early spring months, with occasional summer floods.

Statehood Hydrology

The Upper Gila and San Francisco Rivers experienced slightly below-average flow rates during 1912, the year of statehood, both compared to the pre-statehood record and the long-term record based on the entire period of record (1899-1989). The month of February 1912 also experienced flow rates that were well below average for the month. Table 13 below shows the monthly average discharge data for the year 1912 at USGS gauging stations which were recording data that year. Table 14 shows flow data from the day of Arizona statehood, February 14, 1912.

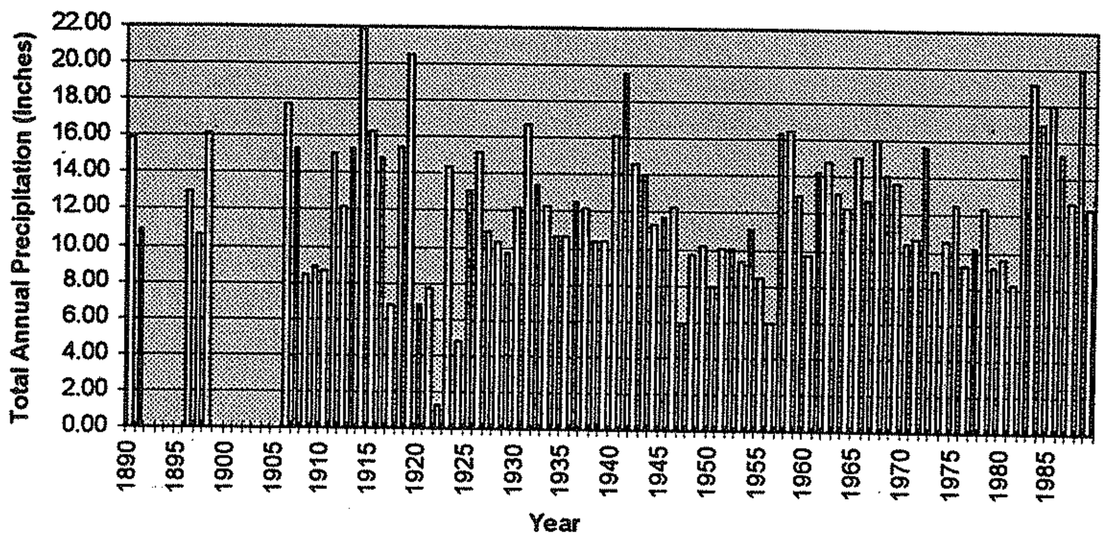
Table 13 Monthly Average Discharge (cfs) for Gila and San Francisco Rivers 1912				
Month	Gila River near Redrock	Gila River near Guthrie	San Francisco near Alma	San Francisco at Clifton
January		101		74
February		60		63
March		601		948
April		328		341
May		99		216
June		26		278
July		315		
August	99	173	48	
September	93	178	37	
October	87	145	36	143
November	86	115	15	55
December	82	97	18	118
Annual	-	182	-	-

Table 14 1912 Flow Measurements - Gila and San Francisco Rivers February 14, 1912		
Period	Gila River near Guthrie	San Francisco at Clifton
February 14, 1912	65 cfs	70 cfs
February, 1912 Average Flow	60 cfs	63 cfs
February, 1912 Range of Flow	35-75 cfs	40-70 cfs
Long-term Average Flow for February	324 cfs	314 cfs

Compared to pre-statehood data, the average discharge rate during February, 1912 for both the Gila River at Guthrie, Arizona, and the San Francisco River at Clifton were in the range of approximately 56% of normal. Compared to the entire record, the February, 1912 averages for these two stations are a mere 20% of normal. Therefore, flow conditions on the day of Statehood are not representative of the ordinary and natural flow conditions of the Upper Gila and San Francisco Rivers.

Precipitation records from 1912 support the trend identified by flow measurements on the Upper Gila and San Francisco Rivers. During February, 1912, 0.38 inch of precipitation was recorded at Clifton, Arizona. The average precipitation for February at Clifton for the period 1906 through 1988 was 0.92 inch. The total annual precipitation of 12.13 inches measured at the Clifton station during 1912 falls below, but near, the long-term average of 12.39 inches. Figure 5 shows long-term precipitation trends at the Clifton, Arizona station.

Figure 5. Annual Precipitation at Clifton, Arizona 1890-1988



Source: (USDA, Weather Bureau, 1906-1988, and USGS, 1900)

Post Statehood Hydrology

Long-term stream gauging records and data summaries have been assembled by the USGS for several stations along the Upper Gila and San Francisco Rivers. These long-term records include data for the entire period of record for each station, which in some cases includes data from the pre-statehood period in addition to more recent data. The following paragraphs summarize average monthly and annual statistics for the stream gauges located on the Upper Gila and San Francisco Rivers in the study area and within a reasonable distance outside the study area boundaries or the study reach for the period following statehood.

Upper Gila River

Gila River below Blue Creek, near Virden, New Mexico. USGS gauging records from the general reach of the Gila river surrounding this gauge are available beginning January 1923 under the name "Gila River at Virden Bridge, Near Duncan, Arizona," and beginning May, 1914 under the name "Gila River near Duncan, Arizona." Supplemental information to the station description at this location are included in Appendix B. Because the records are not continuous, only the more recent data from the gauge titled "Gila River below Blue Creek, near Virden, New Mexico" were used to evaluate the long-term record for this location within the study reach. Following is a monthly summary of the data from this gauge site. The statistics shown here are based on data gathered from USGS Water Supply Papers published from 1927 through 1989:

Table 15
Monthly Streamflow Statistics for Gila River below Blue Creek, near Virden, New Mexico
1928-1978, 1981-89

Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	209	64	1390
February	293	61	1280
March	387	45	1460
April	255	28	1140
May	141	14	907
June	45	4.4	183
July	81	4.9	366
August	221	9.4	1160
September	194	4.9	1510
October	170	5.4	1670
November	107	35	520
December	186	48	1800
Annual	190	43	640

Gila River Near Clifton, Arizona. USGS gauge measurements in this reach of the Gila River were initially recorded under the name "Gila River near Guthrie" from November 6, 1910 through July 11, 1918, and were cited as such in previous sections of this report. This gauge site is approximately 4 miles farther upstream than the gauge location known as "Gila River

Near Clifton, Arizona," which is approximately 6 miles upstream from the confluence with the San Francisco River. Data presented in the USGS Water-Resources Investigations Report 91-4041 titled "Basin characteristics and Streamflow Statistics in Arizona as of 1989" (USGS, 1991) combines the data from the Guthrie gauge with that of the Clifton gauge to form an equivalent gauge record.

Table 16
Monthly Streamflow Statistics for Gila River near Clifton, Arizona (Guthrie)
1912-1917, 1929-33, 1949-89

Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	258	43	1360
February	324	24	1670
March	396	21	1770
April	249	12	1690
May	121	12	874
June	41	9.4	171
July	121	13	934
August	234	17	898
September	191	8.2	1210
October	194	8.7	1750
November	111	11	564
December	237	17	2390
Annual	206	43	930

Gila River at Head of Safford Valley, Near Solomon, Arizona. This USGS gauge site was established April 21, 1914 in nearly the same location as exists today. The gauge site is located below the intake to the Brown Canal, so discharge in the canal is added to the gauge site discharge value (the maximum discharge of the Brown Canal is reported to be approximately 25 cfs). The statistical results presented in the following table do not include data recorded from 1914 through 1920. No explanation for this omission was apparent, nor is one given in the USGS documentation (UGSG, 1991).

Table 17 Monthly Streamflow Statistics for Gila River at Head of Safford Valley, Near Solomon 1921-1933, 1936-1989			
Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	490	93	3370
February	680	103	3870
March	801	82	3380
April	568	64	2780
May	291	38	2040
June	100	20	388
July	218	44	735
August	528	66	2500
September	392	36	2080
October	403	40	7450
November	240	49	2230
December	494	60	5800
Annual	433	101	1680

Gila River at Safford, Arizona. The Gila River at Safford gauge site was operated from 1941 through 1946, and then from 1957 through 1965. This site in located at the downstream end of the Upper Gila River study reach.

Table 18 Monthly Streamflow Statistics for Gila River at Safford 1941-1946, 1957-1965			
Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	445	74	2040
February	458	27	2170
March	491	13	2660
April	337	4.7	1680
May	154	0.13	1560
June	15	0.00	130
July	94	5.6	442
August	428	11	1660
September	380	16	1180
October	194	0.16	1180
November	139	0.28	403
December	288	1.3	1400
Annual	284	87	1120

San Francisco River

San Francisco at Alma, New Mexico. This USGS gauge site is located upstream of the Arizona/ New Mexico border and is representative of flow at the upper end of the San Francisco River study reach. The history, and other information for this station were provided in the "Pre-Statehood Hydrology" and "Statehood Hydrology" sections of this chapter.

Table 19
Monthly Streamflow Statistics for San Francisco River near Alma, New Mexico
1904-1907, 1909-1912

Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)	Estimated Maximum Flow Depth (Feet)
January	245	43	2001	0.8
February	339	110	1498	0.8
March	508	103	1430	1.1
April	393	171	719	1.2
May	84	45	187	0.6
June	13	2.4	31	1.7
July	40	2.0	502	0.5
August	89	14	931	0.7
September	76	15	712	0.7
October	34	19	132	0.5
November	59	16	201	0.7
December	134	28	942	0.8
Annual	168	44	774	0.8

San Francisco River at Clifton, Arizona. This USGS gauge site is located near the midpoint of the San Francisco River study reach, downstream of the confluence with the Blue River. The history, and other information for this station are provided in the "Pre-Statehood Hydrology" and "Statehood Hydrology" sections of this chapter.

Table 20
Monthly Streamflow Statistics for San Francisco River at Clifton, Arizona
1914-1915, 1917, 1928-1933, 1936-1989

Month	Average Monthly Discharge (cfs)	Average Monthly Min. Discharge (cfs)	Average Monthly Max. Discharge (cfs)
January	240	37	1590
February	314	39	1630
March	418	44	2140
April	328	36	2250
May	155	24	1240
June	53	11	178
July	107	29	657
August	204	41	1360
September	149	22	816
October	246	23	4290
November	116	28	1450
December	255	34	2450
Annual	215	42	937

Summary

Streamflow data gathered for the Upper Gila and San Francisco River study reaches, summarized in the previous paragraphs indicate the following:

- The Upper Gila River is a naturally perennial stream. The average annual discharge for the Upper Gila River varies from about 200 cfs to 430 cfs in the study reach.
- The San Francisco River is a naturally perennial stream. The average annual discharge for the San Francisco River varies from about 90 cfs to 215 cfs.
- The minimum monthly average flow (range: 15 to 100 cfs) for the Upper Gila River study reach occurs in June, as does the average minimum flow (0.0 cfs to 20 cfs).
- The minimum monthly average flow (range: 13 cfs to 53 cfs) for the San Francisco River study reach occurs in June. The average minimum flow (2.0 cfs to 11 cfs) occurs in June and July.

Flow duration data represent the percent of time a given flow rate was equaled or exceeded. For example, a 90% flow rate of 200 cfs indicates that 90 percent of the time, the flow rate will be greater than 200 cfs; a 50% flow rate of 500 cfs means that more than half of the time the flow rate exceeds 500 cfs. Table 21 presents flow duration estimates reported by the USGS (1991) at gauge stations near the Upper Gila and San Francisco River study reaches.

Table 21
Duration Table of Daily Mean Flow for Period of Record

Gauge	1%	10%	20%	50%	80%	90%	99%
Gila River near Virden, NM	1,760	404	214	91	43	21	3.3
Gila River near Clifton, AZ	2,010	455	230	80	28	18	9
Gila River at Head of Safford Valley, Near Solomon, AZ	3,970	932	456	174	91	62	29
Gila River at Safford, AZ	3,480	694	322	66	7.9	0.52	0.00
San Francisco River at Clifton, AZ	2,120	417	208	76	45	34	18

Source: (Garret & Gellenbeck, 1991)

Average flow statistics are required to estimate the average flow depth, velocity, and width for the study reaches. The long-term average flow rates for the Upper Gila River and the San Francisco River are shown in Table 22.

Table 22
Long-Term Flow Statistics for the Upper Gila River and the San Francisco River

Reach	Median (50%) Flow (cfs)	Average Annual Flow (cfs)	Average Annual Minimum Flow (cfs)
Upper Gila River	66-174	190-433	43-101
San Francisco River	32-76	90-215	42-44

It is noted that both the San Francisco River, and the Upper Gila River between Duncan and the Head of Safford Valley, experience increasing average annual discharges in the downstream direction (a "gaining stream"). Records indicate that the Gila River in the reach between the Head of Safford Valley and Safford experiences decreasing average annual discharges (a "losing stream"). This could be attributable to several factors or a combination of factors, including the following:

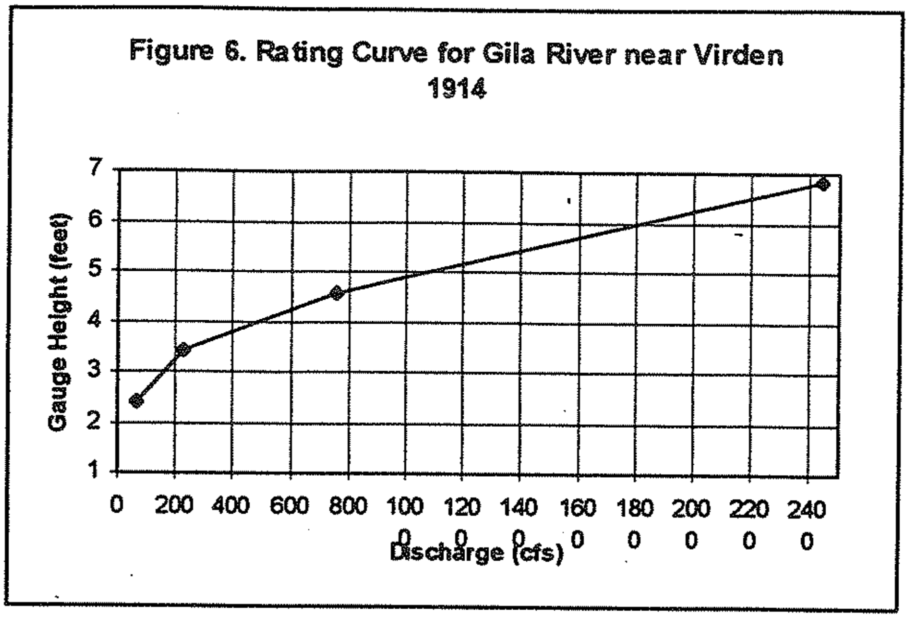
- Shorter period of record for the Gila River at Safford station (25 years).
- Large irrigation diversions in the Safford Valley.
- Increased natural stream channel losses downstream from where the river emerges from the relatively narrow canyon with shallow bedrock near the head of the Safford Valley.

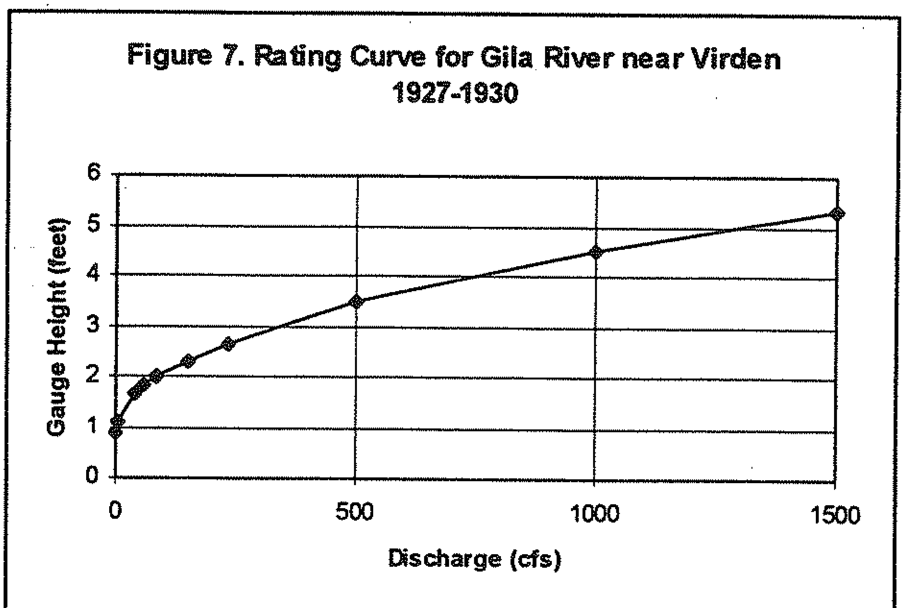
In addition, it is noted that the average annual discharge rates at all gauge locations are equaled or exceeded only approximately 20% of the time (Compare Tables 15-20 with Table 21). This is due to a wide gap between base flow conditions and the annual peak floods. That is, floods account for a significant portion of the average annual runoff volume. For example, the 90% flow rate which is considered by some agencies to represent the base flow rate, varies from 0.52 cfs to 62 cfs on the Upper Gila River (average annual flow = 190-433 cfs), and is approximately 34 cfs on the San Francisco River at Clifton (average annual flow = 90-215 cfs). Similarly, the median flow rate (50%) is measurably smaller than the average annual flow rate for both rivers (Table 22). Therefore, it may be prudent to base decisions regarding susceptibility to year-round (vs. seasonal) navigation on the median or base flow rates, rather than the average annual flow rates.

Hydraulic Rating Curves

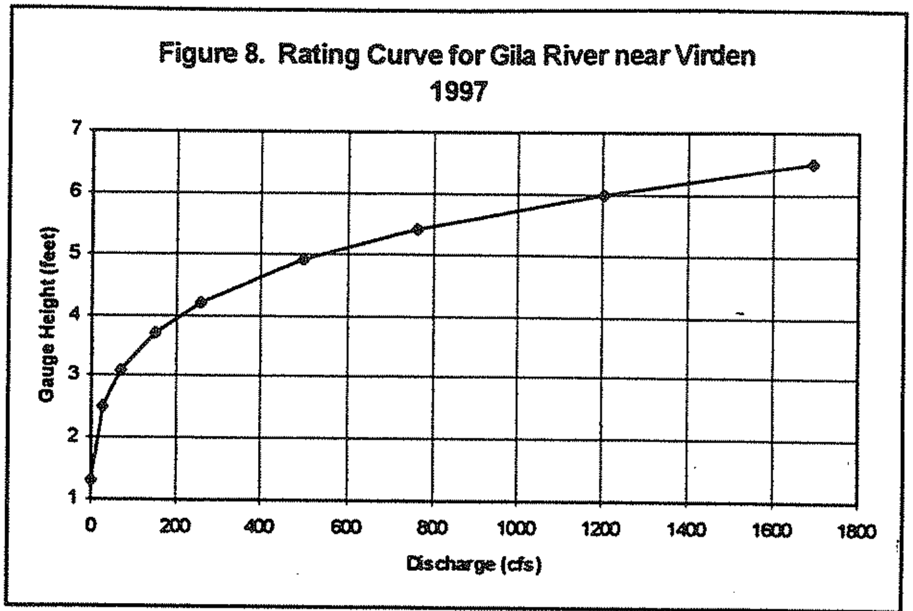
A collection of hydraulic rating curves were assembled for both pre-statehood (or near statehood) conditions and current conditions. Except for the hydraulic rating curves for the "Gila River near Virden" site for 1927-1930, and the "San Francisco River at Clifton" site for 1946-1948, all historic rating curves shown below were developed from the actual USGS gauge records (including discharge measurements), and not from historic hydraulic rating curves found during the data collection effort. The current hydraulic rating curves dated 1997 for all gauges were obtained from the USGS Water Resources Division in Tucson, Arizona. No historic hydraulic rating curves were available for the Gila River at Safford gauge site, nor were any published or unpublished stage discharge data available for this site from which an accurate hydraulic rating could be developed.

Gila River near Virden





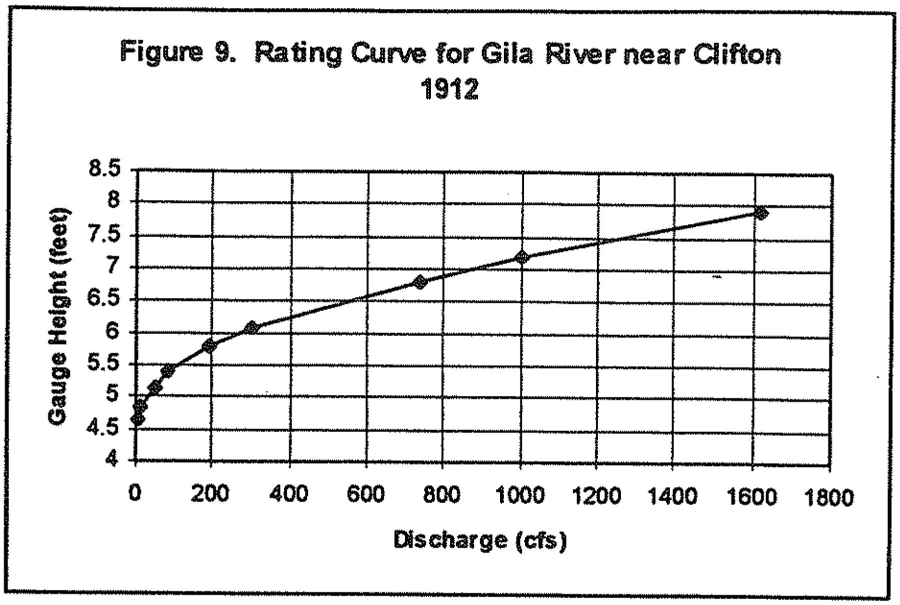
Source: (USGS, 1930)

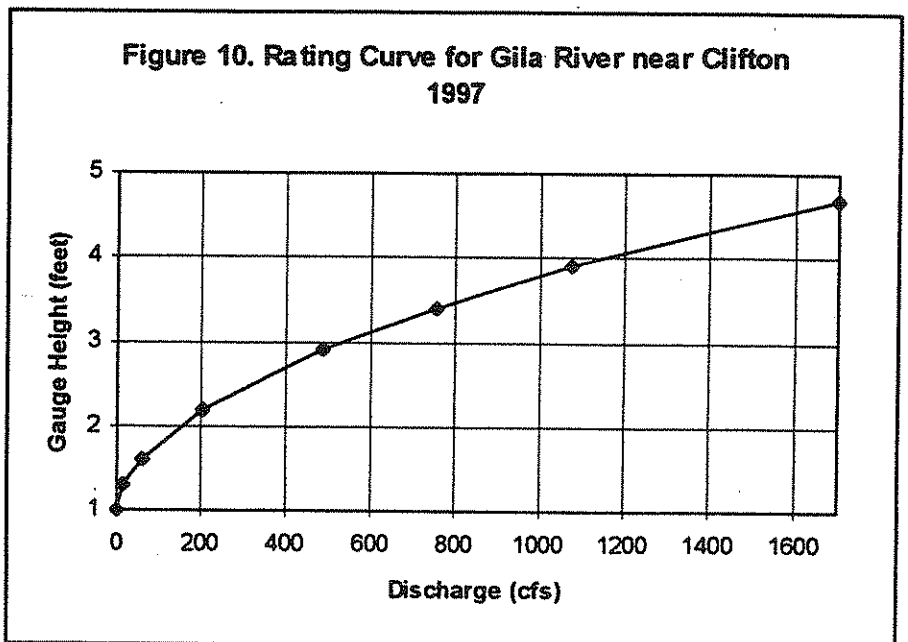


Source: (USGS, 1997)

The rating curve shown in Figure 6 for the Gila River near Virden is actually for a historic station located nearer to Duncan, but the published gauge record calls it "near Virden," using the same name as the existing USGS gauge. In general, however, in comparing the 1927-1930 rating curve to the 1997 rating curve, it appears that the channel may have become somewhat deeper between 1930 and 1997. For example, a discharge of 600 cfs on the 1927-1930 rating curve corresponds to a flow depth of approximately 2.7 feet deep, whereas the same discharge on the 1997 rating curve corresponds to a flow depth of approximately 3.8 feet deep, a difference of about one foot at 1000 cfs. This difference could be result of a system-wide adjustment, or a local short-term fluctuation in the elevation of the sand-bed channel.

Gila River near Clifton

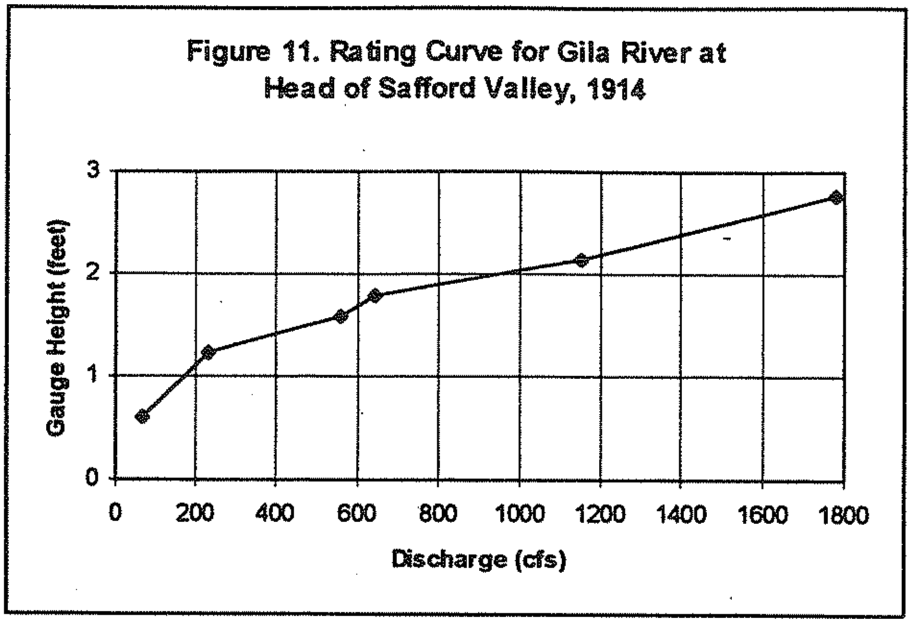


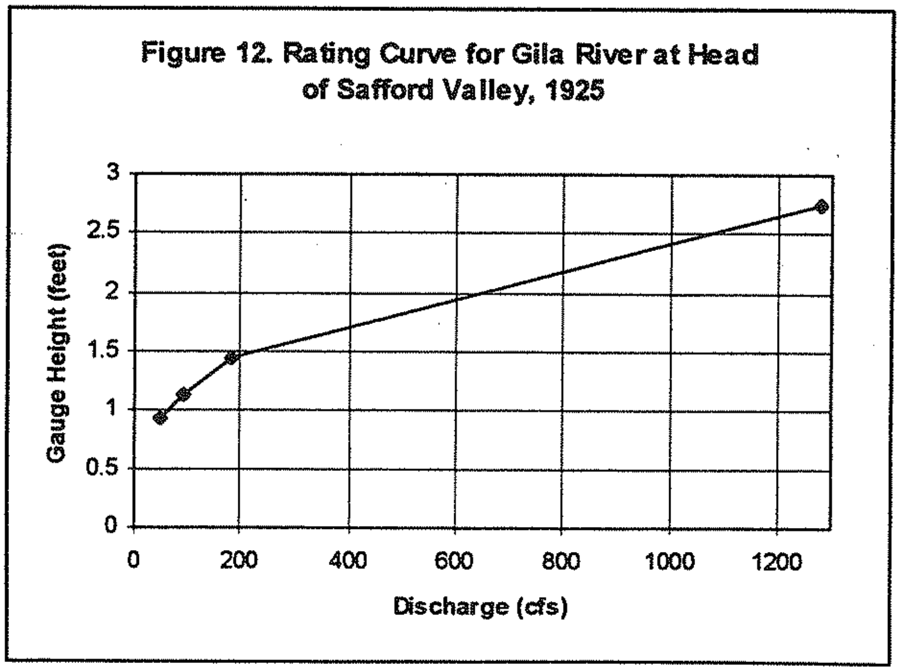


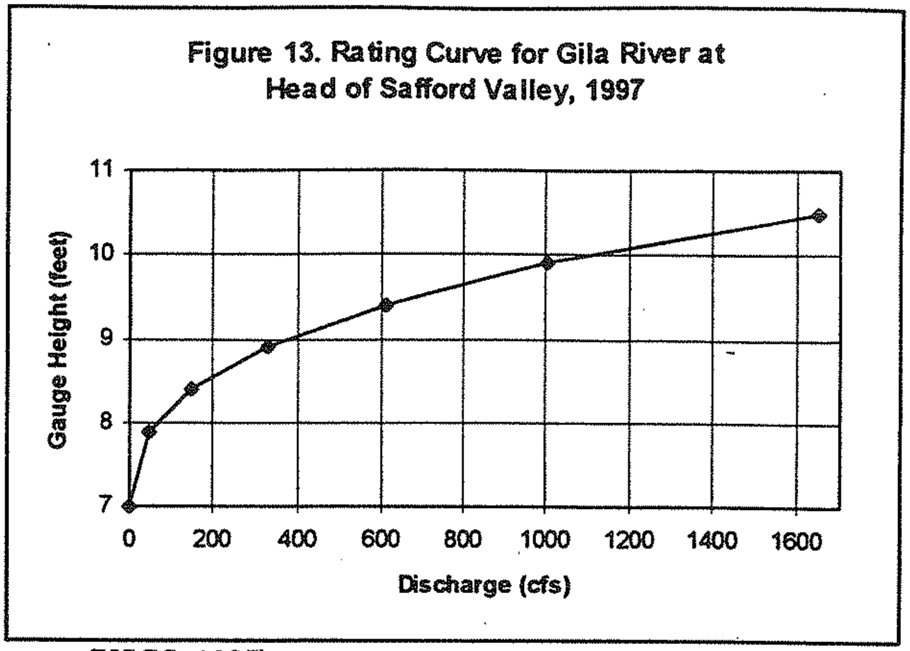
Source: (USGS, 1997)

Comparing the rating curves in Figures 9 and 10 for the Gila River near Clifton shows that at 600 cfs and 1000 cfs, the depths do not vary by more than about 0.2 foot. Therefore, it may be assumed that the low-flow channel geometry has not changed significantly since the time of statehood for the reach of the Upper Gila River near Clifton.

Gila River at Head of Safford Valley, Near Solomon







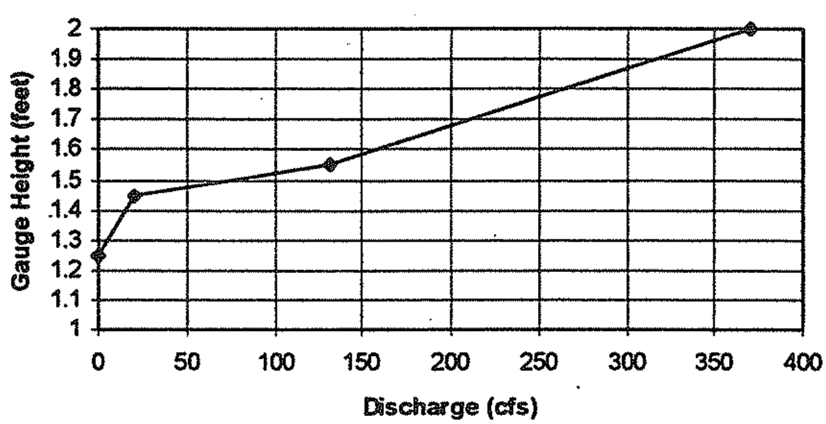
Source: (USGS, 1997)

The earliest rating curve for the Gila River at Head of Safford Valley stream gauge (i.e., 1914) corresponds to a gauge location which is approximately 0.4 mile farther downstream from where the existing gauge is located. The channel widens considerably in the 0.4 mile reach between the current gauge location and the 1914 gauge location. A comparison of a 1925 rating curve to the current rating curve reveals little difference in the flow depths at the same discharges. In 1925, the gauge location was the same as for 1914. This rating curve shift could be evidence of channel incision related to a local short-term perturbation or a long-term trend; the gauge data alone is not sufficient to draw conclusions regarding historical channel adjustments.

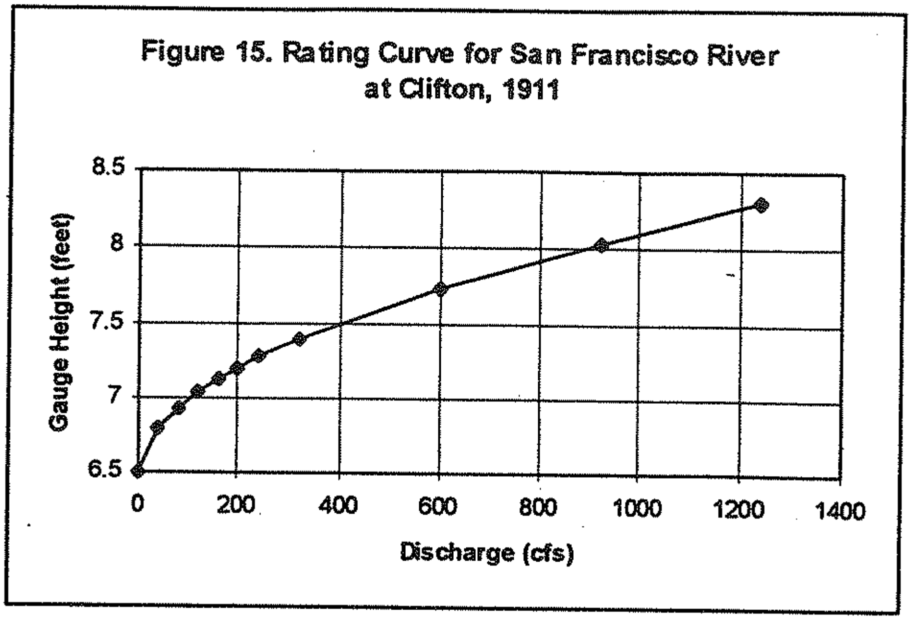
San Francisco River near Alma

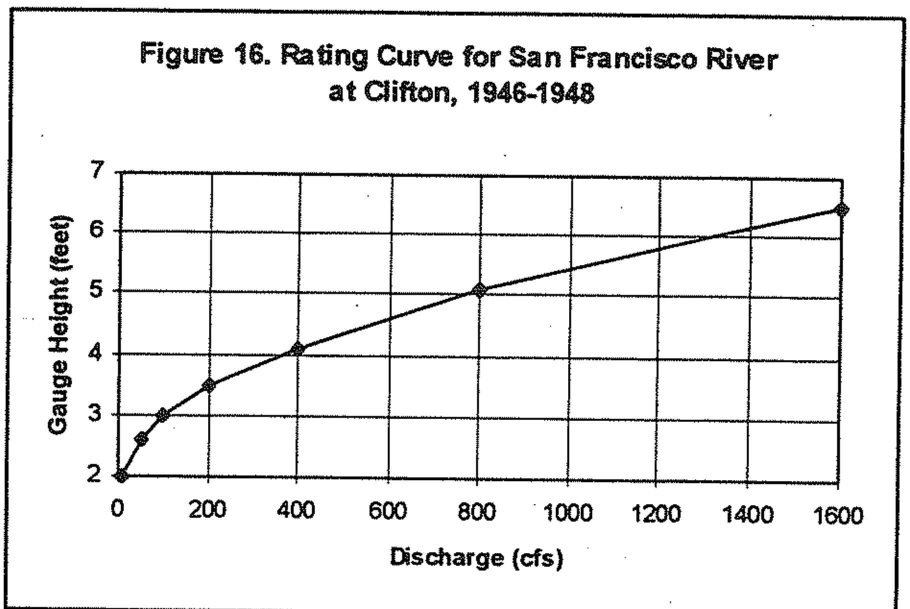
Other than the published gauge record itself, no other notes or documentation were found which record historic channel geometry at the Alma, New Mexico gauge location. The rating curve shown in Figure 14 is based on assumptions made from an assortment of USGS discharge measurements.

Figure 14. Rating Curve for San Francisco River near Alma, 1910



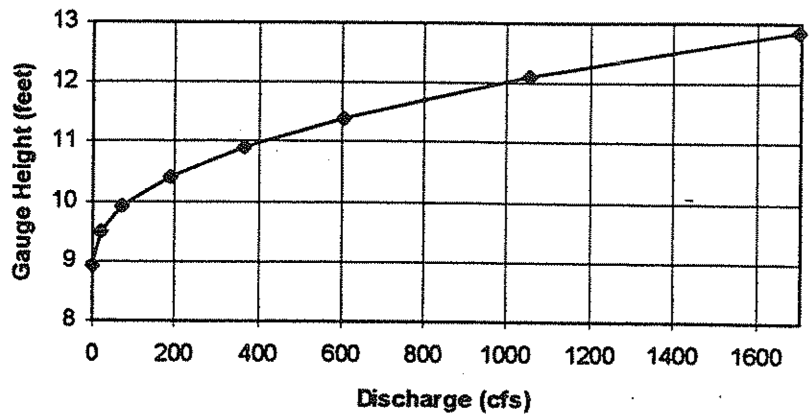
San Francisco River near Clifton





Source: (USGS, 1948)

Figure 17. Rating Curve for San Francisco River at Clifton, 1997



Source: (USGS, 1997)

A comparison of the three rating curves for the San Francisco River at Clifton (Figure 15-17) reveals that at 600 cfs and 1000 cfs, the earlier channel flowed at about half the depth of the 1946-1948 and the current channel, indicating that some degree of channel incision may have occurred.

Average Flow Characteristics

Table 23 summarizes flow characteristics estimated from the published streamflow data, USGS discharge measurement notes, and the hydraulic rating curves shown in Figures 6-17. In almost every case, low flow characteristics were calculated using unpublished USGS discharge notes which include flow width, area and velocity data. Usually, in these cases, there were a large number of data points at low flow rates, and fewer discharge measurements which fell within 10 percent of the average annual discharge. As a result, low-flow characteristics are considered the most accurate of those contained in Table 23.

To determine the flow characteristics at the 2-year flood and at the 5-year flood, the most recent USGS rating curve for each gauge location was used for maximum depth. The average depth was then estimated using historic cross-sections where available, and the velocity was determined by dividing the discharge by the cross-sectional flow area.

Table 23 Upper Gila River and San Francisco River Flow Characteristics				
Recurrence Interval	Discharge (cfs)	Hydraulic Depth (ft)	Average Velocity (ft/sec)	Top Width (ft)
Gila River Near Virden, NM (Source data: Cross Section, USGS, 1931)				
90 % Flow	21	0.6	1.3	27
Median (50%) Flow	91	0.9	2.2	45
Mean Annual Flow	190	1.2	1.6	100
2-Year Flood	4,980	5.5	8.5	107
5-Year Flood	10,400	7.5	12.6	110
Gila River Nr. Clifton/Guthrie, AZ (Source data: USGS Discharge Measurements, 1930, 1939, 1940, 1950)				
90 % Flow	18	0.7	1.0	26
Median (50%) Flow	80	1	1.7	47
Mean Annual Flow	206	1.3	2.5	64
2-Year Flood	5,940	3.7	11.5	140
5-Year Flood	11,500	5.5	14	150
Gila River at Head of Safford Valley, Near Solomon, AZ (Source Data: Cross Section, USGS, 1941)				
90 % Flow	62	0.8	0.5	144
Median (50%) Flow	174	1.3	0.9	146
Mean Annual Flow	433	1.9	1.5	150
2-Year Flood	9,400	6.7	8.8	160
5-Year Flood	22,900	11	11.6	180
Gila River at Safford, AZ (Source Data: Cross Section, USGS, 1942)				
90 % Flow	.52	0.1	0.4	12
Median (50%) Flow	66	1.3	0.9	55
Mean Annual Flow	284	2.6	1.5	75
2-Year Flood	8,230	4.0	5.1	400
5-Year Flood	13,500	5.0	5.4	500
San Francisco River at Clifton (Cross Section, USGS, 1931, and Discharge Measurements, USGS, 1910, 1913-14, 1915, 1917, 1918, 1928, 1929, 1940, 1950, 1960)				
90 % Flow	34	0.9	1.4	28
Median (50%) Flow	76	1.0	1.6	49
Mean Annual Flow	215	1.2	2.5	72
2-Year Flood	6,800	4.5	10.1	150
5-Year Flood	17,800	8.5	13.7	153

Federal criteria of minimum flow conditions necessary for navigation of various recreational craft (ASLD, 1997) are presented in Tables 24 and 25. Minimum stream conditions determined by the U.S. Fish and Wildlife Service are summarized in Table 24.

Minimum and maximum conditions are summarized in Table 25.

Table 24

Minimum Required Stream Width and Depth for Recreation Craft

Type of Craft	Depth (ft.)	Width (ft.)
Canoe, Kayak	0.5	4
Raft, Drift Boat, Row Boat	1.0	6
Tube	1.0	4
Power Boat	3.0	6

Source: US Fish and Wildlife, 1978

Table 25

Minimum and Maximum Conditions for Recreational Water Boating

Type of Boat	Minimum Condition			Maximum Condition		
	Width	Depth	Velocity	Width	Depth	Velocity
Canoe, Kayak	25 ft.	3-6 in.	5 fps	-	-	15 fps
Raft, Drift Boat	50 ft.	1 ft.	5 fps	-	-	15 fps
Low Power Boating	25 ft.	1 ft.	-	-	-	10 fps
Tube	25 ft.	1 ft.	1 fps	-	-	10 fps

Source: Cortell and Associates, 1977

From the data summarized in Tables 24 and 25 and flow characteristics of the Upper Gila and San Francisco Rivers shown in Table 23, the following conclusions can be drawn:

- Fifty percent of the time, the hydraulic characteristics in the reaches represented by the USGS gauge locations (except for Gila River near Virden) have sufficient average width and depth characteristics to accommodate all forms of recreational water craft listed in Tables 24 and 25 except for power boats.

- Ninety percent of the time there would be sufficient width and depth at all USGS gauging stations, except for the Safford gauge, to accommodate use of a kayak or canoe.

- None of the reaches represented by the USGS gauge locations exhibited sufficient average velocities to be considered dangerous or impracticable for recreational boating until the 2-year flood flow is reached. Modern boating records indicate that these reaches are currently boated at these flow rates.

It is important to note that the flow characteristics presented in Table 23 represent average conditions at discrete points along the study reaches. There is no doubt that there will be reaches which have obstacles such as broad shallow areas, sand bars, rapids and irrigation diversions which, at certain discharges, will have significantly different flow characteristics. These conditions may, in some cases, preclude or at least hinder use by any boat, especially for travel in the upstream direction.

<u>Summary</u>

The rating curves presented in this section reveal little conclusive evidence regarding long-term low-flow channel characteristics, other than that no large-scale changes or trends are apparent. The rating curves do vary over time, however, and reveal that the low-flow channel is prone to shifting. This is confirmed by numerous published USGS gauge descriptions which include references to shifting low-flow channel conditions at most of the gauge locations. This condition is also revealed in numerous unpublished USGS rating curves, where the curves vary significantly at the lower discharges (i.e., less than 1000 cfs) over two and three year periods as a response to shifting low-flow channel conditions.

The depth of flow associated with the long-term average annual flow rate on the Upper Gila River at the gauge stations listed in Table 23 is estimated to vary from approximately 1 foot to 2.5 feet deep. Similarly, the associated velocities are estimated to vary between approximately 1.5 feet per second and approximately 2.5 feet per second, and the top widths are estimated to vary between approximately 64 feet and 140 feet. On the San Francisco River at Clifton, the flow conditions for the average annual flow rate are estimated to be approximately 1.2 feet deep with an estimated velocity of approximately 2.5 feet per second and a top width of approximately 72 feet.

Since the average annual discharge rates are only equaled or exceeded 20% of the time on the Upper Gila River and the San Francisco River, the average annual discharge rate may not be a representative of "typical" flow conditions as the median (50%) flow rate and the 90% flow rate. The latter flow rates give a truer indication of how often the Upper Gila and the San Francisco rivers are susceptible to certain types of navigation. Based on the long-term gauge record, which demonstrates highly variable flow rates on an annual basis, the Upper Gila River and the San Francisco River would have been susceptible to navigation by low-draft floating boats such as canoes, rafts, kayaks, flatboats, or inflatables, on a seasonal basis or opportunistically in response to brief periods of higher flow, as of the time of statehood.

Floods

The Upper Gila and the San Francisco Rivers, like most rivers in Arizona, experience a wide range of discharge rates, from seasonal dry or near-dry conditions to floods with peak discharges greater than 100,000 cubic feet per second (cfs). Flood discharge rates based on long-term records are listed for various recurrence intervals at various key concentration points in Table 26 .

Table 26
Peak Discharge Estimates at USGS Gauges (cfs)

Gauge	2-Year 50%	5-Year 20%	10-Year 10%	25-Year 4%	50-Year 2%	100-Year 1%
Gila River near Virden	4,980	10,400	15,200	22,900	29,900	37,900
Gila River near Clifton	5,940	11,500	16,800	26,100	35,400	47,000
Gila River at Head of Safford Valley, near Solomon	9,400	22,900	38,000	66,900	98,000	140,000
Gila River at Safford	8,230	13,500	17,700	24,100	29,700	35,900
San Francisco River at Clifton	6,800	17,800	30,000	53,100	77,200	109,000

Source: (USGS, 1991)

Table 27 summarizes some of the largest historic floods recorded at various gauging locations in and near the study reaches of the Upper Gila River and the San Francisco River.

Table 27
Historical Flood Peak Discharge Estimates at USGS Gauges (cfs)

Gauge	Discharge	Date
Gila River near Virden	58,700 41,700	December 19, 1978 September 29, 1941
Gila River near Clifton	57,000 48,800	December 19, 1978 December 29, 1984
Gila River at head of Safford Valley, near Solomon	132,000 100,000 100,000	October 2, 1983 December 19, 1978 January 19, 1916
Gila River at Safford (1940-1965)	33,000 23,900	September 30, 1941 January 14, 1949
San Francisco River near Glenwood	37,100	October 2, 1983
San Francisco River at Clifton	90,900 70,000* 65,000* 60,000* 65,000*	October 2, 1983 December 3, 1906 November 27, 1905 January 10, 1905 February 21, 1891

* Discharge is an isolated historic peak, not part of the systematic record.
Data Source: (USGS, 1991)

Table 26 indicates that the San Francisco River experienced a series of large floods prior to statehood at a frequency that has not been seen since statehood, three separate flood events greater than 60,000 cfs in a two year period, and four separate flood events greater than 60,000 cfs in a 15 year period. Since statehood, however, the San Francisco River at Clifton has experienced five floods with discharges greater than 55,000 cfs.

The greatest recorded peak discharges on the Upper Gila River between Safford and the state line near Duncan occur at the point where the river emerges from a relatively narrow canyon at the head of the Safford valley. It should be noted that the flood peaks listed for Safford on Table 26 do not give a complete flood history, compared to the other gauge locations because of the relatively shorter flow record at Safford. A quick comparison between the annual peak discharges at Safford and those at the head of the Safford Valley reveals that there is little flood peak attenuation in the 15 miles between the two gauge locations. On average, for years in which both gauges have their annual peak discharges recorded on the same day (12 years total), the discharge was approximately six percent less at Safford than at the head of the Safford Valley.

Summary

The Upper Gila and San Francisco Rivers are perennial streams which, except for numerous irrigation diversions, have remained free-flowing since they were first settled in the 1870's. Flow rates within the study reaches probably have not changed significantly since the time of statehood. River flows have been reliable enough over the past 120 years to support irrigation-based agriculture in the Duncan Valley at the upstream end of the Upper Gila River reach, as well as a more extensive irrigation-based farm economy in the Safford Valley downstream of the study area.

Long-term median (50%) flow rates for the Upper Gila River vary from about 66 cfs to 174 cfs between the Arizona/ New Mexico border and Safford. The long-term median flow rate for the San Francisco River varies from about 32 cfs to 76 cfs between the Arizona/ New Mexico border and the Gila River confluence. The long-term flow record demonstrates that the Upper Gila River and the San Francisco Rivers are susceptible to wide seasonal and annual variations in discharge rates.

Typical lowest seasonal flows on the Upper Gila River vary from 0.0 cfs to approximately 20 cfs. The average low flow discharge rates correspond to average flow depths of about 0.5 foot and flow widths less than 40 feet. On the San Francisco River, the lowest seasonal flow, which averages 11 cfs during the month of June, would correspond to an average depth of less than 0.4 foot, and a typical channel width less than about 20 feet. Portions of both the Upper Gila River and the San Francisco River are known to have become dry periodically in certain reaches, although a dry riverbed occurs more frequently on the San Francisco River. It is difficult to determine if these rivers would have experienced no-flow days prior to the advent of large-scale irrigation diversions, due to the lack of flow records that pre-date the irrigation diversions, and the fact that all of the flow in the Gila River is fully appropriated. Furthermore, the combined pre-statehood irrigation diversion capacity was greater than the average annual flow rate of the Upper Gila River during the peak irrigation, which corresponds to the seasonal low flow period.

It is likely that the San Francisco River at and near Clifton may have experienced periods of no flow even without irrigation diversions. The early records for this gauge indicate that the diversions that occurred took place far upstream (in New Mexico), and probably had little effect on discharges recorded at Clifton. Based on the currently available information, it is likely that under natural conditions the upper Gila River would have rarely had no-flow days, but it most certainly would have experienced prolonged periods of low flow in certain reaches during June and July.

According to various federal agency criteria for recreational use of water crafts, and according to long-term gauge records, which demonstrate highly variable flow rates on an annual basis, the Upper Gila River and the San Francisco River would have been susceptible to navigation by low-draft boats on a seasonal basis. Nevertheless, kayaks and canoes could have navigated some portions of the Upper Gila River and the San Francisco River during the lowest flow months, as well as during flows up to approximately the 5-year discharge event. Neither the Upper Gila River nor the San Francisco River would have been susceptible to reliable navigation by larger boats such as powered barges, steamboats, or keel boats, due to the occurrence of rapids, high velocities, long narrow canyons with no access to safe landings, and natural and man-made obstructions such as riffles, waterfalls, and irrigation diversion structures.

Given the criteria for navigability established by HB 2589, the hydrologic record for the Upper Gila and San Francisco Rivers indicates the following:

- **Perennial.** The Upper Gila and San Francisco Rivers are perennial, with a median flow rate ranging from about 32 cfs on the San Francisco River at the New Mexico border to 174 cfs at Safford.

- **Types of Boats**. At the median discharge rates, flow depths, widths, and velocities of about 1 feet, 50 feet, and 2 feet per second may be expected. These river conditions are susceptible to boating using canoes, kayaks and small inflatable boats. Large high-draft boats could not be used in these conditions.

- **Statehood**. For the year of statehood, 1912, the average annual flow rate was about 190 cfs, making it a below average year of flow. The average flow rate for the month of February 1912 was about 60 cfs, less than 20% of the monthly average. Flow rates of about 60 cfs would result in average channel depths of less than 1 foot in most reaches of the Upper Gila and San Francisco Rivers. These low flow rates and depths would have made almost all types of boating tedious. Use of keelboats, steamboats, and powered barges would not have been possible in these conditions.

- **Diversions**. Diversions were made from the Upper Gila River to irrigate and reclaim land. Many of these diversions were established prior to the time of statehood.

- **Obstructions**. More than 40 diversion dams or irrigation head gates had been constructed on the Upper Gila and San Francisco Rivers as of the time of statehood. These dams could have created impediments to certain types of navigation.

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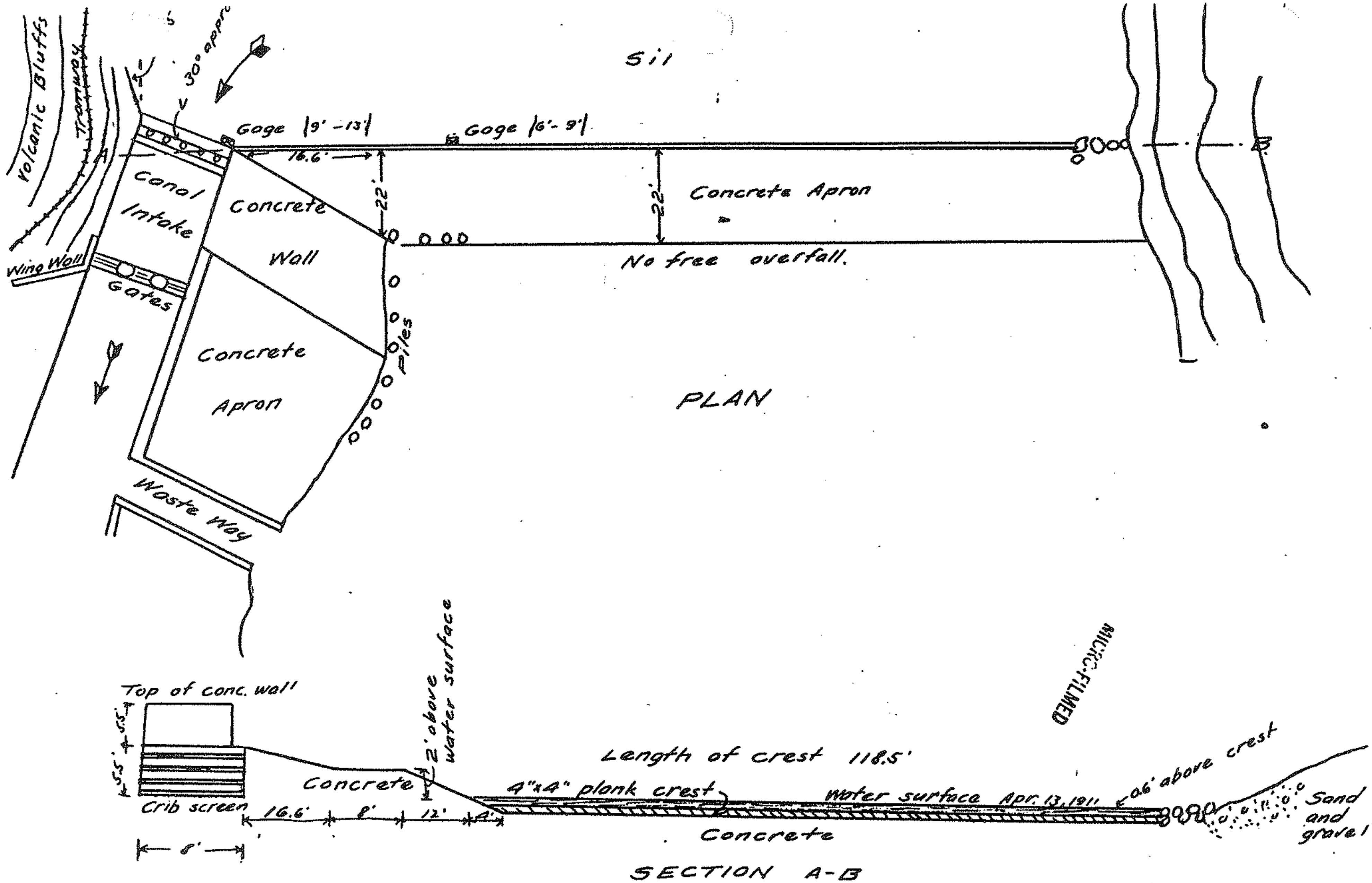
APPENDIX A

Arizona Copper Company Diversion Dam on the San Francisco River near Clifton, Arizona



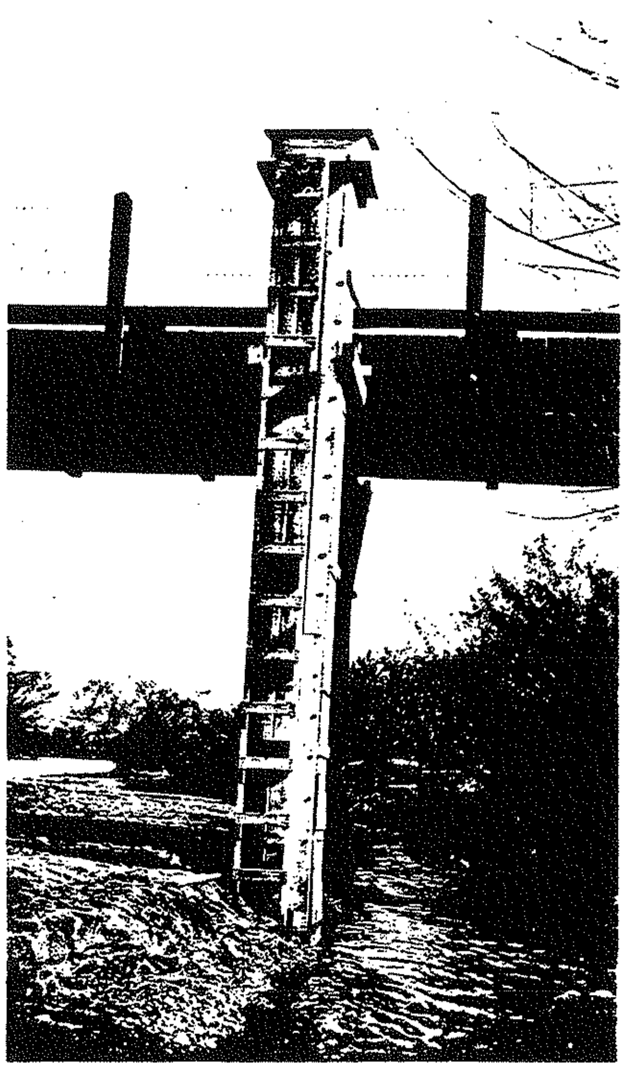
SKETCH OF A. C. CO. DAM, CLIFTON, ARIZ.

APPENDIX B

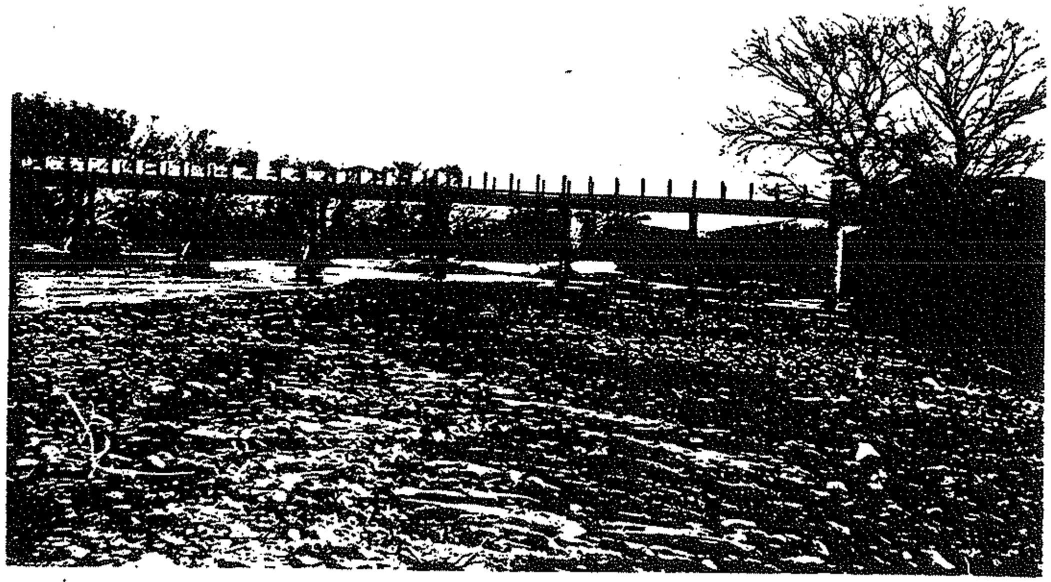
Gila River at Virden Bridge near Duncan, Arizona
Supplement to Station Description

Discontinued

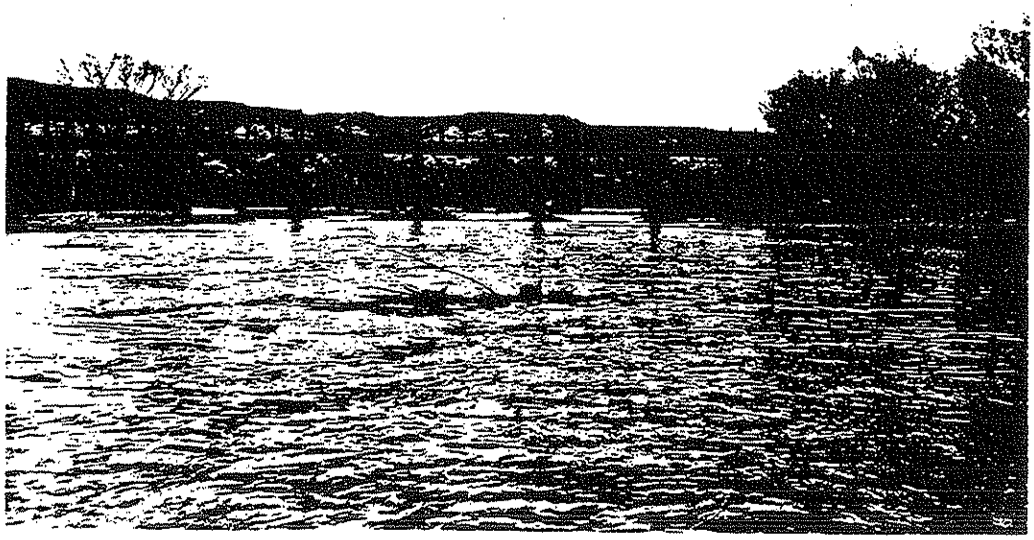
Gila River at Virden Bridge near Duncan, Arizona.
Supplement to Station Description. June 3, 1931.



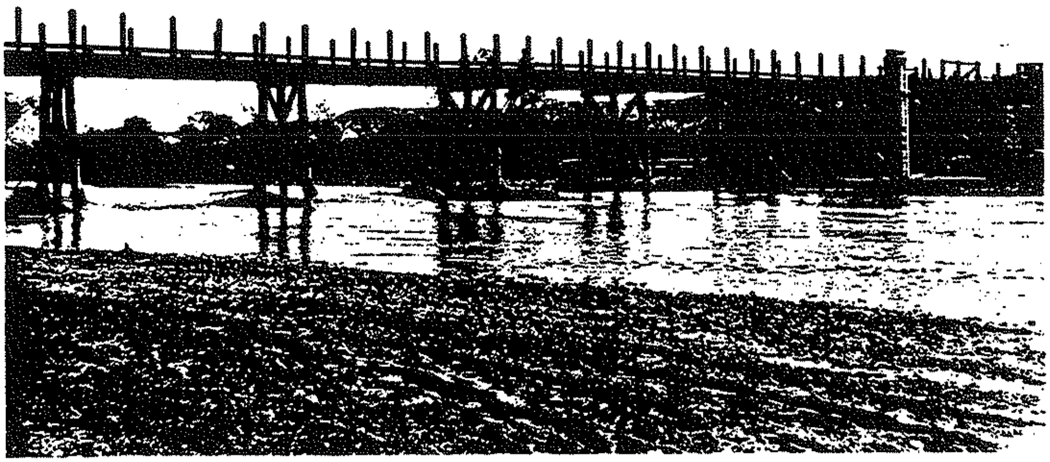
Close-up of gage well showing main details
and small channel past gage. December 2, 1930.



View looking upstream showing channel past gage and bridge from which measurements are made. Only a small stream flows past the gage at present. December 2, 1930.



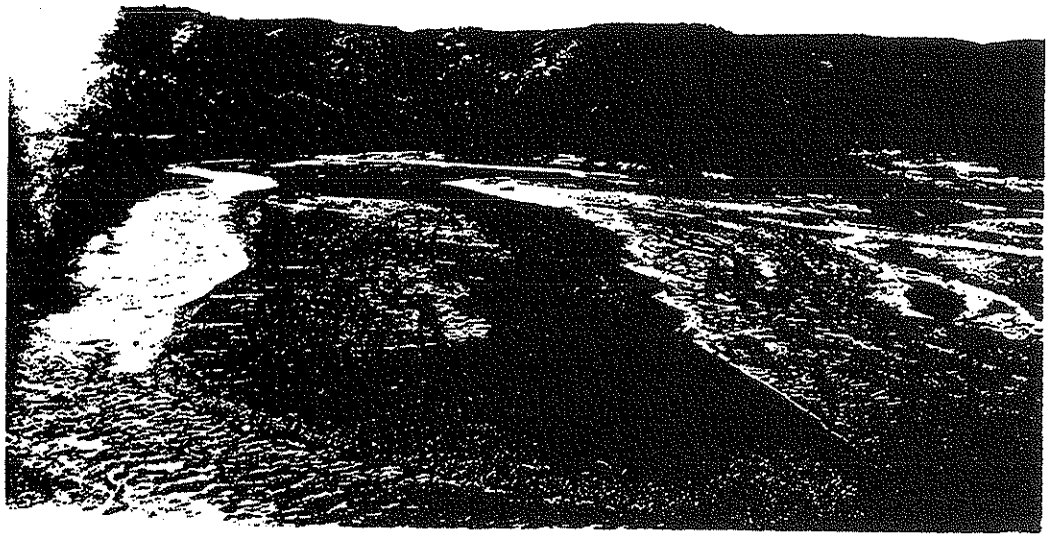
View looking downstream showing channel past gage, which can be seen at left of picture. December 2, 1930.



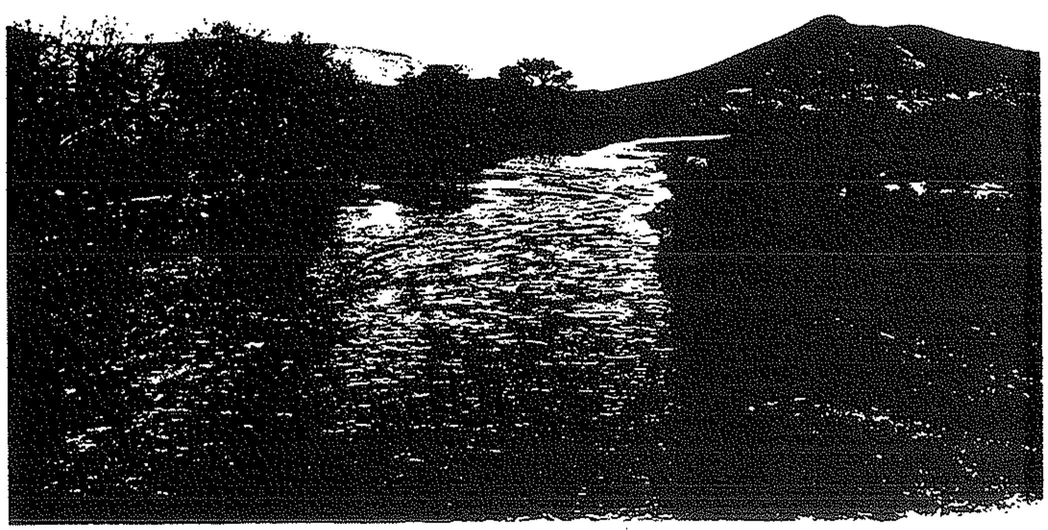
View from right side looking upstream and across towards gage. A small channel flows past the gage. December 2, 1930.

General view of Virden Bridge from left side. Gage can be seen at right of middle part of picture. Main channel is beyond gage. December 20, 1930.

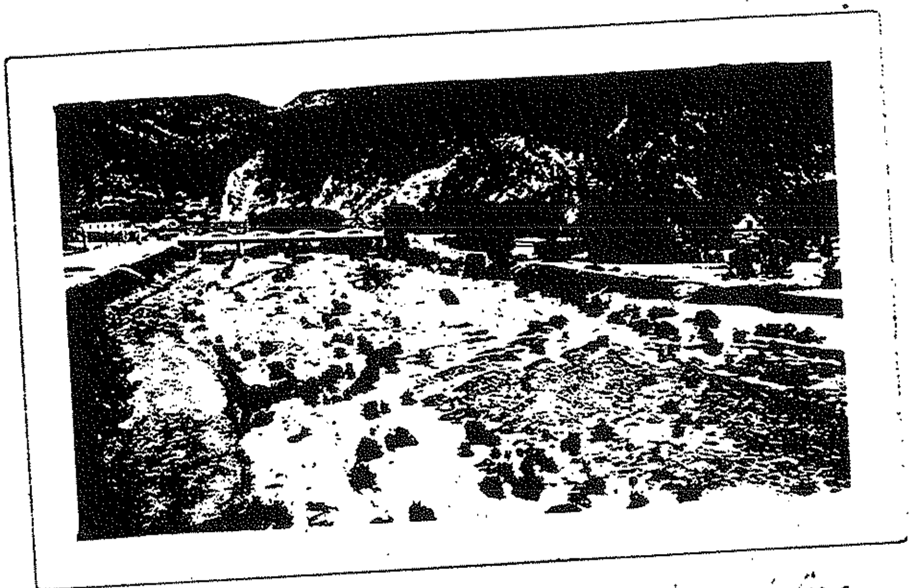
1



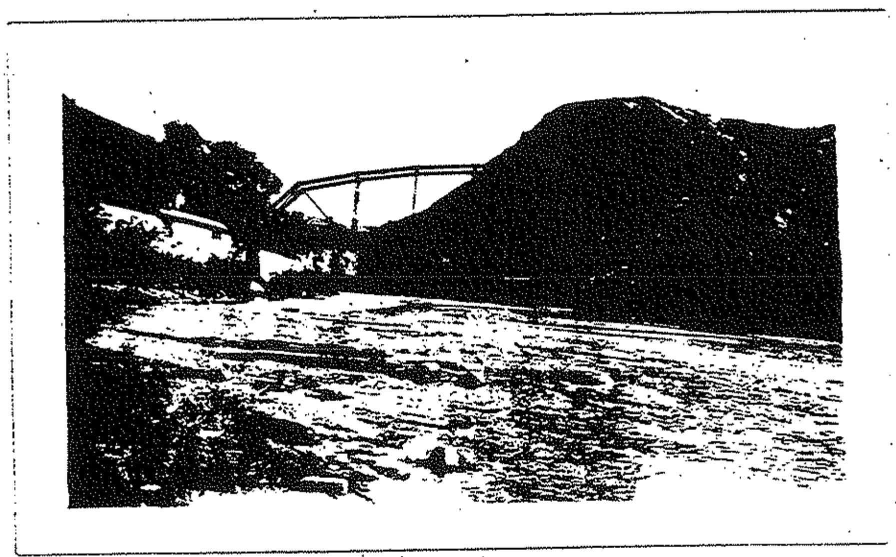
View looking downstream from bridge showing channel below gage.
December 20, 1930.



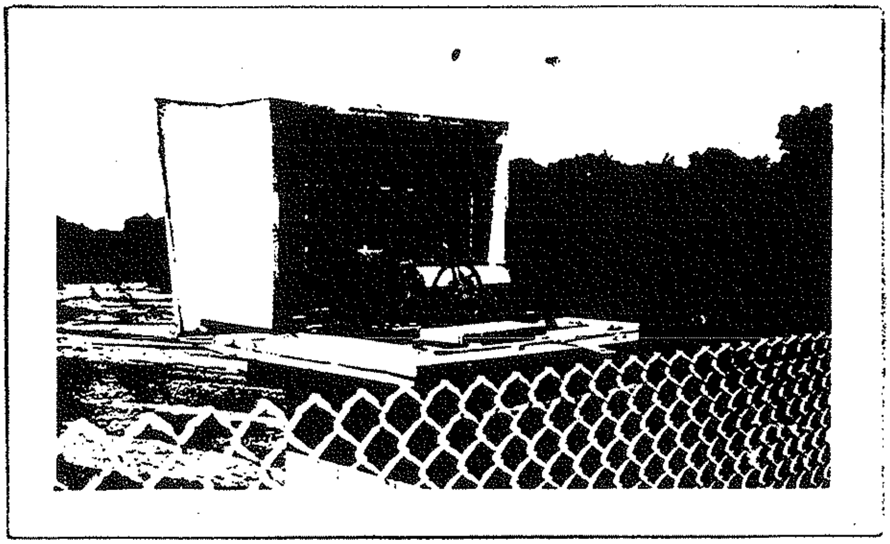
View looking upstream from bridge showing channel above gage. Small side channel at extreme right of picture flows past gage.
December 20, 1930.

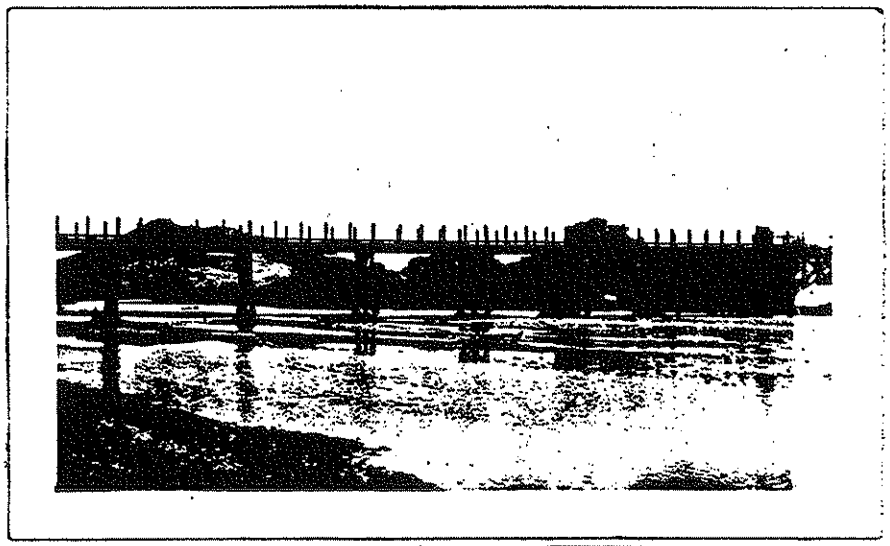


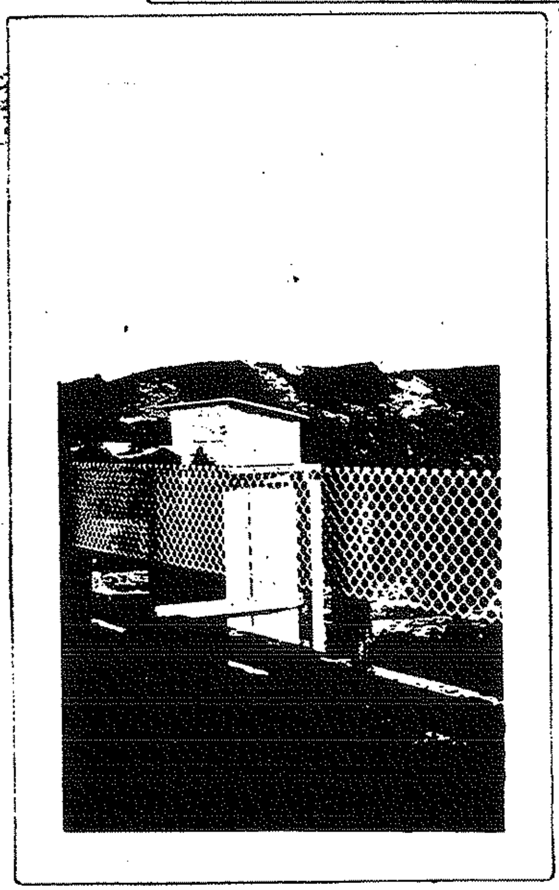
Looking upstream towards gaging station
1927 — 48 and after

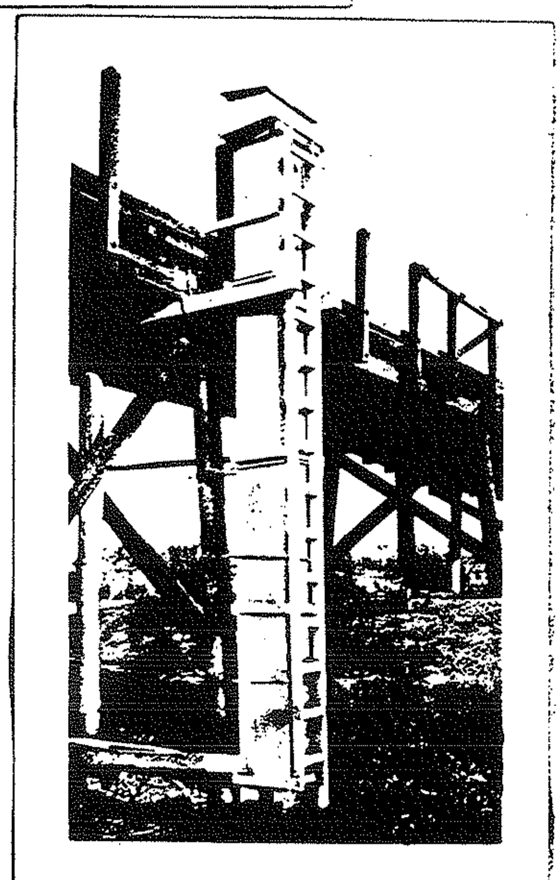


Looking downstream
shows high water measuring section
1927 — 48 and after









Section 6

Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

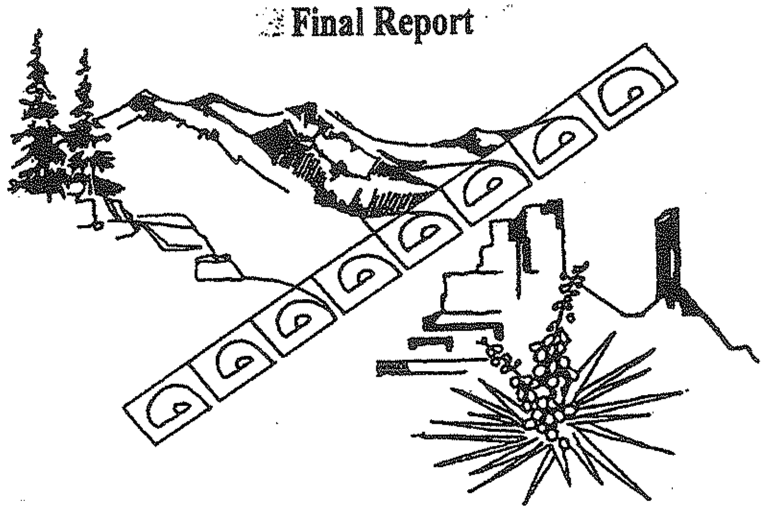
Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

Final Report



Prepared by

SFC Engineering Company

In Association With

George V. Sabol Consulting Engineers, Inc.

JE Fuller/Hydrology & Geomorphology, Inc.,

and

SWCA, Inc. Environmental Consultants

Boating on the Upper Gila and San Francisco Rivers

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June 17, 1997

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Section 6:

Boating on the Upper Gila and San Francisco Rivers

Introduction

The exact boat type, stream depth, width, velocity, and flow duration which define what "navigability" means for Arizona rivers have not yet been definitively established by ANSAC or the Arizona Legislature, although ARS §37-1128 lists several boats types[1], that if no evidence of their historical use on a river is found, establishes a presumption of non-navigability. The objective of this section of the report is to provide information on the types of boating which have occurred historically and in modern times on the Upper Gila and San Francisco Rivers. Several types of information are presented including the following:

- Federal navigability criteria
- Historical accounts of boating
- Modern boating records

Historical and modern accounts of boating on the Upper Gila and San Francisco Rivers are presented in this section. Historical boating on the river includes use of unspecified boats (presumably low-draft, non-powered boats), canoes, and rafts. Modern boating on the river primarily includes the use of canoes, rafts, and kayaks. Other information on historical boating on the Upper Gila and San Francisco Rivers was presented in Section 3. Hydraulic rating curves and hydrologic data for the Upper Gila and San Francisco Rivers were presented in Section 5.

Federal Agency Boating Criteria

Some federal agencies have formally described stream conditions which favor various types of boating. One such description was developed by an intergovernmental task force, the Instream Flow Group, to quantify instream flow needs for certain recreational activities, including boating (US Fish and Wildlife, 1978). The US Department of the Interior independently developed its own boating standards (Cortell and Associates, 1977). These

[1] Keelboats, steamboats, and powered barges.

federal criteria, summarized in Tables 1 and 2, were developed primarily for recreational boating, not necessarily for commercial boating. Minimum stream conditions required are summarized in Table 1. Minimum and maximum conditions are summarized in Table 2.

Table 1
Minimum Required Stream Width and Depth for Recreation Craft

Type of Craft	Depth (ft.)	Width (ft.)
Canoe, Kayak	0.5	4
Raft, Drift Boat, Row Boat	1.0	6
Tube	1.0	4
Power Boat	3.0	6

Source: US Fish and Wildlife, 1978

Table 2
Minimum and Maximum Conditions for Recreational Water Boating

Type of Boat	Minimum Condition			Maximum Condition		
	Width	Depth	Velocity	Width	Depth	Velocity
Canoe, Kayak	25 ft.	3-6 in.	5 fps	-	-	15 fps
Raft, Drift Boat	50 ft.	1 ft.	5 fps	-	-	15 fps
Low Power Boating	25 ft.	1 ft.	-	-	-	10 fps
Tube	25 ft.	1 ft.	1 fps	-	-	10 fps

Source: Cortell and Associates, 1977

Some Arizona boaters surveyed for previous navigability studies did not agree with the minimum velocity criteria given in Table 2. They argue that, since boats can be used on lakes and ponds which have no measurable (zero) velocity, no real minimum velocity exists, except perhaps for tubing. Therefore, it is assumed that the minimum velocities in Table 2 are probably intended to indicate what stream conditions are most typically considered "fun."

The Bureau of Land Management (BLM) apparently has adopted a more narrow definition of navigability (Rosenkrance, 1992). BLM criteria to determine title navigability include:

- The original condition of waterway at date of statehood is used.
- Use by small, flat bottom sport boats or canoes is not navigation.
- Navigation must occur at times other than during seasonal floods.
- Inaccessible streams are not navigable.
- Long obstructions such as bars make upstream segments non-navigable.

The BLM navigability criteria do not necessarily conform to the definition of navigability established in ARS §37-1101. No specific, documented decisions by federal agencies for the Upper Gila and San Francisco Rivers were identified during the course of this study. However, testimony at the June 10, 1997 ANSAC hearing in Globe, Arizona indicated that the BLM has determined an unspecified portion of the Gila River to be navigable. The BLM Safford office currently monitors recreational and commercial boating activities in the Gila Box Riparian National Conservation Area portion of the Upper Gila River.

Historical Accounts of Boating

There were at least three historical accounts of boating on the Upper Gila and San Francisco Rivers around the time of Arizona statehood, as described in Section 3 of this report. Newspaper stories were the primary source of historical boating accounts in this sparsely populated area. All of the documented accounts of boat use on the Upper Gila and San Francisco Rivers indicate that boat use was recreational. Of the three documented historical accounts of boating on the Upper Gila and San Francisco Rivers, exact dates can be assigned to only one. In January and February, 1895 two men boated without difficulty from Clifton down the San Francisco River to well past Safford on Gila River. Although this episode occurred prior to the advent of recorded stream gauging on the Upper Gila and San Francisco Rivers, the long-term average flow rates for the months of January/February were estimated at about 258/324 cfs and 240/315 cfs, respectively (Tables 16 & 20, Section 5)

It is noted that for all of the instances of boat use on the Upper Gila and San Francisco

Rivers, the boaters floated in the downstream direction. No evidence of boating in the upstream direction was found. The type of boats typically used were flat-bottomed boats, canoes, and rafts. Stanley Sykes of Flagstaff reportedly canoed the entire Gila River in Arizona at some time during 1909. Information presented in Table 3 summarizes probable stream characteristics required to support use of the types of canoes available at statehood. The criteria for canoes are not substantially different from criteria for canoes available today.

Table 3

Flow Requirements for Pre-1940 Canoeing

Boat Type	Depth
Flat Bottomed (Wood or Canvas)	4 in.
Round Bottomed (Wood or Canvas)	6 in.

Source: Slingluff, J., 1987

Modern Accounts of Boating

Today, the Upper Gila and San Francisco Rivers are popular recreational boating streams, with some commercially-operated boating expeditions occurring during optimum flow conditions in the late spring. Given that the hydrologic analysis (Section 5) concluded that flow conditions at statehood were not significantly different from existing flow conditions, and the geomorphic investigation (Section 4) concluded that channel conditions were similarly unchanged, modern boat use may provide evidence of susceptibility to navigation by some types of boats as of the time of statehood. Although boat-making technology has improved since the time of statehood, with the use of inflatable rafts, inflatable and hard-shell kayaks becoming some of the preferred modes of recreational travel, these improvements generally have only made the boats more durable. The depth or width of water required has not substantially changed.

Modern boating accounts of the Upper Gila and San Francisco Rivers include the following:

1. The Central Arizona Paddlers Club (CAPD), an organization of boaters, recently conducted a survey of their members to determine what rivers had been boated. With 20 percent of members responding, the survey indicated that all of the Upper Gila and San Francisco Rivers study reach has been boated in recent years (Central Arizona Paddlers Club, 1992).

2. Arizona State Parks (1978) lists the following Upper Gila and San Francisco River reaches in its outdoor recreation and boating guide:

    - Gila River - Virden, New Mexico to State Route 191 (formerly known as SR 666)
    - Gila River - State Route 191 to Bonita Creek (Head of Safford Valley)
    - San Francisco River - Clifton to Gila River

3. A boating guide to the Southwest lists both the Upper Gila and San Francisco Rivers as boatable streams (Anderson, 1982).

    - San Francisco River. The San Francisco River from Alma, New Mexico to Clifton, Arizona is described as a Class I and II river suitable for kayaks, canoes, and small rafts. However, the guide notes that the San Francisco River is currently (ca. 1982) closed to all types of boating from March 15 to July 15 to preserve nesting habitat for the Black Hawk and other sensitive birds. The guide also notes that this time period corresponds to the optimum boating period for the San Francisco River.

    - Gila River - Alma, New Mexico to Three Way, Arizona. This reach of the Gila River is described as boatable by canoes and kayaks, with little detailed information available on conditions.

    - Gila River - Lower Gila Box. This reach of the Upper Gila River is described as a Class II and III river suitable for kayaks, canoes and small rafts. The BLM manages this reach, and recommends use by canoes or rafts.

    - Gila River - Downstream of Solomonville, Arizona. This reach is described as boatable, but not recommended due to numerous obstructions in the form of barbed wire fences.

4. Testimony at a recent ANSAC hearing on June 10, 1997 in Globe, Arizona by commercial river running operations referenced their use of the Upper Gila River for rafting.

5. Several books and magazines describe boating trips on the Upper Gila River. The July, 1997 issue of *Arizona Highways* includes an article describing a September trip through the Gila Box at about 150 cfs in inflatable boats, with a notation that BLM staff have boated the Gila Box during every month of the year. The book, *Gila Descending*, by M.H. Salmon describes a May, 1983 canoe trip down the entire Upper Gila River at a flow rate ranging from more than 1,000 cfs to about 260 cfs. With regard to the degree of boating expertise required, Salmon states that canoeing the river was "a piece of cake...most anyone could have done it, had he or she the interest and the time."

6. A world wide web site[2] describes recommended boating conditions for raft, canoe and kayak use in the Gila Box reach. The site claims that the river can be floated all year long, by different types of boats according to the flow rate and season, and states that the Gila Box can be canoed between flow rates of 150 cfs to 1,500 cfs. The text of the web site is reproduced in the Appendix.

Summary

The Upper Gila and San Francisco Rivers were used for recreational boating as of the time of statehood (Section 3). Historical hydrologic conditions in the Upper Gila and San Francisco Rivers probably would have met current federal criteria for some types of recreational boating, for most of the year. No evidence of boating in the upstream direction along the Upper Gila and San Francisco Rivers, or use of large machine-powered boats was found. No evidence of significant commercial boating industries developed on the Upper Gila and San Francisco Rivers as of 1912 was uncovered. Both rivers are currently boated for recreational purposes, primarily during the winter and spring months, with limited commercial river running operations in the Gila Box Reach.

[2] located at http//:www.gorp.com/gorp/resource/us_river/az_gila.htm

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Appendix: Floating the Gila[1]

Generally the Gila River can be floated year long, depending on the flow and type of raft used. This 23 mile float takes you through a spectacular unroaded canyon with 500 foot sheer cliff walls and dramatic geologic features. Bird watching is popular with over 150 species of birds making their home in the canyon at some time of the year. Raptors such as the uncommon zoned tailed hawk, black hawk, and peregrine falcon can be seen, along with many of the colorful neotropical birds that migrate to this area in the spring and summer. Most of all, this river is known for its solitude and primitive nature.

Put in: South of the town of Clifton on State route 191 turn onto the Black Hills Back Country Byway and travel south four miles until you reach the Gila River and the Old Safford Bridge. The best place to put in is on the south side of the river.

Take out: From Safford cross the Gila River north on Eighth Avenue and turn right at the "Y" onto Airport Road. Travel six miles to a stop sign and turn left onto Sanchez Road. From there travel six more miles until you reach a Bonita Creek BLM sign and turn left onto that dirt road. Once on the dirt road continue traveling approximately 2.5 miles to the West Entry Sign of the Gila Box Riparian National Conservation Area. From the Entry sign travel .5 miles to Dry Canyon parking area on the right side of the road. Dry Canyon parking area can be used for overnight parking while on the river.

Flow Guidelines

Since the water flow in the Gila River varies dramatically from year to year it is difficult to state average flows by month. One should always obtain the water flow in cubic feet per second (cfs) prior to planning to float the Gila River. The months January through April experience the highest flows from snowmelt and rain. These flows can range between 100,000 cfs to only 250 cfs with extremely cold water temperatures. Flows generally are much lower during the months of May and June and rise some during the monsoon rainy season of July, August and September. The following flow level guidelines are offered as a safety measure in determining what water craft the river should be floated with:

CFS Level: 10,000 and above
Not Recommended
CFS Level: 6,000 to 10 000
Type of Water Craft: 14 ft. river raft and larger.
Difficulties: Very swift cold water with class III rapids. Logs and debris probable in water. Advanced and very experienced rafters only.
CFS Level: 3,500 to 6,000
Type of Water Craft: 12 ft. river raft and larger. Advanced and very experienced hard shell kayakers.
Difficulties: Swift current with class II and III rapids. Experienced rafters only. At upper level debris and some logs could be in the water.

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[1] From Web site at www.gorp.com/gorp/resource/us_river/az_gila.htm

CFS Level: 1,500 to 3,500

Type of Water Craft: 12 ft. river raft and larger. Advanced kayakers (inflatable and hard shell).

- Difficulties: Probably the best time to float the river for novice crafters. Challenging float for kayakers.

CFS Level: 500 to 1,500

Type of Water Craft: 14 ft. river raft and smaller. Inflatable and hard shell kayaks. Experienced canoeists.

Difficulties: Larger river rafts will have to maneuver frequently to find deep water to float, but good for beginners. Excellent for novice inflatable kayakers and canoeists.

CFS Level: 150 to 500

Type of Water Craft: Canoes, and inflatable kayaks.

Difficulties: Excellent for beginners. River narrows considerably with nice chutes with some white water. Floaters may have to pull their boats through short shallow stretches. Warm weather and drifting solitude.

Section 7

Arizona State Land Department

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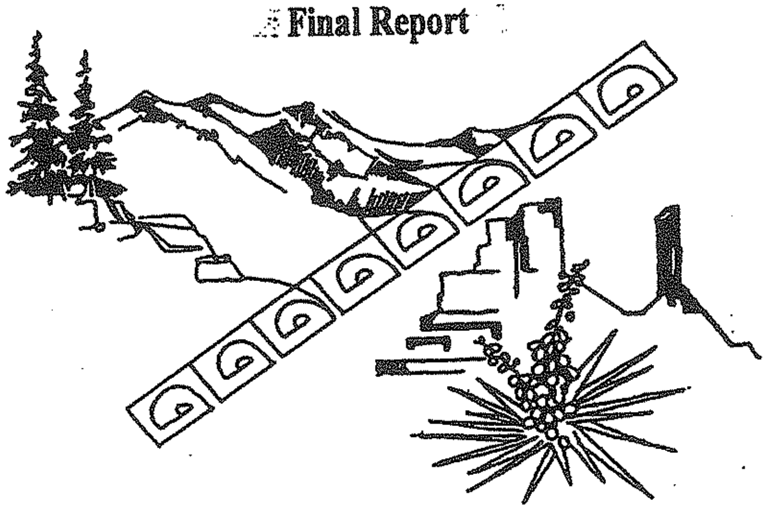

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Navigable Rivers Land Use GIS

I. Methodology

A Geographic Information System (GIS) was developed depicting the 100-year floodplain and land ownership/use within the floodplain (see Appendix A for data organization). The GIS was designed not to aid in the determination of navigability but to help study the impacts should the river be declared navigable. Information regarding the ownership and use of land in the vicinity of the river may be depicted as maps or as statistics.

The general land ownership categories depicted by the GIS are as follows:

Ownership Categories

Private
State of Arizona
Bureau of Land Management (BLM)
U.S. Forest Service
National Wildlife Refuge
National Park Service
Indian Reservation
U.S. Farm Service Administration
Other / No Data

The general land use categories depicted by the GIS are as follows:

Land Use Categories

Vacant Land
Residential - Single Family
Residential - Multiple Family
Hotel - Motel - Resorts
Condominiums
Commercial Property
Industrial Property
Farm/Ranch Property
Public Utilities
Natural Resources
Special Use Property
General Service Use

Additional data, such as county, township, range, section, book, map, parcel, source, legal parcel area, state land use code, and owner descriptions, are also contained in the GIS.

A. Base Data

The base layers for the GIS, including rivers, counties, and public land survey system, were obtained from the Arizona Land Resources Information System (ALRIS) maintained by the Arizona State Land Department (ASLD). Additional river data were obtained from 1:100,000 scale Digital Line Graph (DLG) files maintained by the United States Geological Survey (USGS).

B. Floodplain

The 100-year floodplain was digitized from Federal Emergency Management Agency (FEMA) maps of varying scales. Georeferencing (i.e. registration of map data to real world coordinates) was accomplished via section corners and, in a few circumstances, street intersections. Arbitrary lines were digitized at junctions with tributary floodplains. Adjacent maps were edgematched; significant mismatches were not adjusted but were closed using straight line segments.

C. Land Ownership/Use

Parcels were digitized from paper County Assessor maps. Georeferencing was accomplished using the following:

1. Section corners or subdivisions (e.g. quarter-quarter-section corners),
2. Legal descriptions using a section corner or subdivision as a reference point,
3. Distances, based on map scale, from a section corner or subdivision,
4. Corresponding features in a smaller scale map (e.g. a map of a housing development might be registered via its corresponding outline depicted in a section map), and/or
5. Adjacent features.

Digitizing was accomplished as follows:

1. Clearly delineated parcel boundaries were digitized as depicted. Lines in large scale maps generally took precedence over corresponding lines in small scale maps.
2. Areas of parcel overlap were assigned to one parcel or the other as deemed best. Unclear boundaries between two parcels were digitized according to best judgement.

3. Parcels of vague or undepicted location were not digitized unless an outline could be obtained from an alternate source (e.g. ALRIS data or USGS 1:100,000 DLG files).

4. Linear (non-polygonal) parcels, depicting railroad right-of-way (ROW), were not digitized. An exception was made if adjacent parcels clearly depended on a ROW edge, in which case a 200' wide corridor was applied.

When necessary, adjacent maps were edgematched. Small scale features were adjusted to large scale features. Attributes were assigned in a fashion consistent with ASLD's Gila River coverage:

1. Parcel numbers were assigned where clearly designated, unless the parcel clearly was non-private (State, BLM, etc.), in which case a "non-private" parcel code (AZ, BLM, etc.) was assigned.

2. Parcels which were not numbered, but were clearly labeled (Arizona, U.S.A., etc.) were assigned non-private codes as appropriate. Where a conflict existed between assessor maps and ALRIS data over USA vs. State ownership, the ownership reflected in the ALRIS data was assigned.

3. Unlabeled or questionable parcels, uncoded road and rail ROW parcels, parcels outside the floodplain, and undigitized regions were assigned a zero parcel number.

4. Sections outside the study area were assigned "background" (BACK) parcel codes.

Relate files, containing land ownership and use data, were generated from State Revenue data. A list of parcel values was generated from the digitized parcels and submitted to the State Revenue office. Data received from the State Revenue office were converted to a table and reprocessed. If, after a quality check, the ID of a digitized parcel was not listed in the State Revenue data (e.g., if a parcel split or merge had not yet been depicted on the County Assessor map), it was assigned "Other / No Data" ownership.

D. Plots

Once all datasets were assembled, checked, and finalized, they were transported to the State Land Dept. building in Phoenix. Annotation coverages were created for the final plots, and existing scripts and tables adapted to production of the final plots. One complete series was created for each river reach.

II. Results and Discussion

The study area was divided into three map sheets for plotting purposes. Floodplain maps were available for the entire study area.

All private parcels were digitized from paper maps. The boundary of the White Mountain Apache reservation was obtained from USGS 1:100,000 DLG files.

Ownership Category	Percent
Private	19.8
State	10.4
BLM	36.3
U.S. Forest Service	21.0
U.S. Farm Service	1.1
Other / No Data	11.4

Land Use Category	Percent
Vacant Land	2.9
Residential - Single Family	0.9
Residential - Multiple Family	< 0.1
Hotel - Motel - Resorts	< 0.1
Commercial Property	0.5
Industrial Property	< 0.1
Farm/Ranch Property	13.4
Natural Resources	2.3
Special Use Property	0.8
General Service Use	67.8
Other / No Data	11.4

Appendix A: GIS Data Organization

A. Base and Reference Layers from ALRIS

Name	Contents
AZTRS	Public Land Survey System of Arizona
COUNTIES	County Boundaries
HYDRO	Hydrology
LAND	Surface Management
RAILS	Railroads
TRANS123	Major Roads

B. Data Organization

A separate workspace is created for each river reach. The principal ARC/INFO coverages contained in each workspace are FLOOD, depicting the 100 year floodplain, PARCELS, containing digitized parcels, RIVER, depicting the river itself, and SHEETS, depicting the mapsheets.

1. FLOOD

The FLOOD coverage has polygon topology. The PAT contains the following items:

ITEM NAME	WIDTH	TYPE	N.DEC
IN_OUT	3	C	0
SOURCE	20	C	0
SC	1	N	0

<u>IN_OUT Values:</u>
in = Part of floodplain
out = Not part of floodplain

SOURCE	SC
FEMA (Detailed Study)	1
FEMA (Approximate)	2
Non-FEMA	3

2. PARCELS

The PARCELS coverage has polygon topology. The PAT contains the following items:

ITEM NAME	WIDTH	TYPE	N.DEC
TOWNSHIP	4	C	0
RANGE	4	C	0
SECTION	2	C	0
COUNTY	2	N	0
BOOK	3	C	0
MAP	3	C	0
PARCEL	4	C	0
CODEDATE	8	D	0
OWN_CODE	12	C	0
SOURCE	20	C	0
CATEGORY	10	C	0

Items TOWNSHIP, RANGE, SECTION, and COUNTY conform to the data dictionary of the ALRIS LAND layer.

Parcels which have a book, map, and parcel number, are coded as follows:

ITEM	Example
COUNTY	9
BOOK	103
MAP	043
PARCEL	1A
OWN_CODE	091030431A

Other parcels are coded as follows:

STANDARD CODES FOR NON-PRIVATE PARCELS

ITEM	Example
BOOK	101
MAP	040
PARCEL	0
OWN_CODE	0

PARCEL Values:

0	= No data or "other" (e.g. Right-of-Way)
AKCH	= Ak-Chin (Maricopa) I.R.
ASNF	= Apache-Sitgreaves NF
AZ	= State of AZ
BLM	= BLM
BWR	= Bill Williams N.W.R.
CONF	= Coronado National Forest
GILA	= Gila River I.R.
NAV	= Navajo I.R.
PFNP	= Petrified Forest NP
SANC	= San Carlos I.R.
SANX	= San Xavier I.R.
SALT	= Salt River I.R.
SRWR	= Salt River N.W.R.
TOHO	= Tohono O' Odham (Papago) I.R.
TONF	= Tonto National Forest
TONM	= Tonto National Monument
WMA	= White Mountain Apache I.R.

"Background" parcels, i.e., sections outside the study area, are coded as follows:

ITEM	Example	
BOOK	999	
MAP	999	
PARCEL		BACK
OWN_CODE		BACK

The CODEDATE item contains the date of completion of the coverage. The principal source used to determine the geometry of a particular parcel is documented via the SOURCE item.

SOURCE Values:

ASLD Base	= Base data from AZ State Land Dept. (AZTRS)
County/Paper	= County Assessor paper maps
County/Digital	= County Assessor digital maps
County/GIS	= County GIS
USGS 100K DLG	= USGS 1:100,000 DLG files
ALRIS LAND	= ALRIS LAND coverage
Various	= Various Sources

The CATEGORY item is a temporary item used in the generation of status maps.

Each PARCEL coverage has a relate file, OWNDATA, with the following structure:

ITEM NAME	WIDTH	TYPE	N.DEC
OWN_CODE	12	C	0
OWNER	2	N	0
LC	2	C	0
DEL_FLAG	1	C	0
STATUS_DAT	8	D	0
LAND_USE	4	C	0
AREA	8	C	0
UNITS	1	C	0
OWNER1	40	C	0
OWNER2	40	C	0
OWNER3	40	C	0

OWN_CODE is the relate item to the PARCELS coverage. OWNER is the ownership lookup code and LC the use lookup code, used for querying and plotting. DEL_FLAG is a State Revenue record code, probably indicating a record slated for future deletion. STATUS_DAT is the date of the record. LAND_USE is the four-digit State land use code. AREA is the legal area of the entire parcel. UNITS is the units of the legal area (acres or square feet). OWNER1 through OWNER3 are the first three fields of the taxpayer name and address section.

3. RIVER

The RIVER coverage has line topology. There are no additional attribute items.

4. SHEETS

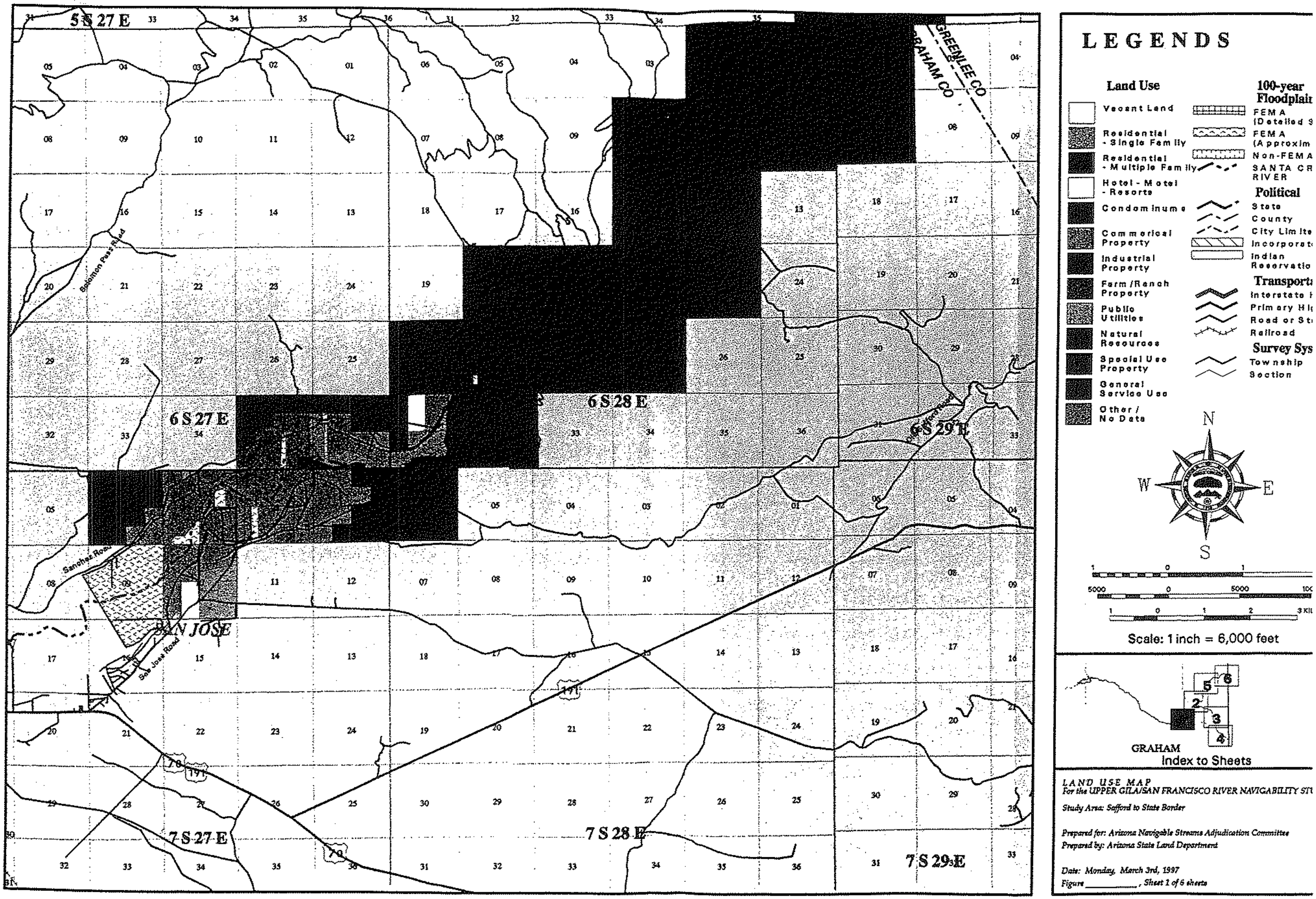
The SHEETS coverage has line topology. The AAT contains the following item:

ITEM NAME	WIDTH	TYPE	N.DEC
SHEET	2	N	0

Values correspond to the mapsheet number.

APPENDIX B

Land Ownership and Land Use Maps on File at Arizona State Land Department, Drainage and Engineering Section



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Sanchez Road
San Jose Road
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Residential - Multiple Family
Hotel - Motel - Resorts
Condominiums
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Industrial Property
Farm/Ranch Property
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For the UPPER GILA/SAN FRANCISCO RIVER NAVIGABILITY STU
Study Area: Safford to State Border
Prepared for: Arizona Navigable Streams Adjudication Committee
Prepared by: Arizona State Land Department
Date: Monday, March 3rd, 1997
Figure ________, Sheet 1 of 6 sheets

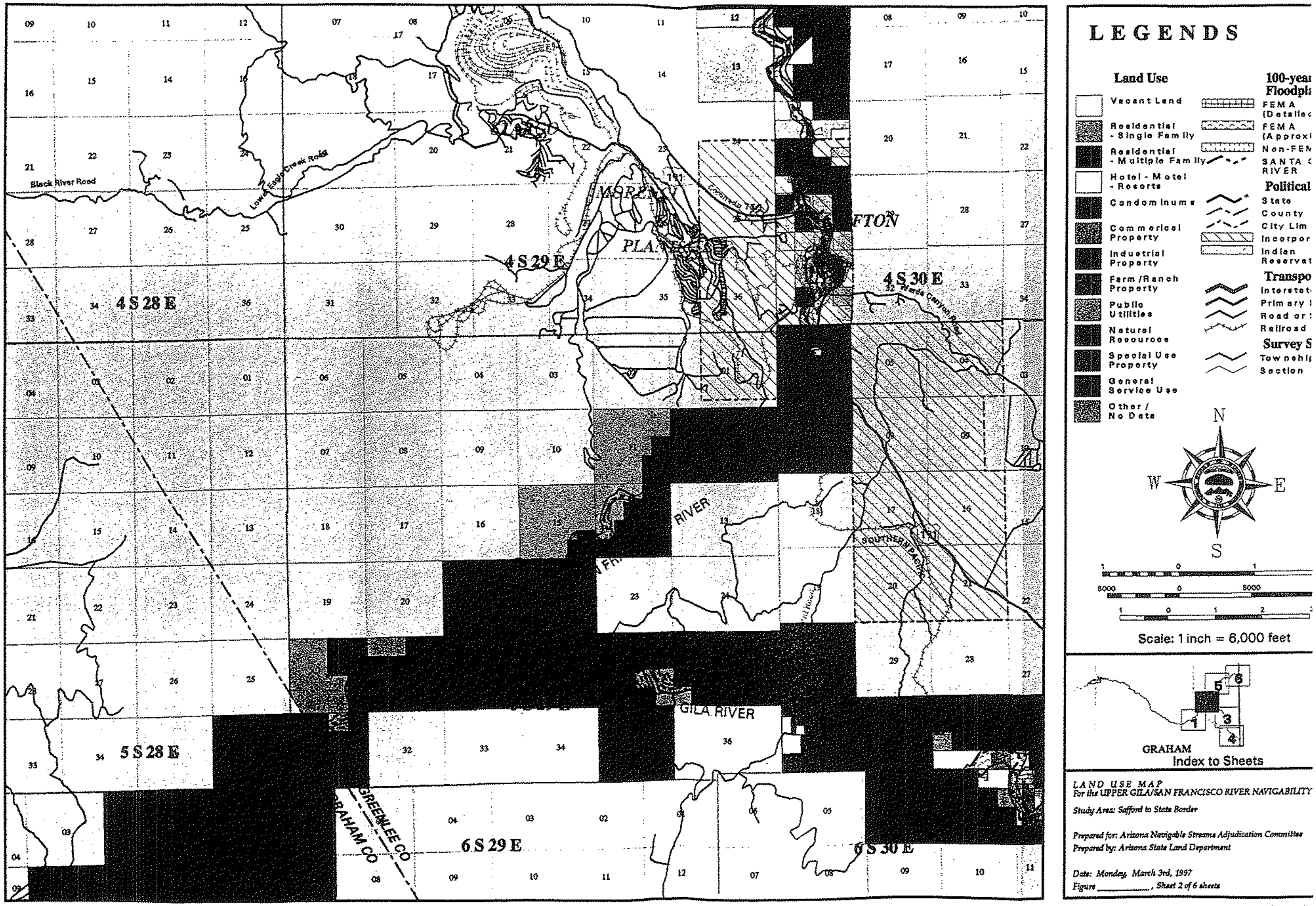

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Figure ________, Sheet 2 of 6 sheets
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4 S 30 E
5 S 28 E
6 S 29 E
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GRAHAM CO
Black River Road
Lower Eagle Creek Road
SOUTHERN PACIFIC
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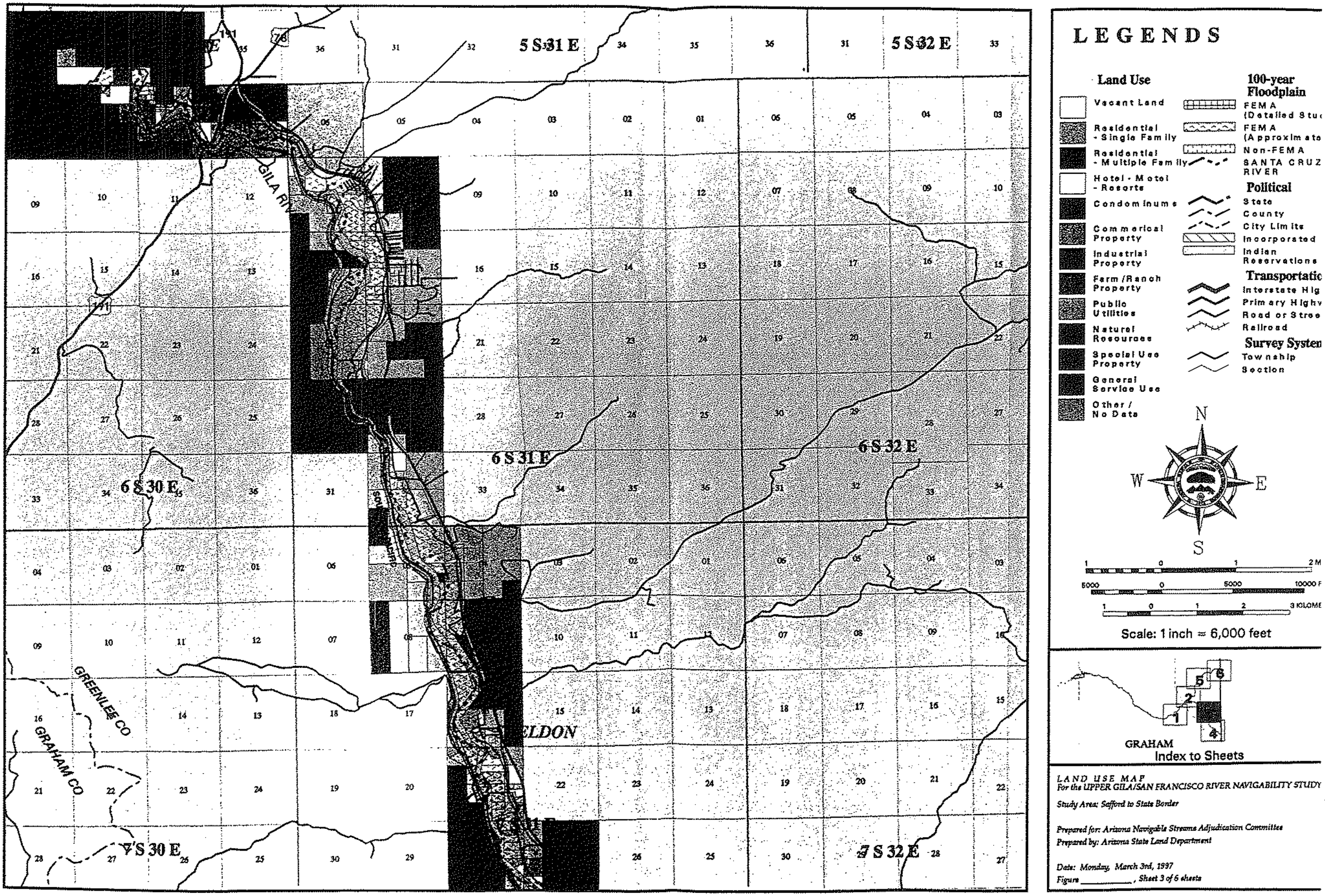
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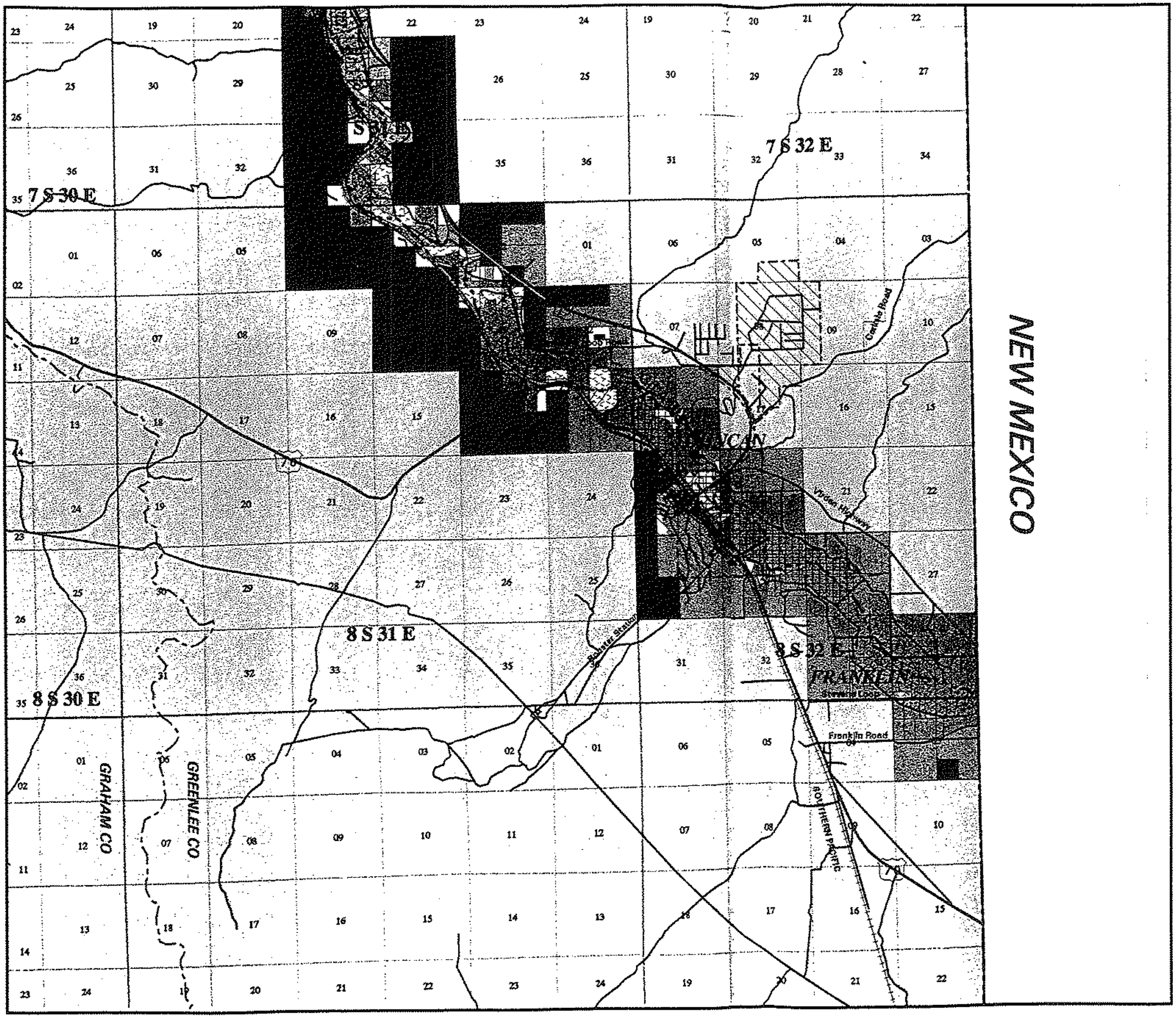

LEGENDS

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- Residential - Single Family
- Residential - Multiple Family
- Hotel - Motel - Resorts
- Condominiums
- Commercial Property
- Industrial Property
- Farm / Ranch Property
- Public Utilities
- Natural Resources
- Special Use Property
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Study Area: Safford to State Border

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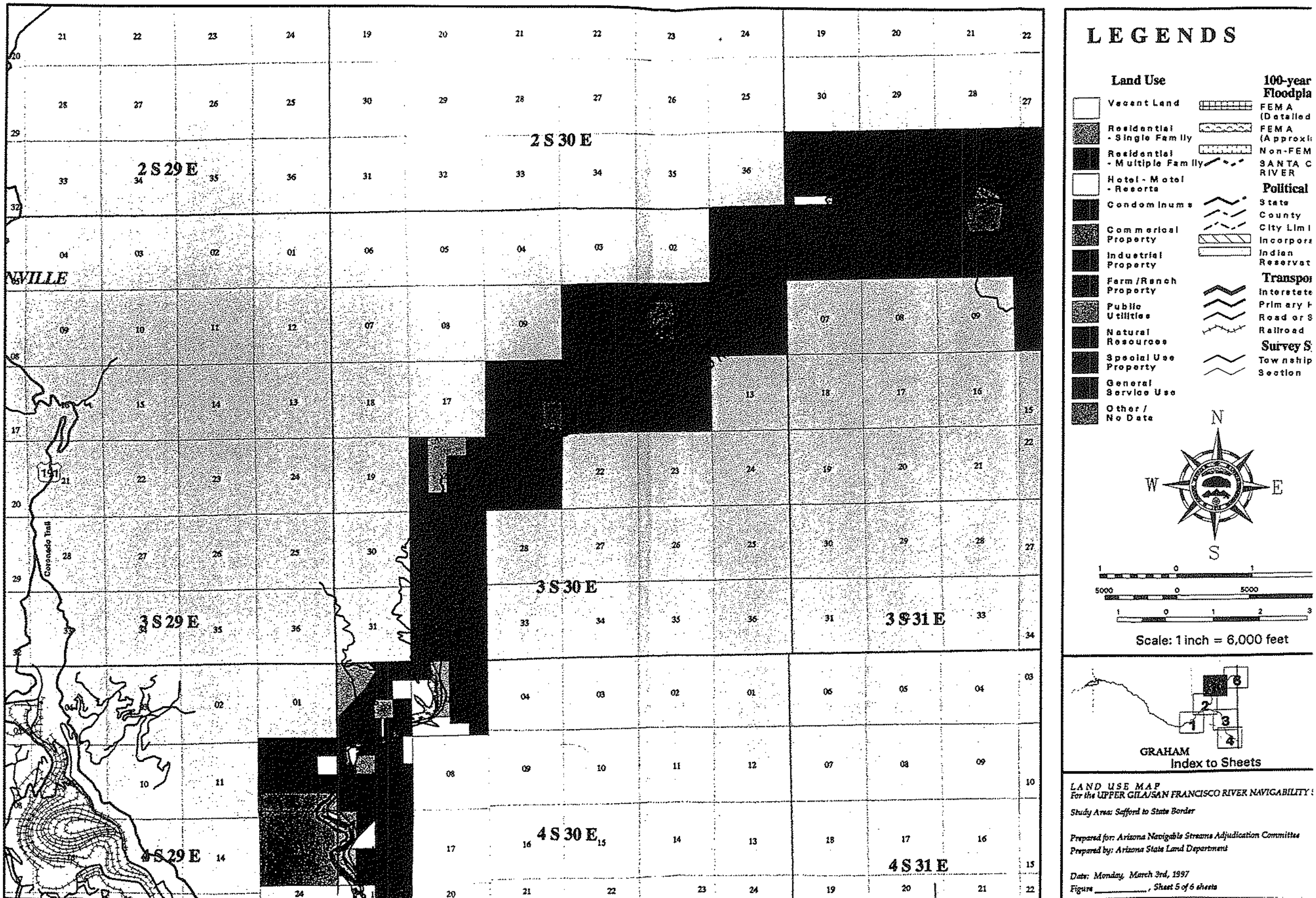

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Hotel - Motel - Resorts
Condominiums
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For the UPPER GILA/SAN FRANCISCO RIVER NAVIGABILITY
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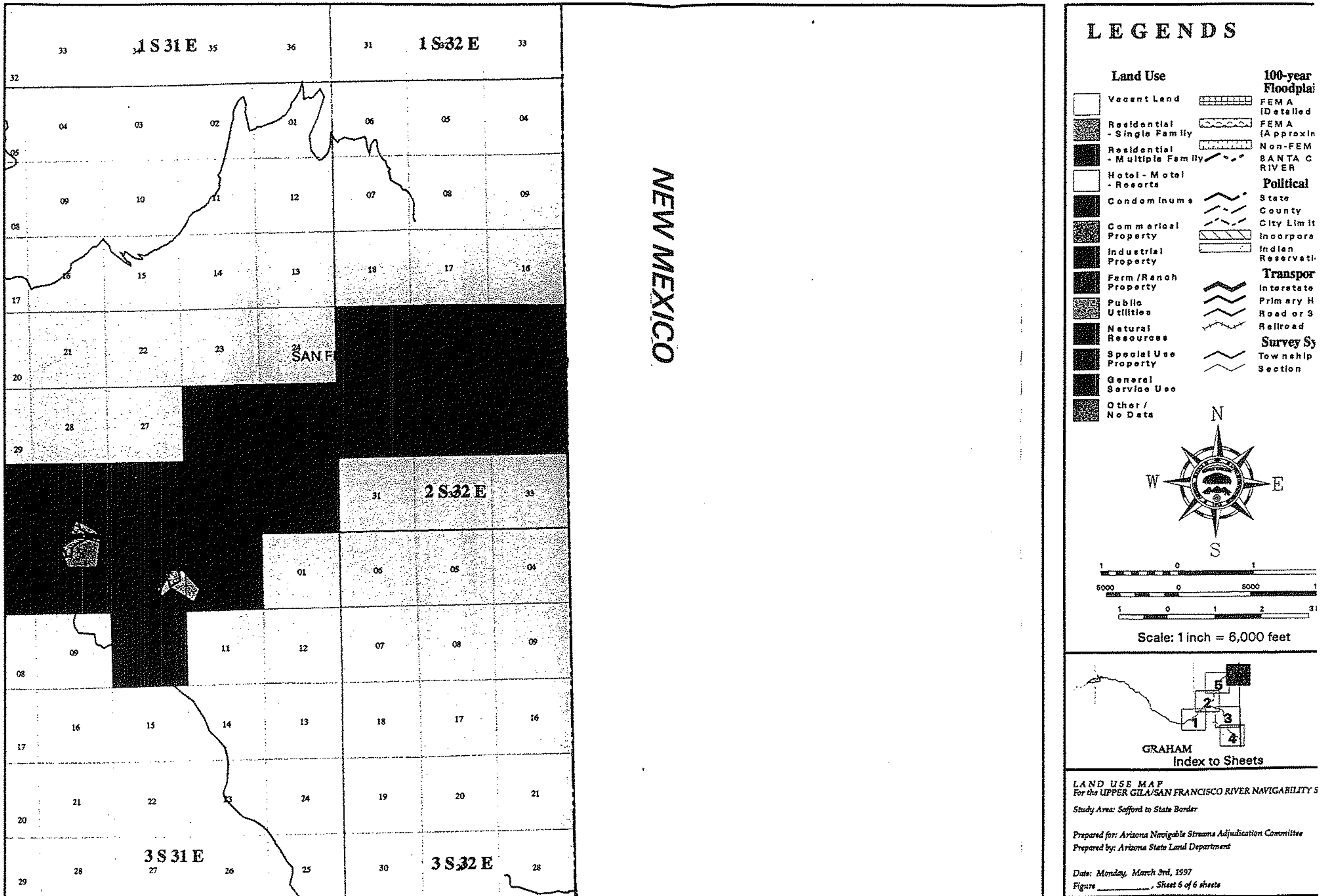

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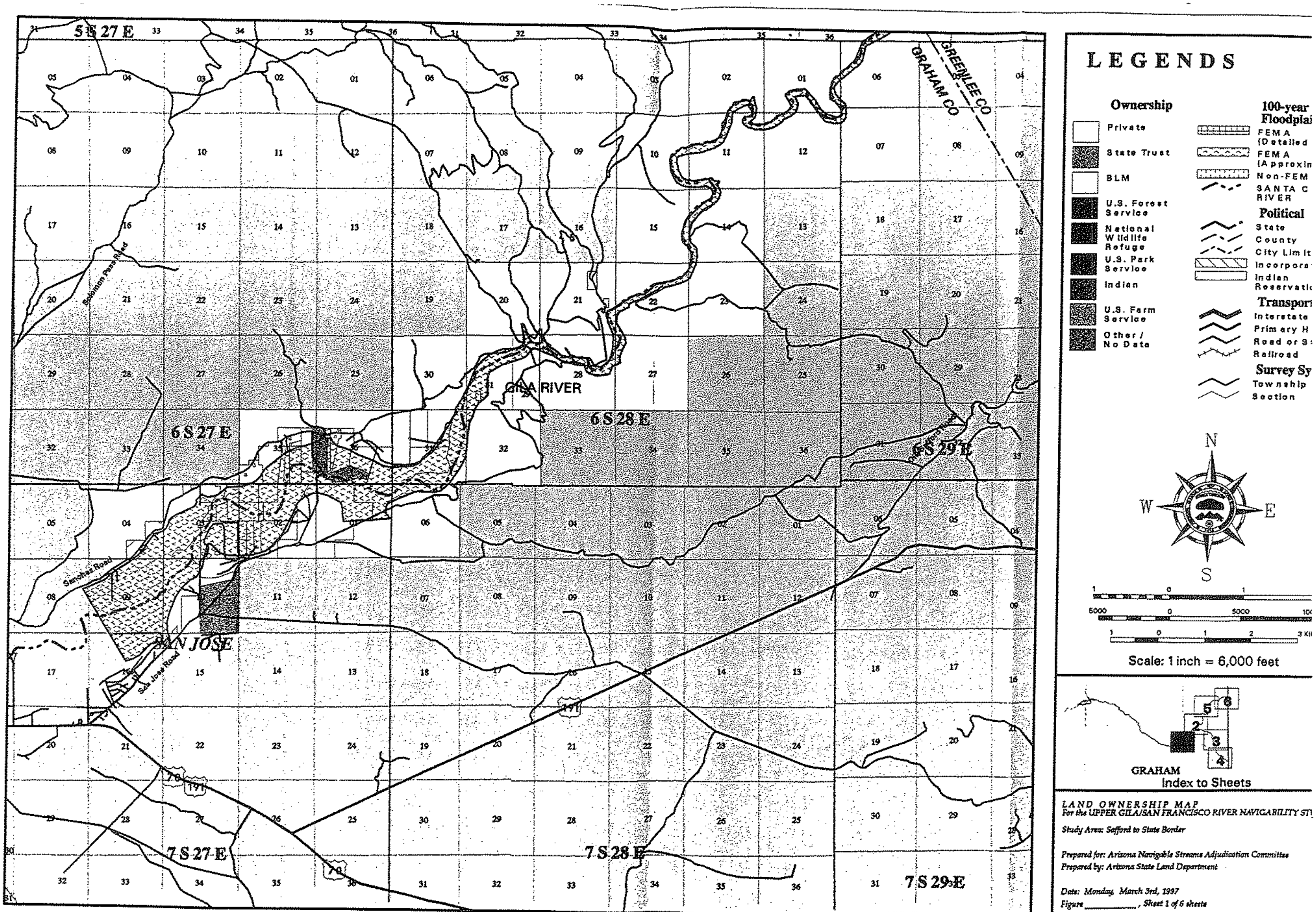
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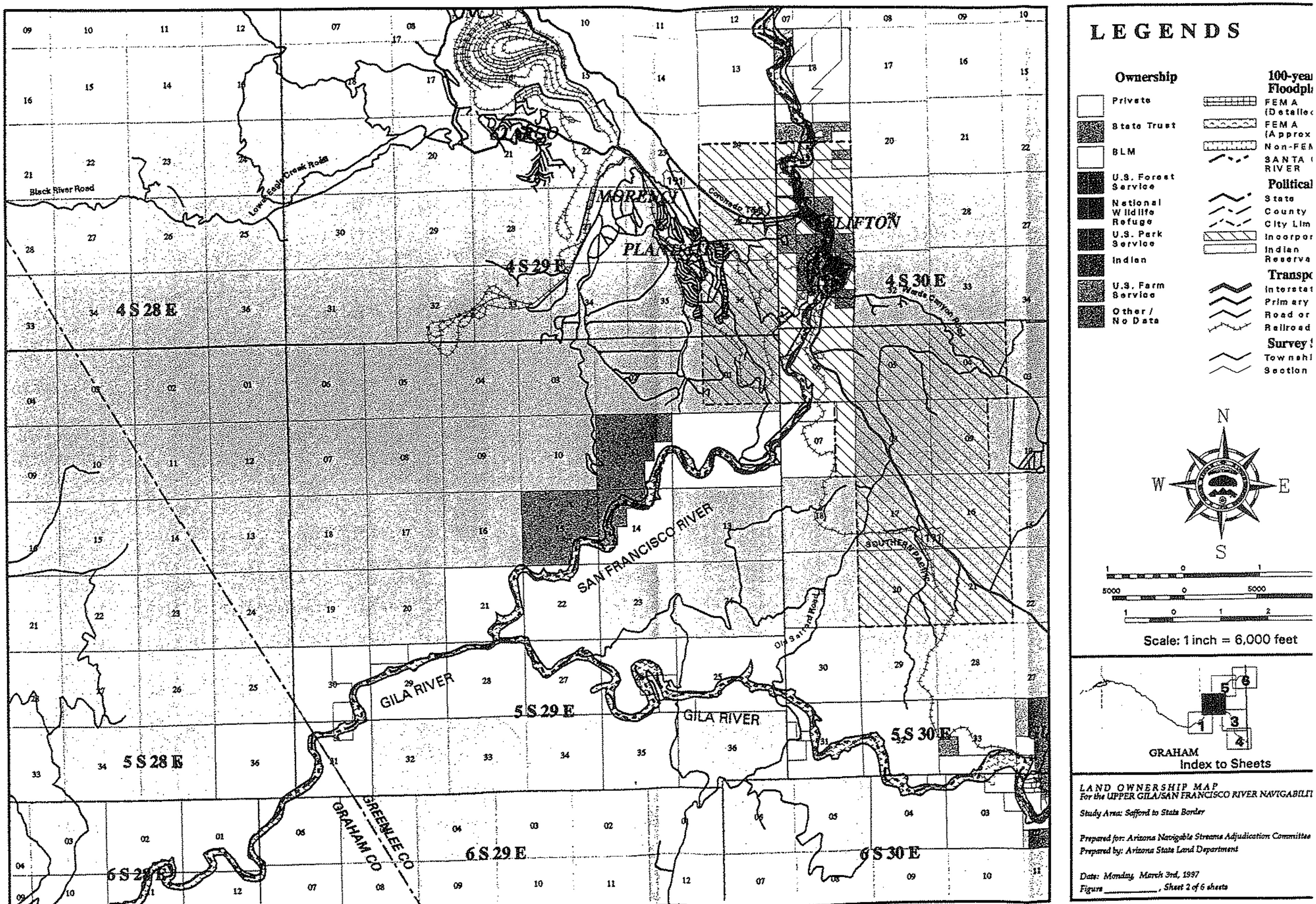
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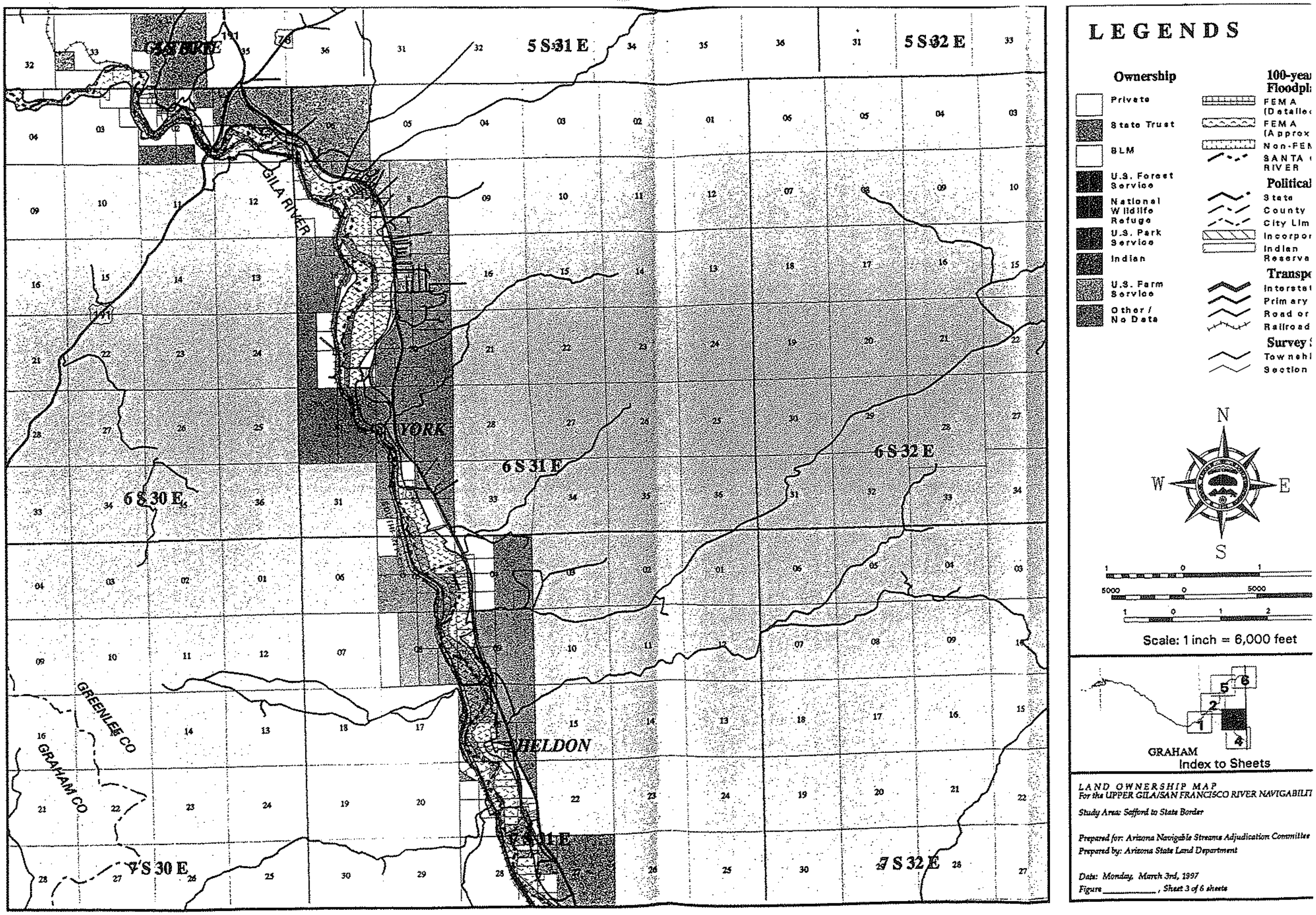
Ward Canyon Road
SOUTHERN PACIFIC
Old Safford Road



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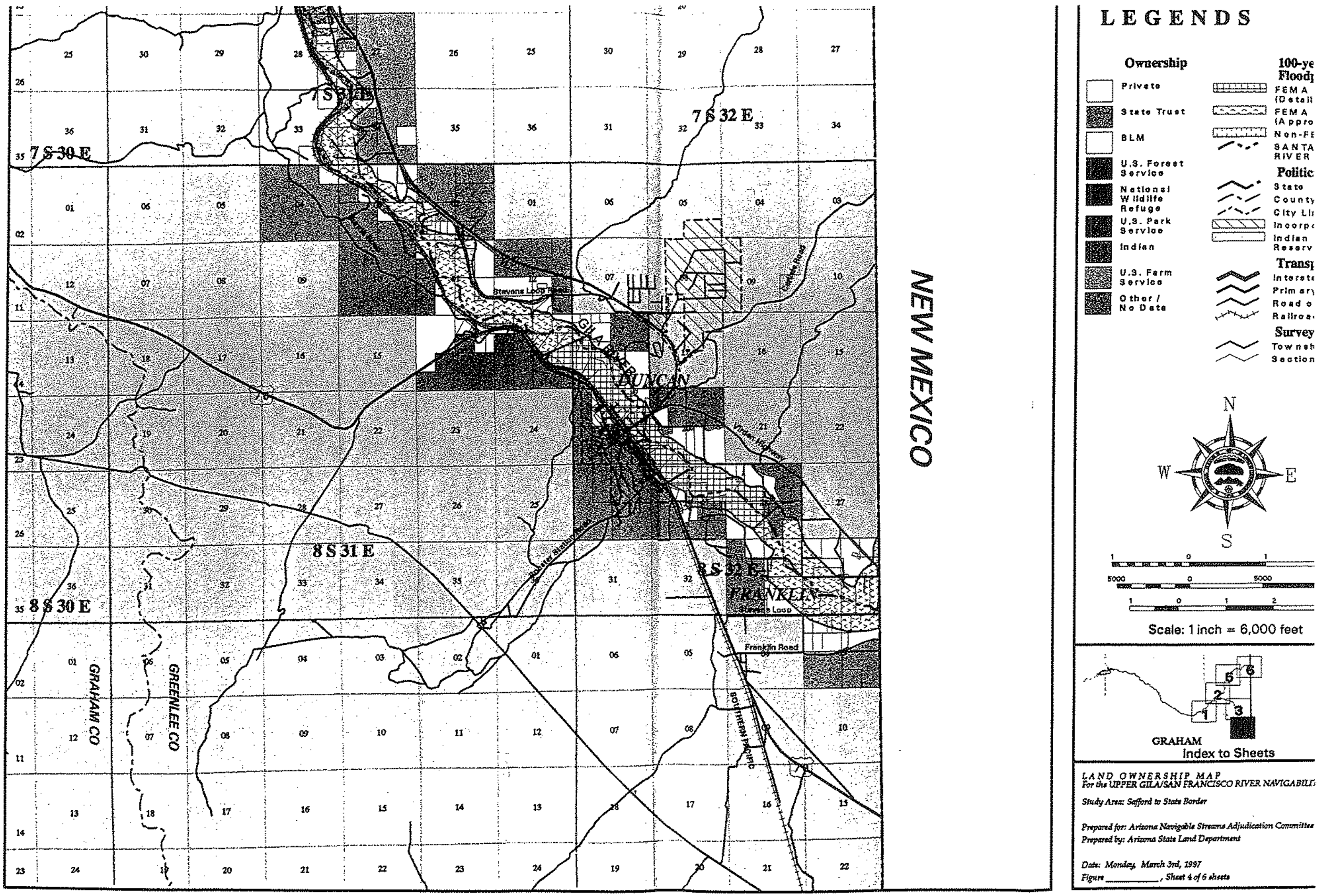
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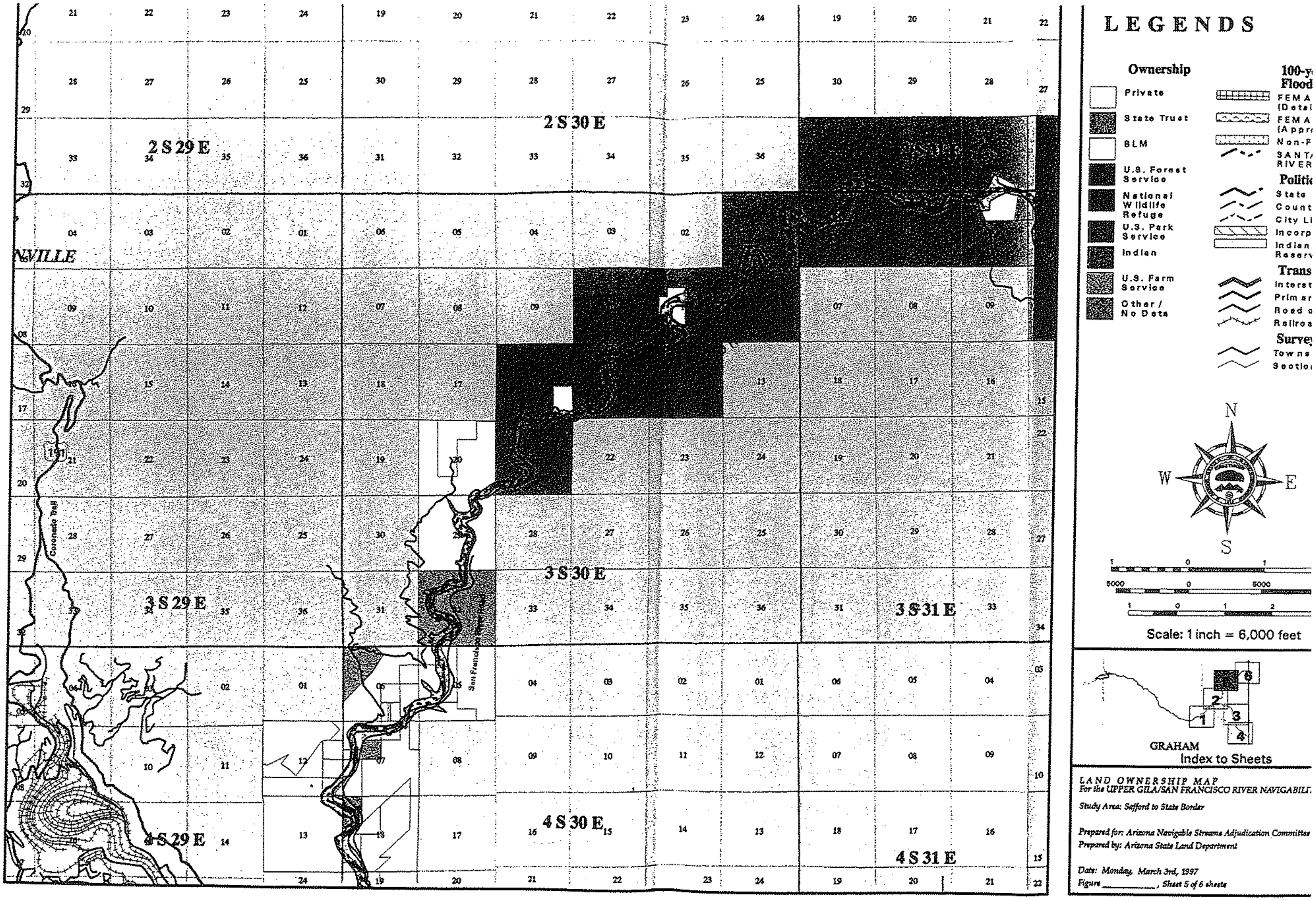
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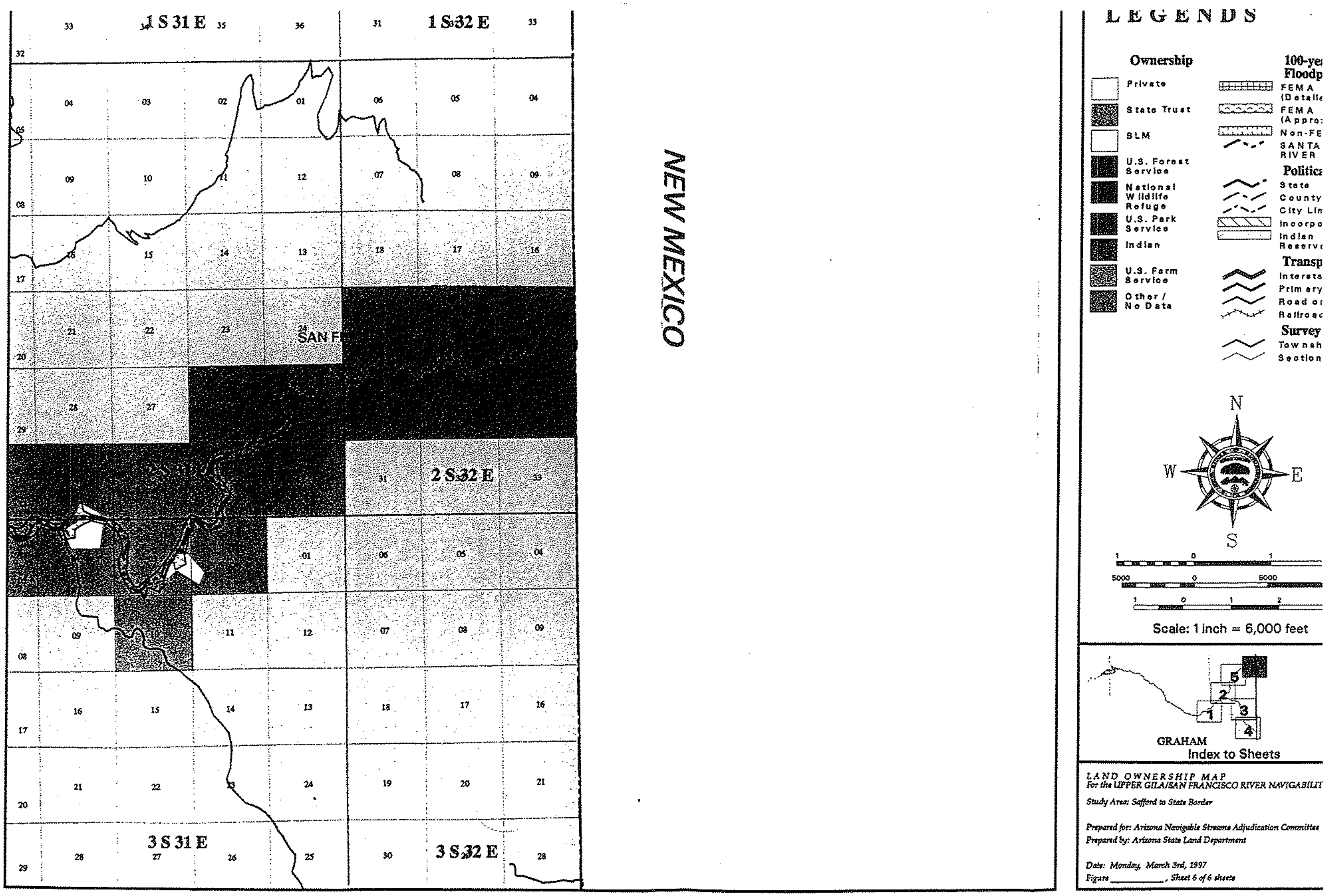

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Arizona State Land Department

ARIZONA STREAM NAVIGABILITY STUDY

for the

UPPER GILA RIVER

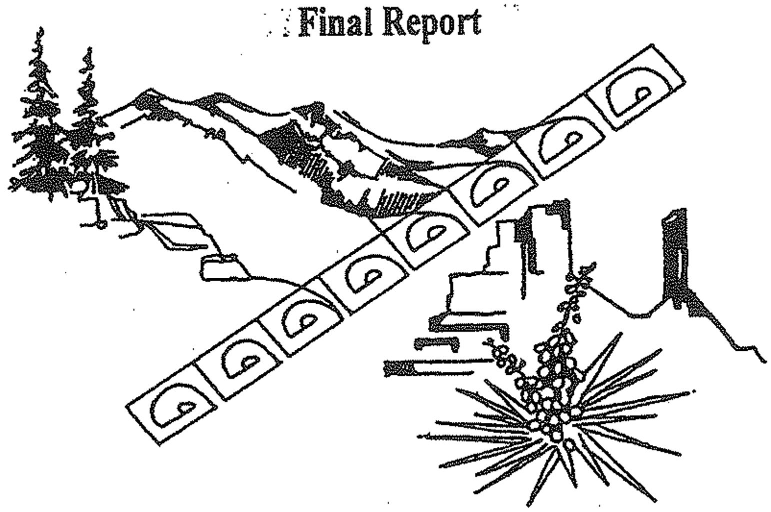
Safford to the State Boundary

and

SAN FRANCISCO RIVER

Gila River Confluence to the State Boundary

Final Report



Prepared by

SFC Engineering Company

In Association With

George V. Sabol Consulting Engineers, Inc.

JE Fuller/Hydrology & Geomorphology, Inc.,

and

SWCA, Inc. Environmental Consultants

Section 8

Summary for the Upper Gila and San Francisco Rivers

Prepared for

SFC Engineering Company
7776 Pointe Parkway West, Suite 290
Phoenix, Arizona 85044-5403

&

Arizona State Land Department -
Drainage & Engineering Section
1616 W. Adams St.
Phoenix, AZ 85007

Prepared by

JEFuller/ Hydrology & Geomorphology, Inc.
583 W. Magdalena Dr.
Tempe, AZ 85283

June 17, 1997

Section 8

Summary

The Upper Gila and San Francisco Rivers are perennial streams that have provided reliable sources of water for sustenance, agriculture and recreation throughout Arizona's recorded history, as well as during the prehistoric period. Despite the long history of perennial river discharges, there are only a few recorded instances of use of the rivers for boating around the time of Arizona Statehood in 1912. Not until recently, when recreational boating became popular, have these rivers been extensively used for navigation. Recent recreational boating of both rivers consists primarily of downstream floating in rubber rafts, canoes, kayaks, and other inflatable boats during seasonal periods of above-average flow.

Archaeological studies of the Upper Gila and San Francisco Rivers in Arizona have been fairly limited, although it is known that the Gila River played a major role in the human settlement patterns and occupational success of prehistoric development within the study area. The rivers provided a permanent water source, fish that were used as a protein source, and a riparian corridor that was rich in building materials, wildlife and vegetation. Therefore, most prehistoric habitations in the study area were close to the rivers. Although archaeologists have documented some 11,000 years of human use in southeastern Arizona, most of the archaeological sites in the study area date to the period from about 50 BC to AD 1200 when farmers of the Mogollon archaeological culture lived in the area. The Mogollon farmers lived in farmsteads and hamlets of as many as 20 rooms scattered along the Gila River and in the vicinity of Clifton, on the San Francisco River. In addition to the riverside farming communities, campsites and specialized activity sites have been identified throughout the uplands adjacent to the rivers. In the early historic period (circa AD 1540-1870) the area was occupied by the Yavapai and Apache, who lived primarily by hunting wild animals and gathering wild plants. Their sites consist primarily of rock overhangs, agave-roasting features, and campsites.

Except for the lower portion of the Upper Gila River near Safford, there is no evidence of extensive prehistoric irrigation agriculture on the Upper Gila and San Francisco

Rivers, as was documented for the Lower Gila River, probably due to the lack of a wide floodplain and arable land area along the rivers. Given that the water supply in the Upper Gila and San Francisco River study area was sufficient to support an extensive canal system and agricultural economy near, and downstream of, Safford, lack of water probably cannot explain the lack of archaeological evidence of prehistoric irrigation agriculture. Archaeological reconstructions suggest that streamflow rates changed little from the AD 740 -1370 period to the AD 1800-1979 period. Archaeological research has not documented any use of the river for commercial trade and travel or any regular flotation of logs.

Historical records of the Upper Gila and San Francisco Rivers extend back to the Spanish explorations of the Southwest during the 1500's. The Spanish are thought to have named the Gila River the "Rio de Los Balsas" (River of Rafts), either because their army was forced to cross the river in rafts, or because of the Indians' use of wicker baskets to cross the river. By the 1820's, Mexico had won its independence from Spain, and American fur trappers such as James Ohio Pattie, Ewing Young, and Kit Carson explored the Upper Gila and San Francisco Rivers, trapping beaver along the rivers, and establishing a travel route into Arizona. These early trappers traveled primarily on horseback or on foot in the study area, although their records indicate that they built and used canoes and rafts when they reached the Colorado River downstream of the study area. The American military expedition of Stephen Watts Kearny and William Emory in 1846, and Bartlett's boundary survey of 1850-1853 of the Gadsden Purchase, included explorations of the Upper Gila and San Francisco Rivers. Later expeditions through Arizona abandoned the Gila River route of the trappers and the military for Cooke's less difficult route located to the south of the study area.

Discovery of copper deposits by Cavalry troops along the San Francisco River during the Apache wars of the 1870's led to establishment of the Clifton-Morenci mining district. With the Apache threat subdued, and the economic incentive for development provided by copper mining, Euro-American settlement of the Upper Gila River occurred, and with it development of farms and ranches to supply the mines, roads and railroads, and a number of small towns. A Bureau of Census map from 1901 shows most of the Gila Valley was irrigated above the confluence with the San Francisco River, but only a small portion of the San

Francisco River near Potter's Ranch above Clifton was irrigated. By 1922, there were about 54 miles of main irrigation canals watering about 4,500 acres of farmland along the Upper Gila River.

Although there is some historical evidence that small boats were used on both the Upper Gila and San Francisco Rivers, transportation in the region was typically by horse, mule, wagon, stagecoach, or rail. A railroad spur was constructed to Clifton by 1883 to transport copper ore, which had previously been shipped by oxen and mule teams. A cattle trail from New Mexico followed the channel of the San Francisco River to the Gila River, and then downstream along the Gila River to other parts of Arizona. This trail remained a popular jeep and four-wheel drive route during low flow months, until the route was recently closed by the U.S. Forest Service to protect the habitat of the endangered Loach Minnow. During the period around statehood, river crossings near Clifton were accomplished by means of swinging bridges (foot bridges) or railroad. Horses, wagons and others had to ford the river.

Several episodes of boating the Upper Gila and San Francisco Rivers were documented during the historical period, in additional to the possible Indian boating noted by the Spanish explorers. The Chiricahua Apaches of the region were known to construct boats made of bull hides stretched over wooden frames for crossing streams, although no instances are specifically recorded for the Upper Gila and San Francisco Rivers. Several persons used canoes or unspecified small boats to float down the entire length of both rivers around the time of statehood. G.W. Evans and Amos Adams floated from Clifton to Riverside (near Florence) in January-February of 1895 in an unspecified type of small boat, and did not report any difficulties until well downstream of Safford. Stanley Sykes used a canoe to float the entire length of the Gila River in Arizona in 1909. Early residents of Clifton reported that building rafts for use on the San Francisco River was a popular pastime for children during the period immediately following Arizona statehood. During recent years, recreational boating has become a popular pastime on both the Upper Gila and San Francisco Rivers, especially during the winter and late spring. No evidence of boating in the upstream direction, sustained commercial boating operations, ferries, or use of keel boats or other powered boats was identified.

Early descriptions of the Upper Gila and San Francisco Rivers do not differ significantly from contemporary descriptions of the rivers. Bartlett (1854) believed that Gila River was not navigable, except during irregular floods. During these "floods" Bartlett felt that flat bottom boats could pass to the Salt River confluence near Phoenix. Whipple (part of the Bartlett survey) felt that the Gila River was an impracticable route for a wagon or railroad route due to its narrow canyons in some reaches. The San Francisco River was described as usually "relatively shallow" flowing over a wide expanse of white sand and reeds. It has steep-walled canyons with a relatively flat floodplain averaging 300-600 feet wide. The permanent stream width was generally less than 30 feet, which meanders across the floodplain. The low flow channel position changes during each flood, creating cut banks and leaving gravel bars. Floods fill the canyon from wall to wall. The Upper Gila was described as a perennial stream, often narrow and shallow enough to travel down the riverbed, except in the impassable (to vehicles) canyons. The river corridor supported a variety of species including beaver, quail, geese, ducks, deer, wolves, coyotes, and fish.

The study area was sparsely populated throughout the historical period, much as it is today. Clifton, at its peak of mining activity in 1910, had a population of about 5,000 (1993 pop. = 3,000). Several small farming and ranching communities grew up along the Upper Gila River to serve the mining community at Clifton. Much of the study is now located within the Apache-Sitgreaves National Forest or is managed by the Bureau of Land Management. Historical uses of the Upper Gila and San Francisco Rivers included limited agriculture supported by irrigation diversions from the rivers, municipal and industrial consumptive uses, recreation, and hunting, gathering, and fishing by Indians prior to the Apache wars.

The geomorphology of the Upper Gila and San Francisco Rivers is substantially unchanged from its condition at or before statehood in most of the study area upstream of the Safford Valley. Most of the Upper Gila and San Francisco Rivers are formed within bedrock canyons. Bedrock along the channel margins in these canyons precludes significant movement of the river channel or other channel changes. In addition, the bedrock geology of the Upper Gila and San Francisco Rivers area made access to the river difficult during the period around statehood, prevented development of extensive irrigation systems, and prevented the development of large population centers near the river. The reach of the Gila River located downstream of the Gila Box widened significantly around the time of statehood in response to large floods, and changed from a narrower, tree-lined river to a wide braided floodplain. Ordinary high and low watermarks may be defined based on existing topographic, vegetative, and soil characteristics.

The Upper Gila and San Francisco Rivers are perennial streams which, except for numerous irrigation diversions, have remained free-flowing since they were first settled in the 1870's. Flow rates within the study reaches probably have not changed significantly since the time of statehood. River flows have been reliable enough over the past 120 years to support irrigation-based agriculture in the Duncan Valley at the upstream end of the Upper Gila River reach, as well as a more extensive irrigation-based farm economy in the Safford Valley downstream of the study area.

As early as 1899, there were 45 diversions in the Duncan and Safford Valleys. The combined capacity of the early diversion canals and ditches was enough to divert all the flow from the Gila River during the peak irrigation season in reaches with irrigated agriculture. Available diversion data for the San Francisco River are sparse; however, even small diversions from the San Francisco River could have had a measurable impact, given the typical low average flow rates during seasons when high irrigation demand coincides with seasonal low flow. Under natural conditions, the Upper Gila River would rarely have had no-flow days, but could have experienced annual periods of low flow during June and July.

Streamflow data gathered for the Upper Gila and San Francisco River study indicate that:

- The Upper Gila River is a naturally perennial stream. The average annual discharge for the Upper Gila River varies from about 200 cfs to 430 cfs in the study reach. The minimum monthly average flow ranges from about 15 cfs to 100 cfs within the study reach, and typically occurs during the month of June.

- The San Francisco River is a naturally perennial stream. The average annual discharge for the San Francisco River varies from about 90 cfs to 215 cfs. The minimum monthly average flow ranges from about 13 cfs to 53 cfs, and typically occurs in the month of June.

- The long-term flow record demonstrates that the Upper Gila River and the San Francisco Rivers are susceptible to wide seasonal and annual variations in discharge rates.

The average annual discharge rates are only equaled or exceeded 20% of the time on the Upper Gila and the San Francisco Rivers. Therefore, the average annual discharge rate may not be as representative of "typical" flow conditions as the median (50%) flow rate or the 90% flow rate, which may give a better indication of their susceptibility to navigation. Long-term median flow rates for the Upper Gila River vary from about 66 cfs to 174 cfs between the Arizona/ New Mexico border and Safford. The long-term median flow rate for the San Francisco River varies from about 32 cfs to 76 cfs between the Arizona/ New Mexico border and the Gila River confluence. Flow depths and widths for the Upper Gila and San Francisco Rivers are shown in Table 1.

Table 1 Upper Gila River and San Francisco River Flow Characteristics				
Frequency	Discharge (cfs)	Hydraulic Depth (ft)	Average Velocity (ft/sec)	Top Width (ft)
Gila River Near Virden, NM - Upstream End of Study Reach (Duncan Valley)				
90 % Flow	21	0.6	1.3	27
Median (50%) Flow	91	0.9	2.2	45
Mean Annual Flow	190	1.2	1.6	100
2-Year Flood	4,980	5.5	8.5	107
5-Year Flood	10,400	7.5	12.6	110
Gila River Near Clifton/Guthrie, AZ - Midpoint of Study Reach (Gila Box)				
90 % Flow	18	0.7	1.0	26
Median (50%) Flow	80	1	1.7	47
Mean Annual Flow	206	1.3	2.5	64
2-Year Flood	5,940	3.7	11.5	140
5-Year Flood	11,500	5.5	14	150
Gila River at Safford Valley, Near Solomon, AZ - Downstream End of Study Reach (Safford Valley)				
90 % Flow	62	0.8	0.5	144
Median (50%) Flow	174	1.3	0.9	146
Mean Annual Flow	433	1.9	1.5	150
2-Year Flood	9,400	6.7	8.8	160
5-Year Flood	22,900	11	11.6	180
San Francisco River at Clifton - Entire Study Reach				
90 % Flow	34	0.9	1.4	28
Median (50%) Flow	76	1.0	1.6	49
Mean Annual Flow	215	1.2	2.5	72
2-Year Flood	6,800	4.5	10.1	150
5-Year Flood	17,800	8.5	13.7	153

According to various federal agency criteria for recreational use of water crafts, and according to long-term gauge records, which demonstrate highly variable flow rates on an annual basis, the Upper Gila River and the San Francisco River would have been susceptible to navigation by low-draft boats on an annual and seasonal basis, respectively. Nevertheless, canoes, small rafts, and kayaks could have navigated some portions of the Upper Gila River and the San Francisco River during the lowest flow months, as well as during flows up to and exceeding the 5-year recurrence interval. Neither the Upper Gila River, nor the San Francisco River would have been susceptible to reliable navigation by larger boats such as powered barges, steamboats, keel boats, etc., due to the occurrence of rapids, high velocities, low flow depths, long narrow canyons with no access to safe landings, natural and man-made obstructions such as riffles and irrigation diversion structures.

The Upper Gila and San Francisco Rivers were used for recreational boating as of the time of statehood. Historical hydrologic conditions in the Upper Gila and San Francisco Rivers probably would have met current federal criteria for some types of recreational boating, for most of the year. No evidence of boating in the upstream direction along the Upper Gila and San Francisco Rivers, or use of large machine-powered boats was found. No evidence of any commercial boating industries developed on the Upper Gila and San Francisco Rivers as of 1912 was uncovered. Both rivers are currently boated for recreational purposes, primarily during the winter and spring months, with limited commercial river running operations in the Gila Box Reach. Current river running guidebooks describe the Upper Gila and San Francisco Rivers as boatable at flow rates from 150 cfs (canoes and inflatables) to 10,000 cfs (large rafts).

Under HB 2589, the Arizona Legislature defined navigability criteria that established a presumption of non-navigability to be used by ANSAC when considering evidence for specific streams. For the Upper Gila and San Francisco Rivers, the following data described in this report relate to the State's navigability criteria:

- **Commercial Trade and Travel.** As of the time of statehood, the Upper Gila and San Francisco Rivers were susceptible to limited forms of commercial trade and travel, although no evidence of such use was identified during that period by this study. The hydrologic and historical record shows that there was sufficient water in the river that would allow use of shallow water boats during regularly occurring portions of the year. Shallow water boating in the downstream direction was most feasible, given the normal conditions of the two rivers.

- **Flow Regime**. As of the time of statehood, the hydrologic record shows that the Upper Gila and San Francisco Rivers were perennial streams. That is, they flow at times other than in direct response to precipitation. Like all rivers, the Upper Gila and San Francisco Rivers respond to excess precipitation with increased flow rates, or to periods of drought with reduced flow rates. However, even during the driest portions of non-drought years, the entire Upper Gila River remains perennial despite diversion of flow by numerous irrigation diversions. The San Francisco River is perennial, but generally has lower flow rates than the Upper Gila River, and occasionally becomes dry during some years.

- **Sustained Trade and Travel Upstream and Downstream**. There was no evidence identified for this study that sustained trade and travel in boats ever occurred on the Upper Gila and San Francisco Rivers, nor is there evidence that trade or travel in boats in the upstream direction ever occurred. However, the hydraulic rating curves indicate that some types of boat traffic could have occurred both upstream and downstream during regularly occurring portions of the year, although upstream travel would have been more difficult than downstream travel. The channel and canyon of the San Francisco River were used a travel route by land vehicles, cattle and horses in both directions throughout the historical period. Portions of the Upper Gila River were used as an overland travel route by the early explorers of Arizona.

- **Profitable Commercial Enterprise**. There was no historical evidence identified for this study that any profitable commercial enterprises were conducted on water using the Upper Gila or San Francisco Rivers for trade and travel as of the time of statehood. Recently, several commercial rafting and floating outfitters have operated seasonal trips in the Arizona/Gila Box of the Upper Gila River downstream of the State Route 191 crossing.

- **Types of Vessels**. The historical record indicates that canoes, rafts, and unspecified floating boats were the only vessels to be used on the Upper Gila and San Francisco Rivers. Keelboats and other powered barges apparently were not used on these rivers, nor is it likely that river conditions would have supported such use. The hydraulic rating curves prepared for the study reach indicate that large keelboats, steamboats or powered barges could not have been used during the low flow conditions on the river as it existed in 1912. During high flows, high velocities and river conditions may have made use of these types of high-draft boats hazardous or impractical.

- **Diversions**. Small irrigation diversions occur throughout the Upper Gila River, and were begun prior to statehood. Several small irrigation dams are found along the Upper Gila River in the study reach. It is not known whether the irrigated lands along the Upper Gila and San Francisco Rivers were covered under the Desert Land Act of 1877. None of the irrigated lands are within Indian Reservations.

- **Recreational Boating**. All of the historical accounts of boating on the Upper Gila and San Francisco Rivers indicate that boating was conducted for recreational purposes. Today, recreational boating on the Upper Gila and San Francisco Rivers is popular, particularly during higher flow periods in the winter and late spring.

- **Regular Flotation of Logs**. Floating of logs may have been possible during portions of most years on the Upper Gila and San Francisco Rivers as of the time of statehood, although irrigation diversions and narrow canyons may have created obstacles to continuous transport. There is no evidence that logs were floated on either river during any period before or after statehood.

- **Impediments to Navigation.** Small irrigation dams were the only known non-natural impediment to navigation in the Upper Gila and San Francisco Rivers that existed in 1912. Rapids in the Upper Gila and San Francisco Rivers are not considered challenging obstacles at flow rates less than 500 cfs, although some Class III rapids (boatable with maneuvering) occur in the Gila Box reach at flow rates over 3,500 cfs.

- **Customary Modes of Transportation**. The customary mode of transportation in the region near the Upper Gila and San Francisco Rivers was not by boat. By 1912, alternatives to boat travel included foot, horse, mule train, wagon, and train.

- **Rivers and Harbors Act of 1899.** The Upper Gila and San Francisco Rivers are not listed under the Rivers and Harbors Act of 1899.

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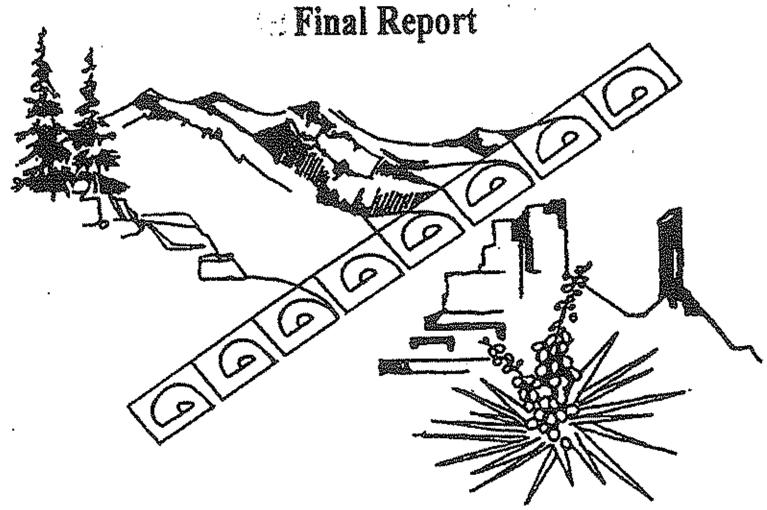

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GLOSSARY

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Acequia - An irrigation ditch or canal.

Aggradation - Progressive deposition of sediment, raising the elevation of the streambed. See Degradation.

Alluvial - See Alluvium.

Alluvial Fan - A large fan-shaped accumulation of sediment; usually formed where a stream's velocity decreases as it emerges from a narrow canyon onto a flatter plain at the foot of a mountain range.

Alluvial Stream - A stream whose bed and banks are formed in sediment transported by the stream itself; a stream with a non-bedrock channel.

Alluvium - A general term for eroded rock material, including soil, deposited by rivers; loose sediment, often from the recent geologic past.

Anecdotal - Undocumented evidence or accounting of an event.

Aquifer - A water-bearing bedrock or alluvium layer.

Archaeology - The systematic recovery, and scientific study, of material evidence of human life and culture from past ages. The study of antiquity.

Arroyo - A term used in the southwest to describe an entrenched, dry wash.

Average Flow - See Mean Flow.

Avulsion - In geomorphology, an avulsion is the sudden relocation of a stream away from its original flow path, usually due to catastrophic sediment deposition in the original flow path.

Bajada - A piedmont comprised of coalescing alluvial fans.

Base Flow - Stream discharge which does not fluctuate in response to precipitation. The minimum discharge in a stream.

Base Level - The minimum elevation to which a stream can erode.

Basin and Range - One of three physiographic provinces in Arizona. The Basin and Range is characterized by elongated, parallel mountain ranges trending northwest to southeast, with intervening basins filled by alluvium eroded from the mountains.

Braided - A braided stream is one flowing with branching and reuniting channels. May be ephemeral or perennial.

Cadastral Survey - A land (legal) survey.

Central Mountain Province (Transition Zone) - One of three physiographic provinces in Arizona, characterized by deeply eroded mountains composed of granitic bedrock.

CFS - Abbreviation for cubic feet per second, a measure of the rate of stream flow.

Channelization - The process of a stream changing from a broad unconcentrated flow path to a more confined, or single flow path.

Confluence - The point where two streams join.

Continuous Gage - A type of stream measuring equipment that records water surface elevations continuously throughout a flood, or over a long period of time regardless of flow conditions. Water surface elevations in the stream can be related to discharge rate.

Control - The river reach or structure which governs stream flow characteristics at a stream gage is called the control. A gage with reliable, consistent stream flow characteristics has "good control."

Crest Stage Gage - A type of stream measuring equipment that records only the highest water surface elevation during a flood or flow event. Water surface elevation can be related to stream discharge rate through use of a rating curve. See Continuous Gage.

Degradation - Channel bed erosion resulting in a topographically lower streambed.

Dominant Discharge - The dominant discharge is the stream flow rate responsible for forming a stream=s geometry. This theory is tenuous when applied to streams in Arizona or bedrock streams.

Empirical - Empirical methods are based on experimentally derived equations, rather than theoretically derived equations.

Entrenchment (Entrench) - Progressive degradation of a streambed or channel resulting in a topographically lower channel bottom usually with steep or vertical banks; a process associated with arroyo formation.

Ephemeral Stream - A stream which flows only in direct response to rainfall. It receives little or no water from springs and no long continued supply from snow or other sources. Its channel is at all times above the water table.

Equilibrium - Balance. When applied to streams, equilibrium means lack of change.

Erosion - Removal of bedrock or alluvium by water or wind.

Flash Floods - Floods which reach their peak discharge rate very quickly are flash floods. In Arizona, the term is often used to describe a flood or flow event moving down a previously dry river channel.

Flow Duration Curve - A cumulative frequency curve depicting the percent of time a given discharge on a stream is equaled or exceeded in a specific period. For instance, a 10 percent flow of 20 cfs means that the stream discharge only exceeds 20 cfs 10 percent of the time; a 90 percent flow of 1 cfs means that the stream flows at discharges greater than 1 cfs 90 percent of the time; the 50 percent flow is the median (not average) flow rate.

Fluvial - Relating to stream flow.

Fluvial Geomorphology - The branch of geomorphology relating to streams. See Geomorphology.

Ford - A river crossing; usually, but not necessarily, with shallow flowing water.

Frequency Distribution - A table which presents data in a number of small classes for use in statistical treatments of the data.

Geomorphic - Parameters or variables relating to geomorphology.

Geomorphology - A branch of geology concerned with the formation, characteristics, and processes of landforms, including rivers.

GIS - Geographic Information System. A database which relates information to spatial characteristics of some land area.

Ground Water - Water stored or moving beneath the ground surface, usually in pore spaces in alluvium, or voids in bedrock.

Ground Water Decline - Lowering of the elevation or volume of ground water relative to the ground surface.

Ground Water Discharge - Transfer or flow of water from underground sources into surface water; a spring.

Headcutting - A process of channel bed erosion whereby a sharp break in the average channel bed slope moves upstream, rapidly lowering the channel bed elevation.

Headwaters - The point, or area, where a stream originates; or the most upstream point of a stream.

Holocene - The most recent epoch of geologic history, usually the past 10,000 years before present; part of the Pleistocene geologic period.

Hydraulics - The science or technology of the behavior of fluids. Characteristics of stream flow such as depth, velocity, and width.

Hydrology - A branch of engineering concerned with water. In the context of this report, hydrology means the characteristics of water flow.

Incised Channel - A stream or waterway which has eroded its bed, creating steep or vertical stream banks. An arroyo, or degraded stream channel.

Infiltration - The process whereby water passes through an interface, such as from air into soil.

Instantaneous Flow Rate - Stream discharge at an instant in time, as opposed to a discharge averaged over a period of time. See Mean Flow.

Intermittant Stream - A stream which flows only for portions of the year, but has sustained flow for a period after rainfall. See Perennial Stream and Ephemeral Stream.

Mean Flow - The mean flow of a river is determined by dividing the total runoff volume by the time in which that volume was discharged, i.e., mean annual flow is the average rate at which the average yearly flow volume would be discharged.

Median Flow - The flow rate which is exceeded 50 percent of the time (conversely, the rate is not exceeded 50 percent of the time).

Morphology - The shape or geometric characteristics, especially of a stream or stream reach.

Navigable (Navigable Watercourse) - A watercourse, or portion of a reach of a watercourse, that was in existence on February 14, 1912, and that was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in the customary modes of trade and travel on water.

Perennial Stream - A stream which flows year round; non-zero base flow.

Permanent Water - Perennial stream flow.

Permeable - A rock or soil unit which is permeable will allow water to pass through it.

Phreatophytes - Deep-rooted plants that obtain water from the water table or the layer of soil just above it.

Physiographic Province - A region of similar geology. In Arizona, three physiographic provinces are recognized: the Basin and Range, the Central Highland (Transition Zone), and the Colorado Plateau.

Pleistocene - The most recent geologic period, usually the past 1,000,000 years before present.

Point of Zero Flow - The stage on a rating curve or gage record where no discharge occurs.

Quit claim - A transfer of one=s interest in a property, especially without a warranty of title to give up claim to property by means of a quit claim deed.

Quit claim deed - A deed that conveys to the grantee only such interests in property as the grantor may have, the grantee assuming responsibility for any claims brought against the property.

Rating Curve - A graph which relates stream discharge to some other measurable stream characteristic such as stage, width, depth, or velocity.

Reach - A segment of a stream, usually with uniform characteristics.

Riparian - Refers to that which is related to, or located near, or living along a watercourse whether natural, man-made, ephemeral, intermittent, or perennial.

Salt Cedar - A non-native, undomesticated tamarisk tree.

Scour - Removal of streambed material by flowing water.

Seep - A small, diffuse spring generally of low discharge rate.

Sinuosity - A measure of how sinuous a stream is: the ratio of the length along the thalweg to the length along the stream valley. Always greater than one.

Sinuous - The Acurviness@ of the channel planform; the degree of meandering.

Spring - The point where underground sources of water discharge at the surface.

Stage - A term used in stream gaging to describe the elevation of the water surface of a stream relative to some datum (fixed elevation). Stream stage is analogous to stream depth.

Stream Gage - A site operated for the purpose of measuring the rate or volume of water discharge in a stream. Accumulated data from a stream gage are called stream gage records.

Subflow - See Underflow.

Tamarisk (salt cedar) - Non-native riparian plants. Presently the dominant vegetation on the floodplain of many streams due to opportunistic growth in channel systems in the southwestern United States.

Terrace (Bench) - A relatively flat geologic or geomorphic surface which parallels a stream and is elevated above the floodplain, and was formed when the river flowed at a higher elevation.

Thalweg - The centerpoint, or low flow channel, of a stream.

Topwidth - The distance across the water surface, perpendicular to the channel, of a flowing stream.

Transition Zone - See Central Mountain Province.

Transmission Losses - Reductions in stream flow due to infiltration of water into the streambed and subsurface.

Underflow - A term used interchangeably with subflow to describe the ground water underlying the surface of a stream's channel.

Unentrenched - See Entrenchment.

Wash - A river or stream with low banks and numerous channels.

Water Table - The upper surface of the underground zone of saturation; the plane which represents the elevation of ground water.

Watershed - The land area draining into a stream, or other body of water.

Xerophytes - Plants that are structurally adapted for life and growth with a limited water supply.

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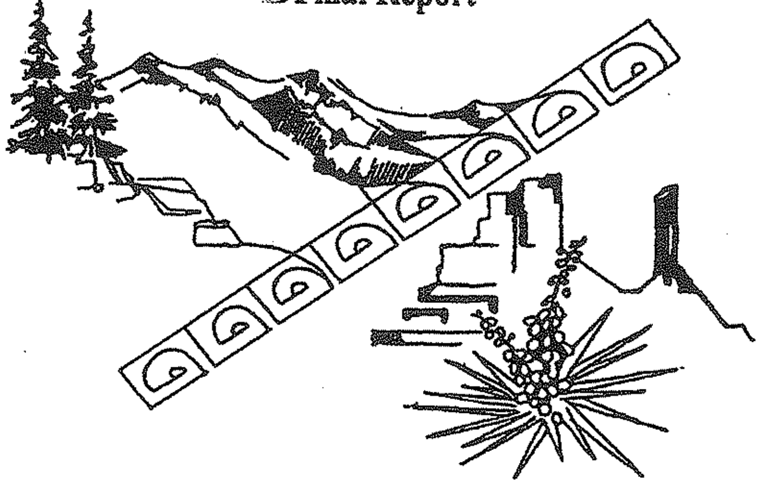

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ACRONYMS

LIST OF ACRONYMS

Arizona Geological Survey	AZGS
Arizona Land Resource Information System	ALRIS
Arizona Navigable Stream Adjudication Commission	ANSAC
Arizona Revised Statutes	A.R.S.
Arizona State Land Department	ASLD
Arizona Upland	AU
Bureau of Land Management	BLM
Cubic feet per second	cfs
Federal Emergency Management Agency	FEMA
Flood Insurance Rate Map	FIRM
General Land Office	GLO
Geographic Information System	GIS
House Bill	HB
Lower Colorado River Valley	LCRV
Right of Way	ROW
Santa Cruz River	SCR
US Geological Survey	USGS

15

BOOK 631 ORIGINAL

R. W. Norris Deputy Surveyor. 96-003-015

Gila River

T. 7. S. R. 9. East

Gila & Salt River Meridian.

Arizona

631

RECEIVED 9-9-97

Field Notes

No. 631

OF

the Subdivision lines of

Township 7. S. Range 9. East

Gila & Salt River Meridian, ~~California~~ Arizona

BY

R W Norris Deputy Surveyor,

under ~~his Contract~~ Instructions of June 12th 1869

Survey commenced July 19th 1869

Survey completed

No. 631

Platted,

Copied for Washington, JOK.

Transcript sent to Commissioner,

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Township ______ R. ______

BOOK 631

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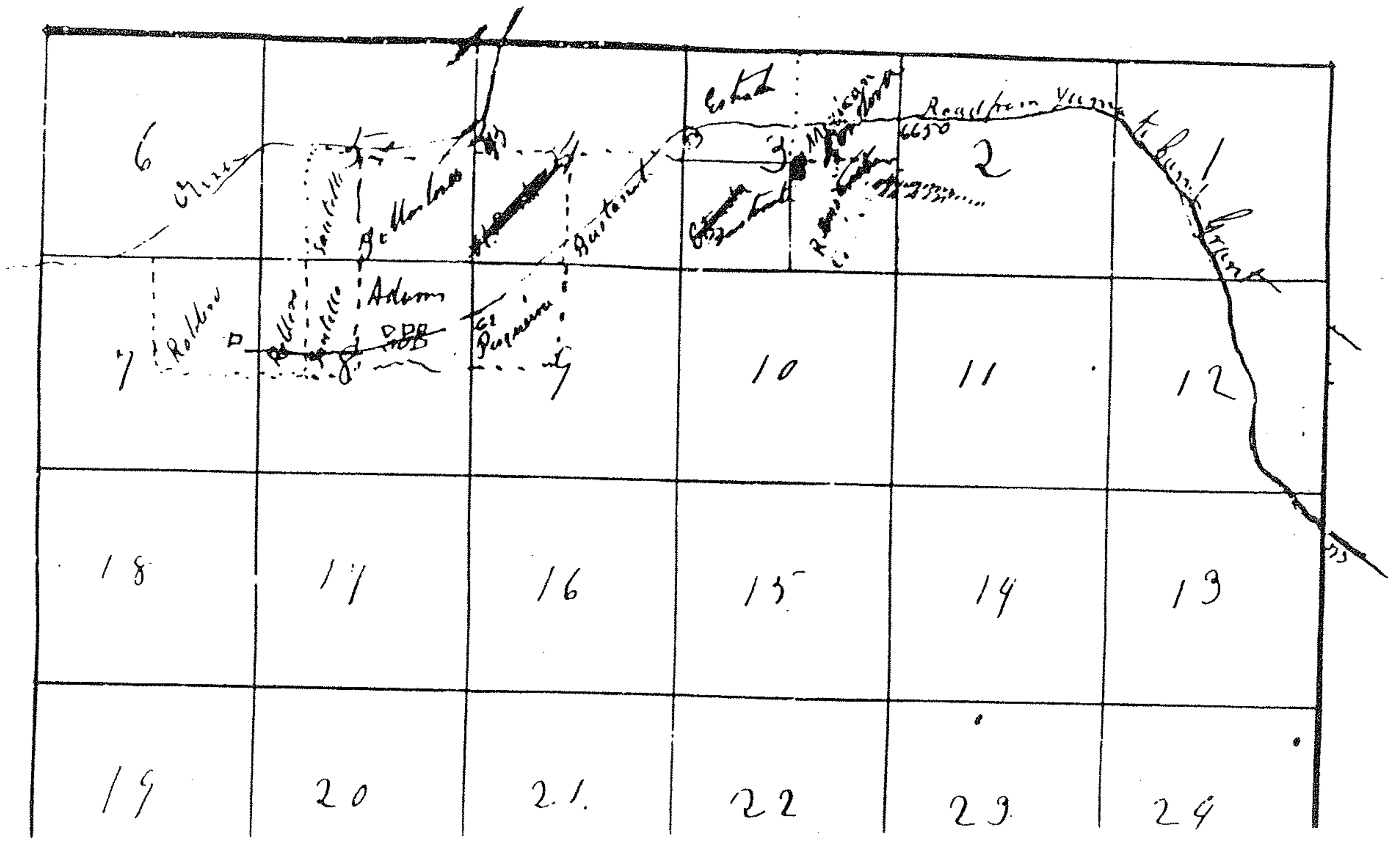
BOOK 631

copied for Washington
by, L.I.K.

Subdivision of Township 5 South
Range 9 East
Gila and Salt River Meridian

BOOK 631

T. 3. S. R. 4. E.



Township 3 South Range 9 East

Chs. Gila and Salt River Meridian

North 89° 54' W. on a True line between Sec. 3 and 10

Va. 13° 45' E.

40.12 Set a charred Stake for the 1/4 Sec. cor. and raise mound with pits as per Instructions

80.25 The corner to Sections 3, 4, 9, 10

Land Rough scrolling and open and 3d rate

North, on a Random line between Sec. 3 & 4

Va. 13° 45' E.

5.00 Descend to Mesquit Table land

40.00 Set a post for temporary 1/4 Sec. cor.

59.00 Road to Camp Grant from Ft. Yuma bearing N. 85° 54' W.

65.00 Field of Valentine Estrada. Claim S. W. 1/4 of Sec. 3

80.84 Intersect the North Boundary 67 lks west of cor. to Sec. 3 and 4. from which corner I Run S. 0° 29' W. on a True line between Secs. 3 and 4

Variation 13° 45' E.

40.84 Set a charred Stake for the 1/4 Sec. cor. and raise mound with Pits as per Instructions

80.84 The corner to Sections 3, 4, 9, 10

Land in mesquit 2nd rate the Remainder 3d rate

Township 5 South, Range 9 East

Chs. Gila and Salt River Meridian

— raise mound with Pits as per Instructions
Land in bottom 1st Rate. The Remainder 3rd rate

East, on a random line between Secs 4 and 9
Feby 25. 1869 Va. 19°45' E.

30.00 Cross Road from Ft. Yuma to Camp Grant bearing N 45 E & S 45 W.

40.00 Set a post for temporary 1/4 Sec. cor

55.00 Leave bottom for hilly & rolling ground

80.43 Intersect N and S. line 15 lks South of cor to Secs. 3, 4, 9, 10, from which corner Run S. 89° 52' W. on a true line between Secs. 4 and 9
Va. 19°45' E

40.21 Set a charred stake for the 1/4 sec cor, and raise mound with Pits as per Instructions

80.43 The corner to Sections 4, 5, 8, 9
Land in Bottom generally 2nd Rate
The Remainder is 3rd Rate

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Township 5, South, Range 9, East

the Gila and Salt River Meridian

North, on a Random line between Sec. 4 and 5

Va. 13.45 E.

4000 Set a post for temporary 1/4 Sec. cor.

47.00 To bed of Gila River in ordinary stage of water

At present it is dry

57.00 To channel of River bearing S. 80 W. to N. 45 E.

62.00 To Sandy 3rd rate Cottonwood land

80.45 Intersect the North Boundary 30 lk West of

Cor. to Sec. 4 and 5 from which corner I Run

S 0° 13' W. on a True line between Sec. 4 and 5

Va. 13° 45' E.

4045 Set a charred stake for the 1/4 Sec. cor and raise

mound with Pits as per Instructions

80.45 The corner to sections 4. 5. 8. 9

Land 2nd rate except on the North side of

the River the line is in a field

R. Bustamente claims the S.E. 1/4 and Jesus

Bustamente the S.W. 1/4 & Ramon Cordova the

N.E. 1/4 of Sec. 9. Adams the N.E. 1/4 of Sec. 8

Jesus Martinez the S.E. 1/4 of Sec. 5

32 19 BOOK 631

Township 5 South Range 9 East

Chs	Gila and Salt River Meridian	
		6
1/4	East, on a Random line between Sec. 5 and 8	80
	Va 13° 45' E,	
40.00	Set a post for temporary 1/4 Sec. Cor,	
	Martinez Claims S.E. 1/4 of Sec 5. Adams N.E. 1/4 of Sec. 8	
79.70	Intersect N and S. line at post corner to Sec.	
	4.5.8.9. from which corner I Run	40
	West on a True line between Sections 5 and 8	
	Va 13° 45' E	80.
39.85	Set a charred Stake for the 1/4 Sec. Cor, and	
	raise mound with pits as per Instructions	
79.70	The corner to Sections 5.6.7.8,	
	This line runs in cultivated ground and	
	the land is 2nd rate	
		80
	West, on a Random line between Sec. 6 and 7	39.
	Va, 13° 45' E,	40.
28.00	To Low Cottonwood bottom 3rd rate	45.
40.00	Set a post for temporary 1/4 Sec. Cor,	80.9
65.00	To Gila River bearing S 75 W & N 45 E	
70.00	Crossed the Same & run 2 ...	

Township 5, South Range 9, East

Chs } Gila and Salt River Meridian

80,60 Intersect the West Boundary 40 lks South of cor to Secs. 6 and 7, from which corner I Run
S.89°43'E. on a True line between Secs, 6 & 7
Va. 13°45'E,

40,60 Set a charred stake for the 1/4 Sec cor, and raise mound with Pits as per Instructions

80,60 The corner to Sections 5, 6, 7, 8
Land in field 2nd rate The Remainder 3d rate overflowed bottom

North, on a Random line between Secs 5 and 6
Va 13°45'E

8,00 Leave field for Sandy Cottonwood bottom
39,00 To high Sandy Level
40,00 Set a post for temporary 1/4 Sec, cor
45,00 To Gila River bearing E, and W.
80,37 Intersect the North Boundary 40 lks West of cor. to Secs, 5 & 6 from which Corner I Run

Township 5, South Range 9. East

Chs.	Gila and Salt River Meridian
	S. 0° 17' West on a true line between Sec 5, Sec 6
	Va. 13° 45' E.
40.37	Set a charred stake for the 1/4 Sec cor and raise mound with Pits as per Instructions
80.37	The corner to Sections 5 6 7 8
	Land 3rd Rate, with heavy growth of Cottonwood and dense undergrowth

The land in this Township has without doubt been cultivated. A great portion of it would produce good Crops if water could be brought upon it. This is almost an impossibility there is barely enough in the Gila River for the use of the Settlements as they are. There is considerable Grammon Grass growing throughout.

Township 5 South Range 9. East
Gila and Salt River Meridian

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ROBERT STOKES
County Administrator • (520) 865 2310

DEBORAH K. GALE
Clerk of the Board • (520) 865-2072

FACSIMILE # (520) 865 4417

THE STATE OF ARIZONA — COUNTY OF GREENLEE

DONALD R. STACEY
District 1

HECTOR RUEDAS
District 2

FRED L. ZUMWALT
District 3

BOARD OF SUPERVISORS
P.O. BOX 908
CLIFTON, ARIZONA 85533

RECEIVED 3-11-1998

ORIGINAL

March 11, 1998

96-003-016
Gila River

Arizona Navigable Stream Adjudication Commission
1700 W. Washington
Phoenix, AZ 85007

97-003-007
San Francisco
River

Reference: Gila and San Francisco Rivers Navigability Determination

Members of the Commission:

The following evidence demonstrates, that the Gila River, was not navigable on or before February 14, 1912, in accordance with the terms of 37-1128 D. and E.

1. Edwin Corle, in the Foreword to his book, The Gila River of the Southwest, describing the history of the rivers states "The Gila has been a changeable river throughout its lifetime of many millions of years, of which only the past twenty five thousand years can be called history visible to man. It has never known a steamboat, very few rowboats, some floating logs, and only a fair assortment of fish."[1]

2. In the five years prior to 1912 (1907-1911), farmers irrigating, in the Duncan and Gila valleys, had a right to divert from the Gila River, 448.64 cubic feet per second.[2] The documented volume of irrigation required numerous and substantial diversion dams in the river.

3. Patents to lands, bordering navigable waters, convey title only to the high-water mark and do not include the bed or bank, of the river, below the high water mark, 73 C.J.S., Public Lands, Section 140.

Federal patents, convey land to private parties, therefore a review of federal land patents to determine, if the bed of the river was excluded, is important in determining whether the river was navigable, at the time of statehood.

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[1] Corle, Edwin, The Gila River of the Southwest, University of Nebraska Press, 1951

[2] Distribution of Waters of the Gila River by the Gila Water Commissioner Don L. Weesner to the United States District Court in and for the District of Arizona, 1995

A patent without any reservations or exceptions, passes to the patentee, everything connected with the soil, forming any portion of its bed, or fixed to its surface, to the extent that the government has ownership and power of disposal, 73 C.J.S. Public Lands Section 140.[3]

Attached is a photocopy of Homestead Certificate No. 1150, granting a parcel of land, a portion of which lies in and through the Gila River bed, to William T. Sanders, dated April 8, 1902. The original document is in the possession of Mrs. Norma O"Dell of Duncan, Arizona. She allowed me to copy the document. The only reservation or exception to the grant of land is, " And there is reserved from the lands hereby granted, a right of way thereon for ditches or canals constructed by the authority of the United States."

I concur with the conclusions and recommendations, of Phelps Dodge Corporation, in its assessment transmitted, to the Commission, on August 15, 1997, for the reasons stated in the submission and the evidence presented reference the San Francisco River.

I also conclude that the Gila River was not a navigable stream before and at statehood and that the Commission should recommend the legislature find that the Gila and San Francisco Rivers were non-navigable on February 14, 1912.

Sincerely,

Fred L. Zumwalt
Fred L. Zumwalt
Supervisor

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[3] Assessment of the San Francisco River's Navigability Prior To and ON The Date of Arizona's Statehood, prepared by All Lands Title, submitted to the Arizona Navigable River Commission August 15, 1997

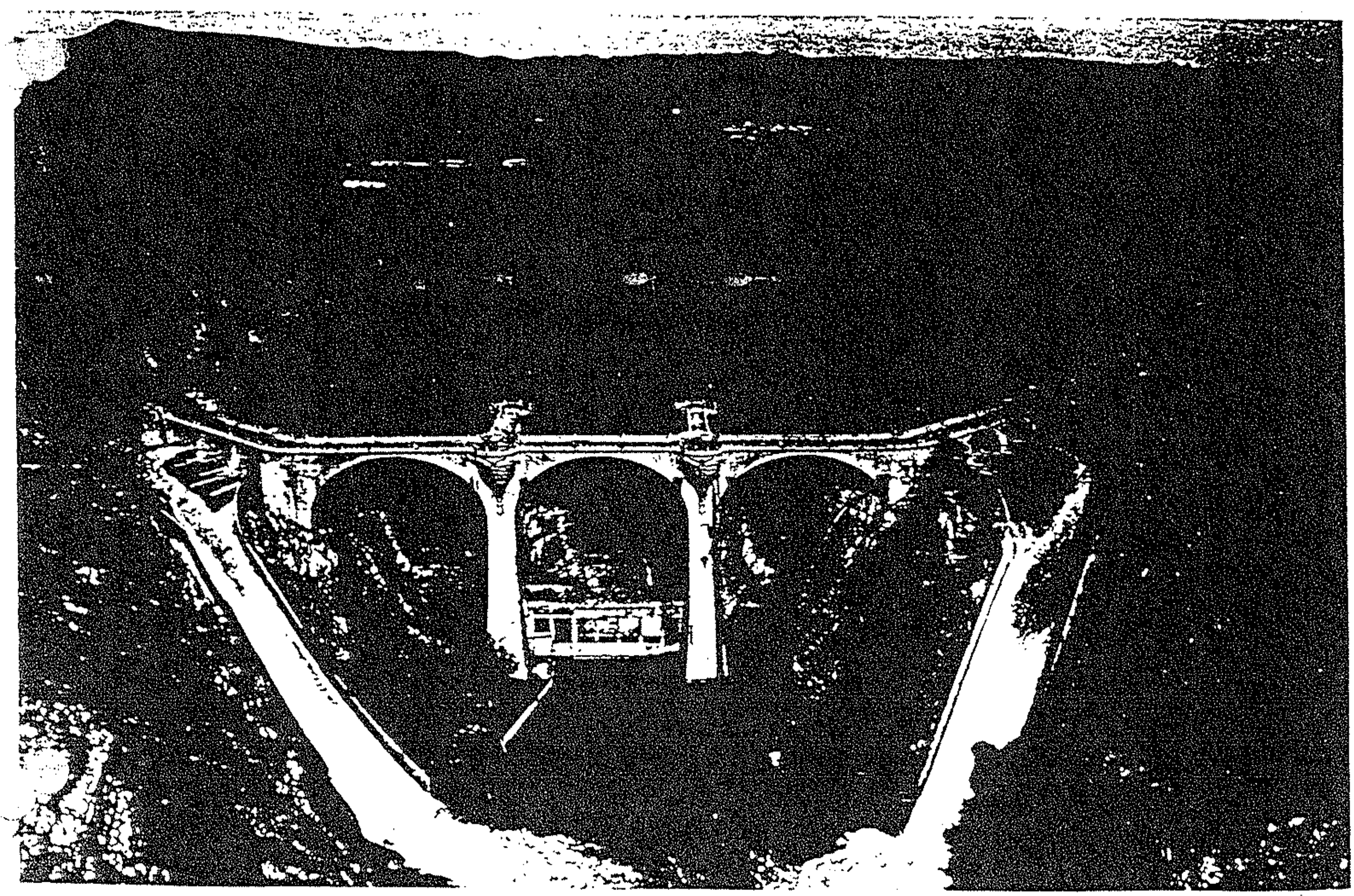
Sixtieth Annual Report

Distribution of Waters of The Gila River

BY THE
GILA WATER COMMISSIONER
DON L. WEESNER

TO THE
UNITED STATES DISTRICT COURT
In and For The District of Arizona

1995



RELATIVE DIVERSION RIGHT BASED ON A DIVERSION RIGHT OF ONE CUBIC FOOT PER SECOND FOR EACH EIGHTY ACRES

Revised to January 1, 1996

Year of Prior.	Duncan Valley		Safford Valley		Total Upper Valleys		San Carlos Indian Reservation	Winkelman Valley			U.S.A.	Total Decreed	Total Modified
	Decreed	Modified 1995	Decreed	Modified 1995	Decreed	Modified 1995		Ind.*	Ind.*	Agr.			
Immem. Rights											437.5	437.5	437.5
1846							12.5					450.0	450.0
1868											449.5	462.0	462.0
1869											460.2	472.7	472.7
1872			0.4	0.4	0.4	0.4					467.7	480.6	480.6
1873			1.0	1.0	1.0	1.0					469.7	483.2	483.2
1874	6.3	6.3	7.9	7.9	14.2	14.2					469.9	496.6	496.6
1875			16.5	16.5	22.8	22.8					473.8	509.1	509.1
1876			24.3	24.3	30.6	30.6					479.5	522.6	522.6
1877			35.4	35.4	41.7	41.7			0.1	0.3	481.5	536.1	536.1
1878			43.9	43.9	50.2	50.2		0.8			481.8	545.7	545.7
1879			51.2	51.2	57.5	57.5		2.0			484.5	556.9	556.9
1880			62.2	62.2	68.5	68.5		3.6	0.3	2.2	484.9	572.0	572.0
1881	12.1	12.1	72.7	72.7	84.8	84.8						588.3	588.3
1882	13.2	13.2	85.6	85.6	98.8	98.8						602.3	602.3
1883			104.8	104.8	118.0	118.0						621.5	621.5
1884	13.7	13.7	126.1	126.1	139.8	139.8		5.7	1.3	2.4	485.3	647.0	647.0
1885	19.3	19.3	142.0	142.0	161.3	161.3		6.4			486.6	670.5	670.5
1886	22.2	22.2	160.8	160.8	183.0	183.0					486.9	692.5	692.5
1887	22.9	22.9	171.0	171.0	193.9	193.9		7.2		2.9		704.7	704.7
1888	30.5	30.5	179.3	179.3	209.8	209.8						720.6	720.6
1889	31.8	31.8	191.4	191.4	223.2	223.2					489.5	736.6	736.6
1890			202.8	202.8	234.6	234.6		7.3			491.3	749.9	749.9
1891	32.3	32.3	215.6	215.6	247.9	247.9					503.5	775.4	775.4
1892	33.5	33.5	221.2	221.2	254.7	254.7					508.5	787.2	787.2
[illegible]	34.5	34.5	228.0	228.0	262.5	262.5					512.5	799.0	799.0
[illegible]4	37.7	37.7	230.3	230.3	268.0	268.0					514.9	806.9	806.9
[illegible]95	42.0	42.0	235.5	235.5	277.5	277.5		7.8			524.2	826.2	826.2
1896	45.6	45.6	246.0	246.0	291.6	291.6					528.1	844.2	844.2
1897	59.8	59.8	249.7	249.7	309.5	309.5						862.1	862.1
1898	69.9	69.9	253.0	253.0	322.9	322.9					528.5	875.9	875.9
1899			260.3	260.3	330.2	330.2					528.6	883.3	883.3
1900	75.3	75.3	270.7	270.7	346.0	346.0						899.1	899.1
1901	76.0	76.0	277.7	277.7	353.7	353.7					529.1	907.3	907.3
1902	78.1	78.1	283.2	283.2	361.3	361.3						914.9	914.9
1903	79.2	79.2	288.4	288.4	367.6	367.6						921.2	921.2
1904	81.3	81.3	318.7	317.0	400.0	398.3					529.7	954.1	952.5
1905	82.4	82.4	321.6	319.9	404.0	402.3						958.2	956.5
1906	83.5	83.5	326.0	324.3	409.5	407.8		8.0				964.0	962.2
1907	85.1	85.1	350.4	347.2	435.5	432.3						989.9	986.7
1908	89.1	89.1	354.4	351.2	443.5	440.3		9.9		4.0	535.0	1006.2	1003.0
1909	90.4	90.4	358.5	355.2	448.9	445.6		22.22			538.4	1027.32	1024.02
1910	91.2	91.2	365.6	361.6	456.8	452.8					540.1	1036.92	1032.92
1911	92.1	92.1	366.6	362.6	458.7	454.7					542.1	1040.82	1036.82
1912	92.2	92.2	372.4	366.9	464.6	489.1					543.8	1048.42	1042.92
1913	92.3	92.3	380.6	374.5	472.9	466.8					558.9	1071.82	1065.72
1914	92.9	92.9	383.6	377.3	476.5	470.2					569.3	1085.82	1079.52
1915	93.4	93.4	390.3	383.8	483.7	477.2						1093.02	1086.52
1916	93.5	93.5	392.2	385.5	485.7	479.0				4.9	775.0	1301.62	1294.92
1917	98.5	98.5	397.4	389.7	495.9	488.2						1311.82	1304.12
1918	99.7	99.2	399.0	391.2	498.7	490.4						1314.62	1306.32
1919	100.0	99.5	404.4	394.7	504.4	494.2						1320.32	1310.12
1920	100.1	99.6	406.3	395.7	506.4	495.3				5.2		1322.62	1311.52
1921	100.2				506.5							1322.72	
1924											1256.5	1804.22	1793.02
1926	100.3				506.6					5.5		1804.62	1793.32
1929	100.7				507.0							1805.02	
Total	100.8	99.6	406.4	395.7	507.2	495.3	12.5	22.22	1.3	5.5	1258.5	1805.22	1793.32

Note * Industrial and Municipal use
1995 modified effective June 1,1995 in accordance with court order

c: R4W\yr95\relatdiv wk4

(4—405 a.)

THE UNITED STATES OF AMERICA,

To all to whom these presents shall come, Greeting:

Homestead Certificate No. 1150

Application 2638

Whereas There has been deposited in the GENERAL LAND OFFICE of the United States a CERTIFICATE OF THE REGISTER OF THE LAND OFFICE at Tucson Arizona, whereby it appears that, pursuant to the Act of Congress approved 20th May, 1862, **"To secure Homesteads to Actual Settlers on the Public Domain,"** and the acts supplemental thereto, the claim of William T. Sanders has been established and duly consummated, in conformity to law, for the lot numbered two the South East quarter of the North West quarter, the North East quarter of the South West quarter and the North West quarter of the South East quarter of Section eighteen in Township eight South of Range thirty-two East of Gila and Salt River Meridian in Arizona, containing one hundred and sixty acres and eighteen hundredths of an acre

according to the OFFICIAL PLAT of the Survey of the said Land, returned to the GENERAL LAND OFFICE by the SURVEYOR GENERAL:

Now know ye, That there is, therefore, granted by the United States unto the said William T. Sanders the tract of Land above described: **To have and to hold** the said tract of Land, with the appurtenances thereof, unto the said William T. Sanders and to his heirs and assigns forever; subject to any vested and accrued water rights for mining, agricultural, manufacturing, or other purposes, and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts, and also subject to the right of the proprietor of a vein or lode to extract and remove his ore therefrom, should the same be found to penetrate or intersect the premises hereby granted, as provided by law. And there is reserved from the lands hereby granted, a right of way thereon for ditches or canals constructed by the authority of the United States.

In testimony whereof I, Theodore Roosevelt, PRESIDENT OF THE UNITED STATES OF AMERICA, have caused these letters to be made Patent, and the seal of the GENERAL LAND OFFICE to be hereunto affixed.

GIVEN under my hand, at the CITY OF WASHINGTON, the eighth day of April, in the year of our Lord one thousand nine hundred and two, and of the Independence of the United States the one hundred and twenty-sixth.

BY THE PRESIDENT: T. Roosevelt

By F. M. McKean, Secretary.

[illegible], Recorder of the General Land Office.

Recorded Arizona, Vol. 11, Page 450

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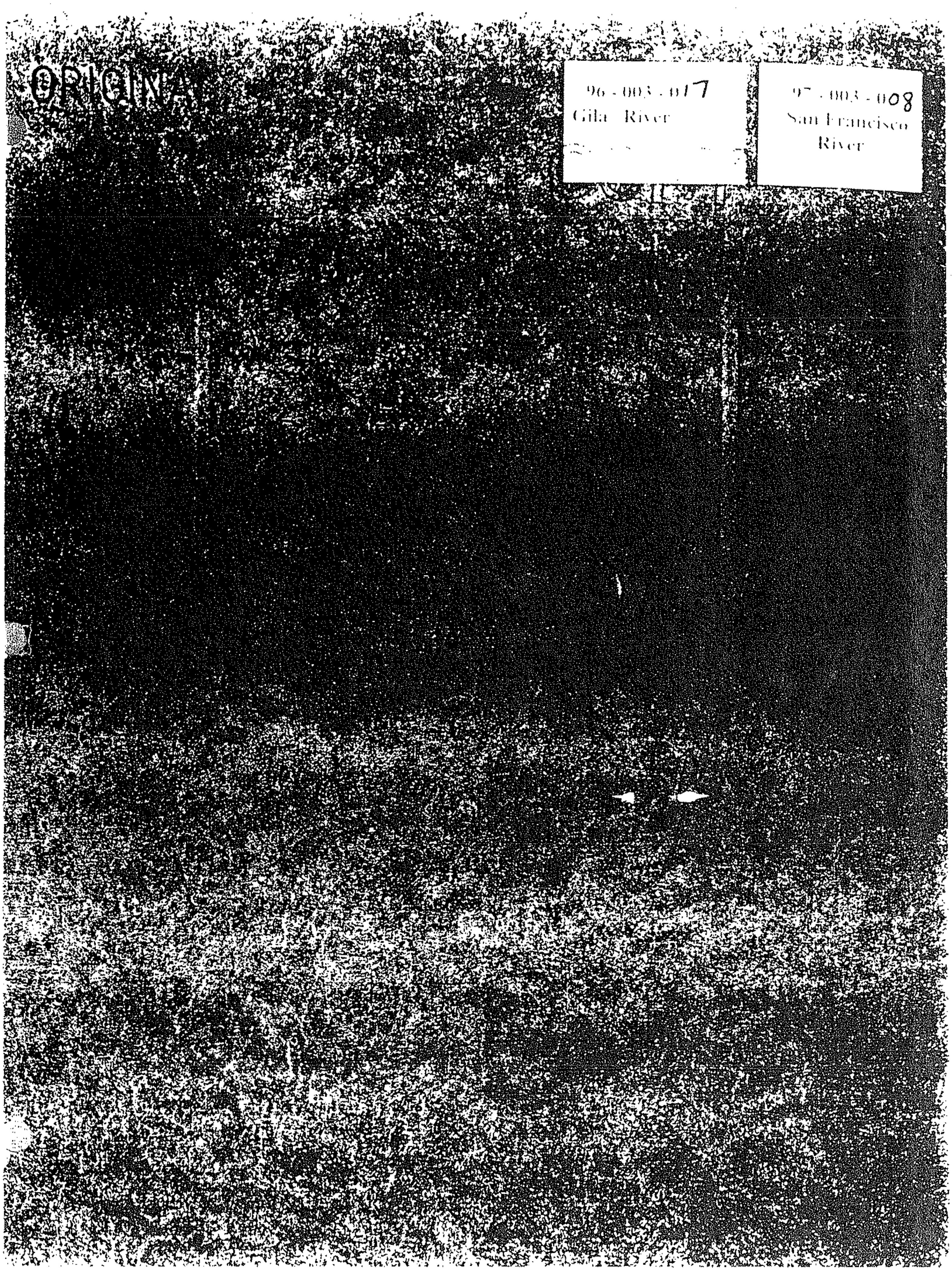

ORIGINAL
96-003-017
Gila River
97-003-008
San Francisco
River

65TH CONGRESS, 3d Session — SENATE — DOCUMENT No. 436

U. S. Dept of the interior

Gila River Flood Control

LETTER

FROM THE

SECRETARY OF THE INTERIOR

TRANSMITTING, PURSUANT TO LAW

A REPORT ON FLOOD CONTROL OF THE GILA RIVER IN GRAHAM COUNTY, ARIZONA

WASHINGTON
GOVERNMENT PRINTING OFFICE
1919

SENATE RESOLUTION 487.

(Reported by Mr. Smith, of Arizona.)

IN THE SENATE OF THE UNITED STATES,
March 1 (calendar day of March 3), 1919.

Resolved, That the report on the Gila River flood control in Graham County, Ariz., by Frank H. Olmstead, transmitted by the Secretary of the Interior, March 3, 1919, pursuant to an act of Congress approved May 18, 1916, be printed as a Senate document, with illustrations.

Attest:

JAMES M. BAKER, *Secretary.*

LETTER OF TRANSMITTAL.

THE SECRETARY OF THE INTERIOR,
Washington, March 3, 1919.

MY DEAR MR. VICE PRESIDENT: I herewith transmit report made by Frank H. Olmstead flood control on the Gila River in Graham County, Ariz., made pursuant to the act of Con-ss approved May 18, 1916 (39 Stat. 159).

Cordially, yours,

FRANKLIN K. LANE.

Hon. THOMAS R. MARSHALL,
Vice President.

LETTER OF SUBMITTAL.

Honorable Sir: I hereby submit my report upon flood control of the Gila River, in Graham County, Ariz., with definite recommendations for protecting banks, stabilizing channel, reducing flood crests, and minimizing silt quantities.

Respectfully,

Frank H. Olmstead.

Mr. Franklin K. Lane,
Secretary of the Interior, Washington, D. C.

[Extract from the Indian Appropriation Act, approved May 18, 1916.]

That the Secretary of the Interior be, and he hereby is, authorized and directed to cause to be made by competent engineers the necessary examinations, investigations, and surveys for the purpose of determining the most suitable and practicable method or methods of constructing levees, revetments, or other suitable works sufficient to prevent the Gila River from further eroding and wearing and washing away its banks and from further overflowing its banks at any point in Graham County, Arizona.

Said engineers shall also determine and report upon the most suitable, feasible, and practicable means of holding the said river within a fixed channel as it flows through said Graham County. Said Secretary shall submit to Congress the result of such examinations, investigations, and surveys, together with an estimate of the cost thereof, with recommendations thereon, at the earliest practicable date. The sum of $10,000, or so much thereof as may be necessary, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the purpose of conducting said investigations, examinations, and surveys.

GILA RIVER FLOOD CONTROL.

Part I.

This investigation was carried out and this report is now made under the provisions of a contract with the Secretary of the Interior dated August 26, 1916, the specific obligation on the writer's part being to design a practical plan for protecting the riparian lands along the Gila River in Graham County, Ariz., against erosion and to confine the stream to a fixed channel within that county.

GRAHAM COUNTY PROTECTION

A practical plan for relieving the flood situation in Graham County, Ariz., presupposes that the cost of the works recommended be not prohibitive when balanced against the benefits to be derived therefrom. The direct benefit of protecting the Graham County lands along the Gila River from further erosion can be estimated somewhat definitely because the agricultural area is limited and there is no portion of it but that to some extent is jeopardized by the possible attacks of the river.

PRESENT IRRIGATED AREA.

Of the total valley area along the Gila River in Graham County there are 35,000 acres of irrigable land and 5,000 acres in addition of fertile bench land contiguous thereto and which could be supplied with water by a high-line canal. Of this 40,000 acres only 27,600 acres are now irrigated. Of this latter amount 1,000 acres are on the San Carlos Indian Reservation, and 26,600 acres in what is locally known as the Safford or Solomonville Valley, the former being the term hereinafter used.

This report is virtually in two parts—one relating solely to present river conditions in Graham County and the plans for improving them; the second relating to a broader investigation of the whole watershed and an analysis of the opportunities for diminishing waste and initiating a proper conservation program for this region.

Graham County, Ariz., reaches from San Carlos to above Solomonville on the Gila River, and includes all the irrigable lands between the San Francisco and San Carlos Rivers. The physical characteristics of the territory included within the county boundaries can not be likened to those of the desert as, for instance, on the lower Gila, nor do they conform to those of the upper Gila watershed where the topography, flora, and all the phenomena of nature are of the sterner type due to higher altitudes.

Graham County, Ariz., covers the territory on either side of the Gila River on the middle reach of the stream. The San Carlos River, which marks the lower line of the county, is 550 miles up the stream from its junction with the Colorado River at Yuma. The Gila River has two large tributaries below San Carlos—the Salt and San Pedro, and one above (the San Francisco), the stream itself heading in the hign mountain recesses of the Mogollon and the Black Range.

HISTORY.

The drainage basin of the Gila River probably presents more points of historical and archæological interest than any other similar area in the United States. As early as 1539, or not more than 50 years after the voyage of Columbus, courageous Jesuit priests of New Spain turned their steps northward in the quest of the fabled "Seven Cities of Cibola," and penetrated this then unknown territory. The route of these early explorers as now generally established, came out of old Mexico from the upper part of the Sonora River and ran over to and down the San Pedro as far as Tres Alamos, and thence across to the Goodwin Wash, passing Goodwin Springs and then reaching the Gila near the present town of Geronimo.

Long before the advent of the Spaniards, however, the fertile valleys of the Gila had sheltered and fed great numbers of ancient people who had attained a remarkably advanced state of civilization, and who at the time of the coming of the Spaniards had either become extinct or had migrated to other lands.

The many ancient ruins along the Gila have long been known and much has been written concerning them. Authoritative accounts have been given by Bandolier, Fewkes, and others in the reports of the Bureau of American Ethnology, and reports of several privately equipped explorations have been published.

CHICHILTICALLI.

The famous ruins of Casa Grande and Chichilticalli are located within the drainage area of the Gila, while many lesser known ones, together with cave dwellings, traces of old canals, and terraced gardens, are to be found, not only on the Gila itself, but on practically every one of its tributaries. Graham County as well as the balance of the upper Gila is not without its share of these relics of prehistoric times. The town of Solomonville is situated on the site of two extensive ruins, while the numerous other ruins in Safford Valley are responsible for its former and original name—the Valley of the Pueblo Viejo.

The so-called Chichilticalli ruins, made famous by the Coronado Expedition, are thought to be located just below Geronimo in the Safford Valley. Some difference of opinion exists, however, as to the exact location of this Chichilticalli ruin, but Prof. F. W. Craigen, who has made an extensive and exhaustive study of this particular question, claims to have established beyond doubt that the ruins which are to be found on the long mesa jutting out into the valley just beyond Geronimo are indeed the long sought Chichilticalli.

On the extreme upper Gila, and in fact throughout the Gila watershed, remains of cave dwellings are to be found wherever physiographic conditions are favorable. A comparison of the relics from the lower pueblos and in the cave dwellings shows their similarity and points strongly to the contention that they were the work of the same or closely related people.

ANCIENT AGRICULTURE.

There can be no doubt that these ancient inhabitants were tillers of the soil and practiced extensive irrigation. Traces of ancient canals are to be found along many different parts of the Gila. Several of the present day ditches, as in the case of the San Jose and the Montezuma in the Safford Valley, follow at least in part the courses of the ancient canals. They also constructed large storage reservoirs, and there is some little evidence to show that they made small rock dams in the mountains, possibly for retardation purposes. Probably the largest ancient irrigation work was that discovered in southern Grant County, N. Mex., by the engineers of the survey of the international boundary line. According to profiles and sections made by Capt. B. D. Gaillard, United States Army, this dam consisted of gigantic earthworks 3½ miles long and 22 to 24 feet high, involving in its construction the handling of 800,000 to 1,000,000 cubic yards of material.

There is still some question as to the identity of these ancient builders. It appears, however, that the best informed writers are strongly inclined to the belief that these prehistoric inhabitants were simply the ancestors of the present day Pueblo Indians, and that an invasion of their country by an outside race drove these agriculturists out of their territory or disbanded them into smaller tribes and thus caused them to lose their former culture and revert to the condition in which they were found at the time of the coming of the whites.

The first exploring Jesuit priest who crossed the threshold of what is now Arizona was Fray Marcus de Niza, who penetrated this inhospitable country as early as 1539. Fray Marcus was followed the next year by the well-known and already mentioned Coronado Expedition.

While the lower regions of the Gila at the time of the Coronado Expedition were occupied and to a certain extent cultivated by the present day Indians, yet the upper Gila had no permanent inhabitants. Subsequent, however, to the Coronado Expedition and prior to the advent of the whites, the whole general territory of the upper Gila was made the hunting grounds of the intractable Apache.

From the time of the Coronado visit, which terminated in 1542, until near the close of the seventeenth century this territory received very little attention from the Spaniards or other explorers. Near the close of the seventeenth and during the early part of the eighteenth century this region was visited by a number of Jesuit missionaries, among whom was Eusibo Francisco Kino, founder of the San Xavier Mission at Tucson and discoverer of the Casa Grande ruins. Mexican occupation and development of the whole region, which was then known as Pimera Alta, kept pace with the growth of the missions.

The expulsion of the Jesuits which took place in 1776 caused an exodus of the Spaniards, and from this time until the treaty of Guadalupe Hidalgo in 1848 this territory was left pretty much in possession of the Indians. The Guadalupe treaty which came as a result of the Mexican War ceded to the United States all that territory north of the Gila, while the present territory south of the Gila was acquired in 1854 by the Gadsden purchase. Some 15 or 20 years previous to the Mexican War, American beaver trappers began to penetrate this territory, and from the accounts of these adventurers beaver were very plentiful indeed along the Gila and its tributaries. American occupation on a large scale began in the early fifties, and as early as 1865 a considerable settlement had grown up on the lower part of the Gila.

In the Solomonville Valley and on the upper tributaries of the Gila the hostilities of the Apaches prevented rapid development. Some time after the Gadsden Purchase a few Mexicans had established themselves in the Safford Valley, but it was not until after 1870 that American farmers ventured into this territory. Development at first was slow, but beginning with the eighties rapid progress was made and many settlers came to take advantage of the agricultural possibilities of the broad and fertile lands in the Safford Valley.

The name "Gila" appears to be of Indian origin and means "spider." According to Bancroft the word was first applied in 1630 to a New Mexican province where the river had its source. Previous to this time, however, it was known as the Rio del Nombre de Jesus.

EARLY FLOODS.

The descriptions of the early explorers indicate that the district has undergone great changes in respect to the width of the Gila River channel and to the stability of its normal flow, but while it is true that the primeval conditions of the virgin watershed did much toward regulating the run-off, the Gila, even in its earlier days, was not without its occasional floods.

One of the oldest Pima Indians claimed that the greatest flood he ever saw took place when he was about 5 years old, and that the river on the Pima Reservation at Sacaton spread from the Casa Blanca ruins to the Double Butte Mountain, a distance of 2 miles. The account of this flood was corroborated in one of the Pima Indian calendars and the date is given as that of 1833. An interpretation of this calendar is to be found on page 38 in the Twenty-sixth Annual Report of the Bureau of American Ethnology.

The next flood of which we have any record appears to have taken place in 1869 and was mentioned by the Indian previously referred to as well as also being reported in the calendar sticks of some of the other Pima Indians. Another flood in 1884 is of record.

It must be remembered that these early floods, which were extensive enough to warrant tribal record, were not in all probability violent flash crests that arose one day and disappeared the next, but were the results of unusual rains of long duration, such as occasionally now, and undoubtedly then, occurred over the Gila River watershed. The effect of these floods was to spread out over wide areas, such as the one described by the old Pima Indian, but never becoming great detritus-carrying, eroding flood crests, such as happen now from ordinary heavy precipitation. This may be safely inferred from the fact that up to less than a generation ago there were no indications, either on the lower river or in the mountains, that heavy erosion had taken place.

William H. Emory, major First Cavalry and United States Commissioner on Mexican boundary survey, 1857, says, in speaking of the Colorado River at Yuma:

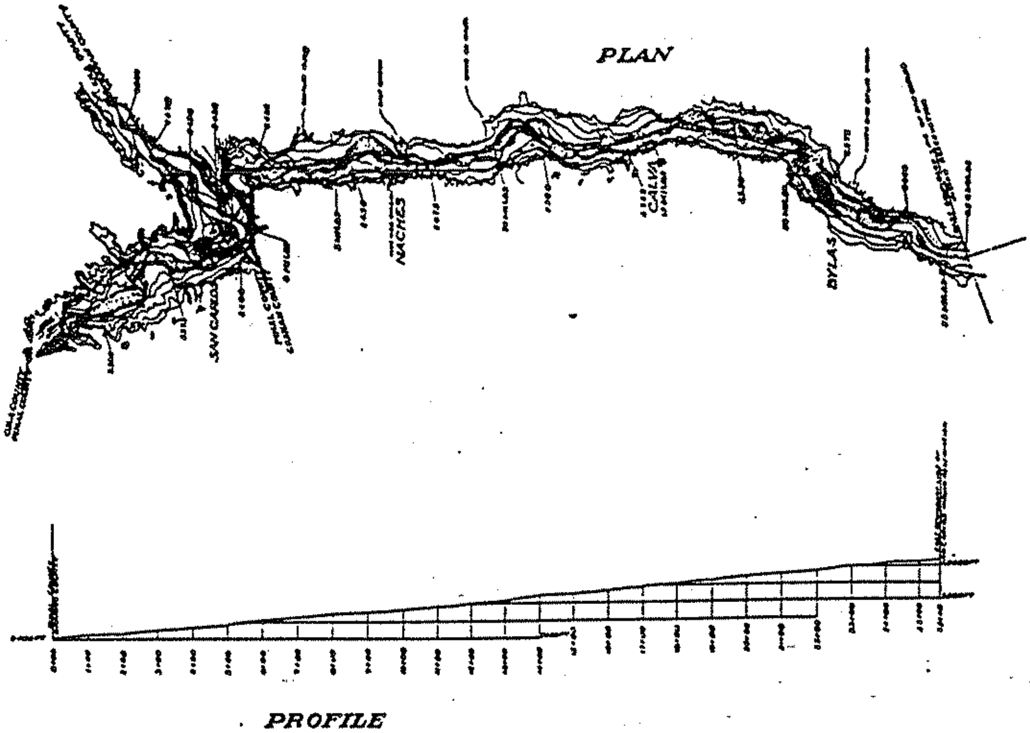
> Colorado River furnishes two-thirds of water (Gila one-third) at an average stage. At the junction the quantity discharged per second was found to be 6,249 cubic feet and velocity of 3 feet a second. At the same point the depth of channel is about 18 feet. * * * The Colorado, as its name implies, is of reddish color and carries down immense quantities of sand and mud. * * The Gila is clearer and its temperature warmer, but somewhat brackish in taste, owing to the large quantity of earthy salts held in solution.

From this short statement from an Army officer accustomed to accurate observation and expression, we can at least glean that the Gila of 1856–57 did run clear at a time when his estimate of the normal flow was one-third of that of the Colorado.

It is a difficult thing for one who does not know the desert or love the mountains to appreciate the intense satisfaction of seeing the former transformed, developed, and made to blossom as the rose through vital contact with the life-giving currents of the latter, nor how discouraging to see these current grow into flood waters and become agencies of destruction.

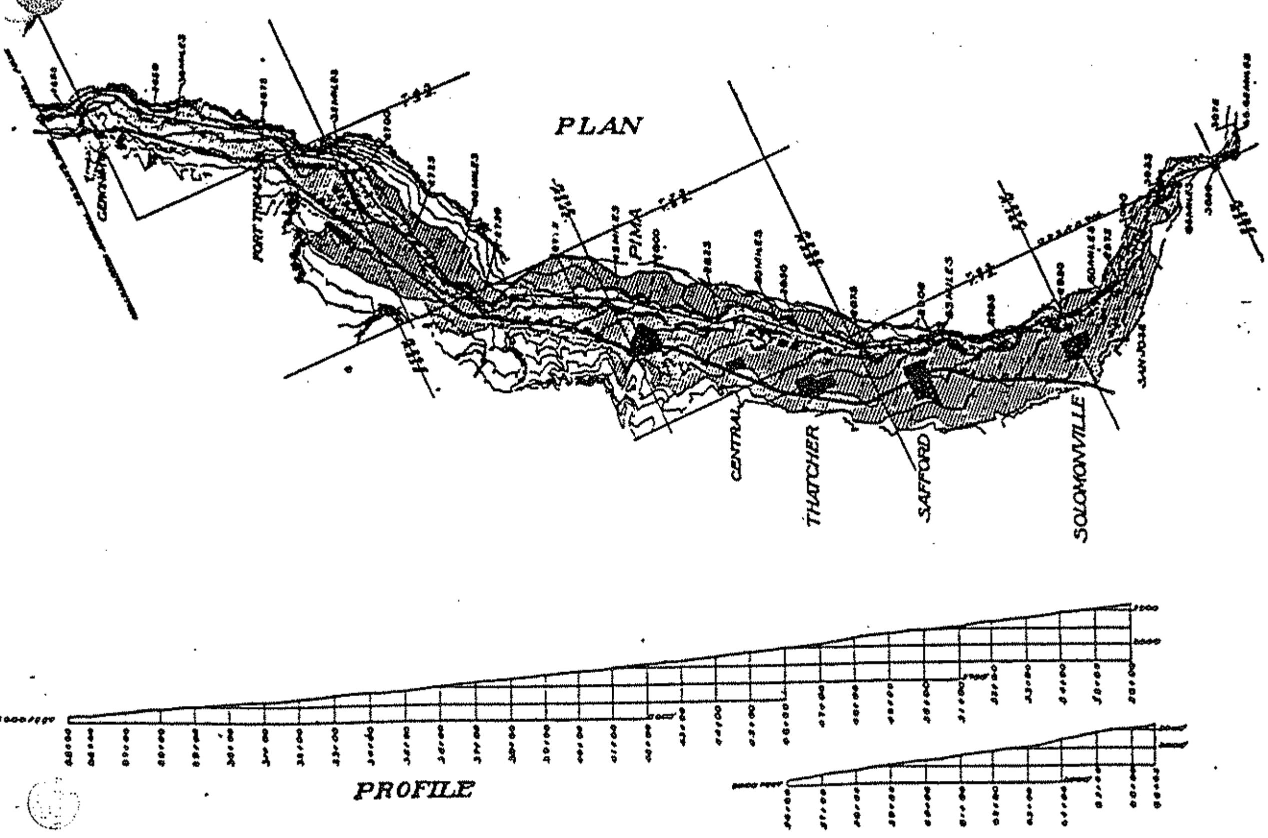
JANUARY, 1916, FLOOD.

From October, 1915, to September, 1916, by actual plane table survey, made under the appropriation available for this work, there was washed away by the Gila River 1,155 acres in Safford Valley and 990 acres in the San Carlos Reservation, or 2,145 acres in all. This was determined by comparison with a plane table survey covering the same area made for the United States Indian Service by the same engineer immediately preceding the prior date.



SAFFORD VALLEY

BLACK AREAS SHOW 12 MONTHS EROSION 1915-1916



OCTOBER, 1916, FLOOD.

There was a ruinous flood on the Gila River in October, 1916, when perhaps some 400 acres more along this Safford Valley reach were washed out, but of which no definite figures are now available.

RECLAIMING RIVER WASH LANDS.

There are some 1,016 acres of newly made river land in Safford Valley that in time, if protected, can be irrigated and used, and some 815 acres in the San Carlos Indian Reservation of the same class, or 1,831 acres in all.

PRESENT RIVER CHANNEL.

The river channel itself now occupies 16,091 acres, or 46 per cent of the agricultural land in the valley. A drawing is herewith submitted showing size and location of the Gila River in 1903 as compared with the size and location of the present channel from the upper end of Safford Valley to a point near the San Carlos Indian Reservation line 30 miles down the stream. This 1903 data was taken by the United States Bureau of Soils by a plane table survey and was probably accurate. This comparison covers the greater part of the irrigable land in Graham County.

There is also shown in this report detail sheets of the proposed works in their relation to the present bank lines of the Gila River

SAFFORD VALLEY LANDS.

Lands of the Safford Valley are to a high degree fertile, easily tilled, and respond to intensive agriculture as only desert lands can, where the valuable mineral constituents of the soil have not been leached out by heavy rains and which have been reinforced by the fertilizing qualities of the irrigation water supply itself.

The settlers have been thrifty and hard working and their occupancy of the land has resulted in developing the valley agriculturally to a marked extent up to the time when uncertainty arose as to the permanence of their holdings on account of the menace of the Gila floods. Since that time there has been somewhat less progress and more unused or poorly cultivated land.

The Safford Valley is the second largest irrigated unit of land in Arizona, the Salt River Valley being the first.

ALKALI CONDITIONS.

There are a few limited areas showing pronounced alkali conditions in the Safford Valley but nothing which can not be reclaimed.

When it is considered how limited the fertile areas of both New Mexico and Arizona are for which there is any considerable supply of irrigation water, the importance of conserving them and developing them to the utmost becomes plainly evident. The total area of New Mexico is 122,634 square miles, while the irrigated area is only 937 square miles. The total area of Arizona is 113,956 square miles, of which only 516 square miles are irrigated.

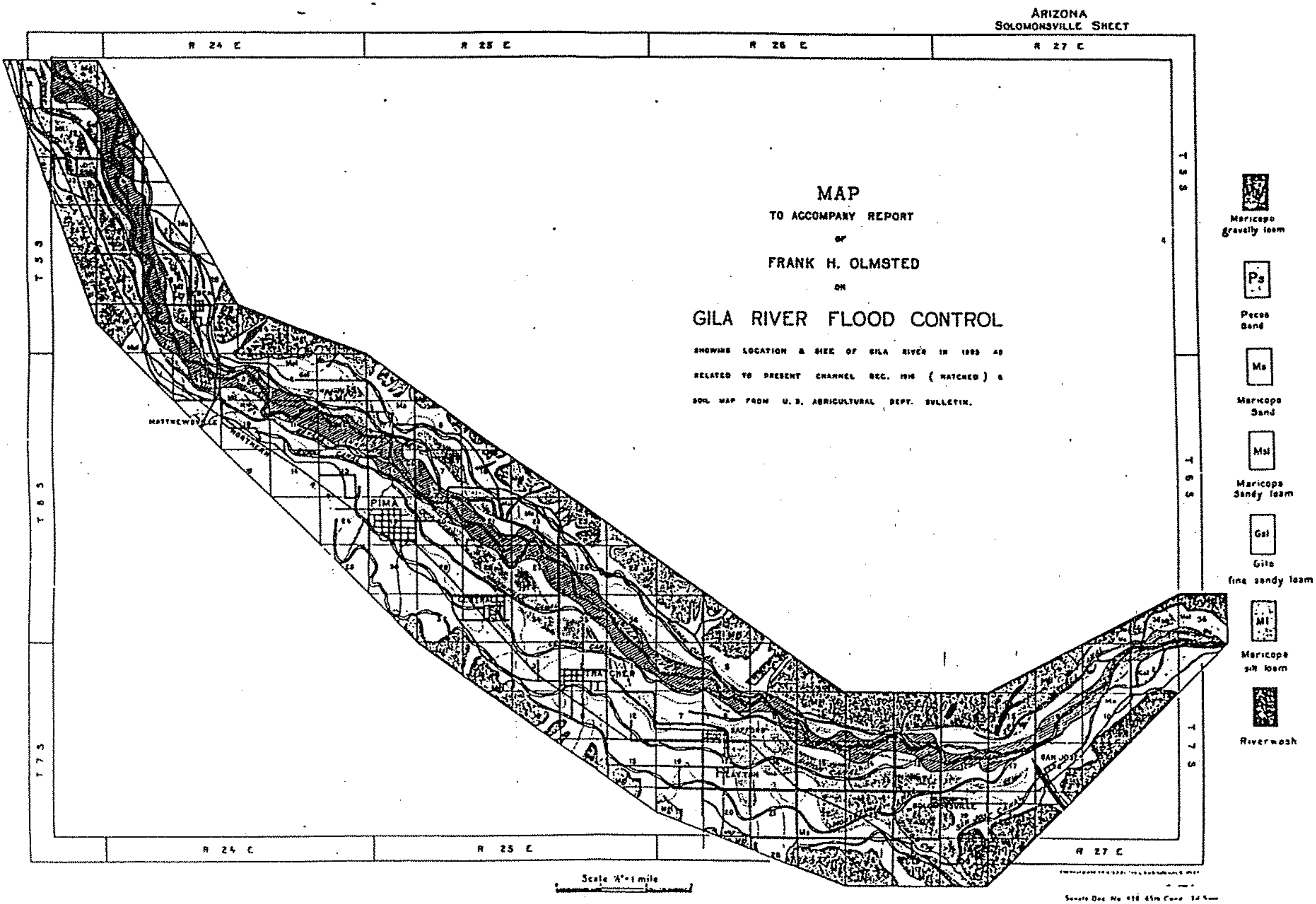
OLD RIVER CHANNELS

Within the memory of many men now living the channel of the Gila River in Graham County averaged in width somewhere between 150 and 200 feet. It now averages 1,935 feet wide. The United States township survey, township 7 south, range 27 east (the township in which Solomonville is located), showed in 1875 the channel to have an average width of 138.6 feet, and to occupy an area of 103.57 acres, whereas now the same length of channel occupies an area of 1,503 acres.

SAN SIMON.

The San Simon Valley, one of the long feeders of the Gila River, having its junction at the upper end of the Safford Valley near Solomonville, and coming in from the south, has had a similar but a more pronounced history. For 60 miles where originally existed an almost continuous line of meadows and flats that are now gulleys and chasms in some places from 500 to 800 feet wide and from 10 to 25 feet deep, that are virtually impassable.

The mountain range back of the Safford Valley from which has come most of the valley fill not supplied by the Gila River, consists primarily of granite, with frequent intrusions of volcanic rock, mostly lavas of recent date, and with general characteristics such as to easily erode.



ARIZONA
SOLOMONSVILLE SHEET
MAP
TO ACCOMPANY REPORT
OF
FRANK H. OLMSTED
ON
GILA RIVER FLOOD CONTROL
SHOWING LOCATION & SIZE OF GILA RIVER IN 1893 AS
RELATED TO PRESENT CHANNEL DEC. 1916 (HATCHED) &
SOIL MAP FROM U. S. AGRICULTURAL DEPT. BULLETIN.
R 24 E
R 25 E
R 26 E
R 27 E
T 5 S
T 6 S
T 7 S
MATTHEWSVILLE
PIMA
THATCHER
SAFFORD
SAN JOSE
Maricopa gravelly loam
Ps
Pecos Sand
Ms
Maricopa Sand
Msl
Maricopa Sandy loam
Gsl
Gila fine sandy loam
Ml
Maricopa silt loam
Riverwash
Scale 1/2"=1 mile

GEN. MARSHALL.

Gen. William L. Marshall, consulting engineer, in reporting to the Secretary of the Interior, March, 1916, on flood damage in Graham County, Ariz., said in paragraph 31:

> There is no precedent for bank protection, nor for flood control, nor for channel improvements, on such a river, or under such conditions (the Gila River in Graham County), but it is quite certain that the banks can not be made stable and erosion stopped throughout the district in question for anywhere near the full assessed value of the 35,000 acres of irrigated lands in the valley.

Gen. Marshall's statement that no adequate bank-protection system for confining the Gila River through Graham County could be constructed within financially practicable limits is undoubtedly true when referred back to any system for doing this work which has hitherto received the approval of American engineers. In this particular case there is an unusual dearth of materials to work with—no available brush or timber, no rock convenient to the Gila River anywhere within the Graham County limits which would be suitable for riprap purposes, and even the aggregates for concrete being in some places wanting.

COST OF ROCK LEVEES.

There has been no construction to receive the general approval of American engineers for such a stream as the Gila River except the one of rock levees where the unit size of the rock itself would be such that even a stream velocity of 15 feet or more a second could not move them. It is quite possible that even that type of work would in some locations gradually fail by the individual rocks moving vertically down through the unstable channel floor from the toe of the levee and so out into and down the stream. In any event the cost of this construction in the case we are considering is prohibitive.

In a letter from Mr. J. C. McClure, member American Society of Civil Engineers, assistant to the president of the Arizona Eastern Railroad, he writes that the cost to the railroad company of delivering this class of rock alongside the track at the railroad crossing of the San Carlos was $2.03 per cubic yard. Using this as a criterion the probable cost of placing rock along the bank of the Gila River where needed, without existing track facilities, would be at least $5 per cubic yard, or, say, $20 a running foot. There are 369,850 linear feet of construction needed to protect the whole reach of the river on both sides of the channel through Graham County. At $20 per running foot this would amount to $7,397,000.

In addition to this prohibitive cost for bank protection, the rock levee does not lend itself to proper alignment of the channel. In many cases the proper side lines are well out in the present stream channel, and a rock levee in such places would cost more than the estimate given.

BRUSH MATTRESS WORK.

Brush mattress work on the Gila River would require the brush itself to be brought in by long railroad haul, and practically can not be considered for use in this improvement. There is no other type of approved engineering construction except reinforced concrete blocks, the cost of which also run to a total figure exceeding the value of the agricultural lands in Graham County.

FLOOD ENGINEERING.

American engineers for many decades have had their attention fixed upon levee construction as the one flood prevention measure worth while; and the Corps of Engineers of the United States Army, than which there is no more splendid body of technical men in the world, have emphasized the benefits to be derived from this class of flood control works to such an extent that it is with some trepidation that an engineer brings forward any plan for obtaining relief from flood damage that does not include as the principal if not sole factor the building of earth or rock levees, and the protection of the same by mattress work or some similar revetment construction. Notwithstanding this apparently unassailable position, there are many American engineers who have felt for years that if the profession were to be judged by its success in dealing with flood problems it would be humiliating and unfair. In almost every line of engineering there has come about, year by year, better designs, more economical construction, and a smaller percentage of failures. Barring this sole exception there has been a general advance in all engineering branches equal at least to the progress made in other lines of human effort, and perhaps greater. In the matter of river control, bank protection, standardizing river flows, and obtaining beneficial physical results somewhat in proportion to the funds expended, we are, conservatively speaking, about where we started 50 years ago. In the meantime our waterways have, from perhaps a combination of causes, become mere drainage lines, and not expanding arteries of travel and trade as they should be. In fact, in this beginning of the year 1917, with every channel and appliance of commerce and transportation congested and taxed to its limit in the United States our magnificent rivers still run unvexed to the sea, carrying absolutely less freight and fewer passengers than 70 years ago. It has been said that these conditions have resulted from the preponderating influence of railroads on American life. This may be true, but it certainly is not necessary nor fortunate that this be so, and the experience of the progressive nations of Europe is an illustration in point to the contrary.

FOREIGN RIVERS.

In France, Austria, and Germany, all the rivers and most of their tributaries have been highly artificialized. Many places in France rivers have been connected with each other by artificial canals, so that it is easy to carry heavy freight by water from one portion of that Republic to another. Not alone have the transportation interests been accommodated, but in the matter of water-power development, swamp-land reclamation—all of them have received their proper need of attention, and the combined result year by year has added to the wealth, security, comfort, and happiness of the French people. In so much as along these obvious lines of development they have so far distanced the American people, it may be quite possible that in the matter of flood control they might have something to teach us.

The writer has spent some time and effort in attempting to learn the degree of success which has attended the efforts of foreign engineers to cope with the river flood problem, which we have so signally failed in mastering. The laws governing rainfall are so obscure, and the law of probability with reference to the recurrence of exceptionally intense rainfalls so often misinterpreted, that it must be admitted that in our own country, as well as in Europe no marked success has attended the efforts of meteorologists to predicate in advance the coming of storms that result in great floods, so that in Europe they are in no better shape than we are, in this respect. The seaward rush of these flood waters has been one of man's most baffling problems for centuries; and when we consider the penalties connected with a failure in any locality to solve the problem, and to provide ways and means for the safe transit of these flood waves to their proper destination, it may well appear strange that so little general attention has been given to this subject in the United States, and that little focused upon levees and digging and redigging out channels.

It is true we are a new country and have been so occupied in the subjugation of the land to the uses of man that perhaps up to this time we may be pardoned for not more acutely realizing the waste and danger associated with our compelled interference with nature's control of the streams and our failure to initiate compensating tendencies restraining them. It has both been stated and denied by recognized authorities that floods over the earth are increasing, and that the same physical penalties which overtook the Assyrians and the Babylonians on the fertile plains of the Tigris and the Euphrates are steadily advancing in their inexorable conquest of the lowlands of this country. This much may be said and received without dispute: that no one cause is responsible for flood conditions in this country; that no one remedy, whether it be an extensive system of levees, or storage reservoirs, or reforestation, or checking the upper headwaters, will prove alone able to relieve the situation. This situation has been created through a combination of many factors, which have operated much faster than the relief measures can, and these relief measures must be as varied as the particular problems in the various watersheds demand and must be persistently applied.

FRANCE.

The French Government in 1860 entered upon the policy of forest protection and reforestation, particularly in the mountain regions, which has been continued to the present time. Up to 1900 the State had acquired for the purpose of controlling torrents over 400,000 acres, and they expended upon the work of protection more than 66,000,000 francs, with a further contemplated expenditure of more than 114,000,000 francs.

The Governments of France, Germany, Austria, Switzerland and Japan, all have expended large sums of money during the past 20 or 30 years in building regulative works in the upper headwaters of flood-producing streams. The character of these works is somewhat illustrated by the photographs submitted, and can be broadly described as reforestation, terracing, the building of retardation structures, and certain types of bank revetments for confining the streams within fixed channels. The particular factor in stream flows which differentiate them is grade. In one river the water moves silently, deep and placid, with almost no indication of current. Another with the same amount of the same character of water will go tearing down between its banks like something alive, the principal difference being the grade of the floor of the stream.

There is some difficulty in arriving at just the results which have been obtained by foreign ernments in the matter of stream regulation by retardation processes, for the reason that is been so closely associated with forestry work that estimates and summaries of this work ign publications are apt not to distinguish between the moneys expended for and the achieved directly by regulation and those which are connected with the improving of st cover conditions.

There are nearly 1,500 brooks and mountain streams in France that when the task of ecting them against excessive flood flow began needed treatment. For a time after the ich Revolution there was little heed paid to the preservation of the natural forest, stream, mountain watershed conditions, which had up to that time been carefully guarded in the rests of the great landed estates of the nobility and enforced by fines, confiscation, and risonment. The effect of this was soon felt throughout the nation, for, although it takes rs of persistent and wise effort to restore the conditions of a watershed so that it again rates as a flood regulator, it only takes a short time, a few sheep or goats, and a little folding he hands in sleep, to create situations and conditions that even when the impelling causes e been removed work on automatically with an ever-increasing destructive tendency. illion acres of these sloping lands on the French mountains are subjected to the attack of se 1,500 streams. Some 2,500,000 acres of forest have been restored since the French people ized the situation, and 31 of the 163 torrents now absolutely controlled were considered hope-ly bad 50 years ago. In addition to this, 654 of these torrents are partially controlled.

The French law of 1882 puts the cost of this work on the National Government.

SWITZERLAND.

Swiss engineers about 1870 commenced systematically to correct and control the torrents he upper Alps. In 1876 the Swiss Bund assumed supervision of the water and forest police he high Alps above a certain elevation, and undertook to give aid in the work of engineering l reforesting for the control of the Alpine torrents. Grazing has been regulated for centuries. the protection forests where flood control is at stake, it is entirely and uniformly prohibited.

The most serious result of the Swiss floods was the amount of detritus carried out upon agricultural lands below. From the pictures herewith submitted it can be seen that the rk of building retarding structures was not expensive; in fact, it seems almost incredible t they could withstand the passage of any considerable amounts of flood waters. But in respect the appearances are misleading, for they have been maintained for a long series rs. As can be seen they were sometimes made of logs, sometimes of logs and rock, some-es of brush, but more frequently of rock alone. The geological formation with which the iss engineers have had to deal was largely slate, which lent itself readily to the economical istruction of dry rubble work dams, but having the disadvantage of only furnishing anchor-e into the loose, friable, decomposing, and unstable slate formation of the side slopes.

GERMANY.

In Germany there has been somewhat the same history in regard to the original tendencies the mountain streams to bring down large quantities of detritus during the flood periods, d to either cause erosion of valuable farming areas on the one hand, or the covering up of tile acres with nonproductive river wash material on the other. At the present time there no other nation more highly developed in improved waterways and water-power develop-ent. Water transportation and modern terminal facilities for both ocean and river traffic e unexcelled, as well as the incidental benefits of artificial drainage flood control and the use the waters for irrigation purposes.

I have gone this much into detail in outlining the practice of these foreign engineers because e recommendations in this report include a treatment of the upper watershed of the Gila ver along somewhat similar lines to those used for many years in certain countries of the d World, and because, outside of the Los Angeles experiments, there has been no precedent r this class of work anywhere in the United States.

CHARACTER OF FOREIGN FLOOD WORKS.

Technically the foreign work consists of maintenance of good forest conditions, the refor-ting, rebrushing, or resodding of denuded slopes as the situation may require, and of con-uring or planting the barren areas where sheet run-off over the slopes is excessive so as to event the quick arrival of the rainfall waters to the drainage lines; second, a system of small eck dams or cross baffles to prevent the swift delivery of water from the minor drainage ees into the main tributaries; third, a system of terracing in places to assist in a more thorough charging of absorbent areas in the high mountains than would naturally take place; fourth, such reservoiring as might prove practicable in the main stream by either some system of retarding or storage reservoirs; fifth, channel works.

In theory and in practice the average unit cost of the check structures is small, and the extensive appropriations that have been made abroad for this purpose have only been required on account of the large areas covered by the work.

INCREASE IN IRRIGATION SUPPLY.

It is to be noted that the foreign work for flood control increases the irrigation supplies of the dry season as well as diminishing the size of the flood crests, and in a country like Italy where irrigation is practiced is an important matter.

GRAHAM COUNTY SITUATION NOT TO BE CONSIDERED ALONE.

It is not practicable to consider the improvement of the river conditions through Graham County alone. The Gila River is a unit, and it can almost be considered a sentient thing whose characteristics in the different reaches of the stream act and react upon each other in such a way that it is hardly possible to maintain good conditions at any one point if most everywhere else the conditions are steadily growing worse. In the past there has been too much piecemeal treatment of the whole subject of river improvement, having the attention focused upon the needs of particular localities without considering at the same time the reacting conditions of the general situation. We have been gathering data, making surveys, writing reports, studying rainfall records, tabulating river measurements on many of the streams of the United States, for 50 years, and there is as much uncertainty and dispute as to the expediency, character, and efficiency of various classes of river control work as there was years ago. Neither can it be thought that if the appropriations available for gathering this data were doubled but that in 10 years from now there would still be more or less uncertainty with regard to the illusive and mysterious character of Nature's processes between the falling of the rainfall from the heavens in one locality and its evaporation later from far distant regions on the earth. Carlyle once said that "In a world where there is so much to know, see how you will do it."

NEED FOR SYSTEMATIC CONSTRUCTION.

The period of firing tabulations of disconnected data and unread reports at the destructive forces of nature should have about passed, and an actual constructive warfare begin, based at least on something we hope to do, and not upon something which, from 50 years' experience, we know we can't do.

GILA WATERSHED THE OPPORTUNITY.

There is no other stream in the United States where the physical opportunities are better, or where the legal basis is more substantial for making the experiment of an entirely new departure from the humiliating program of river appropriations which has distinguished the last half century, than the Gila, and which, if successful, would initiate a conservation system along the lines proved out by Switzerland, France, and Austria, during the past 40 years.

OBLIGATION TO INDIANS.

The moral and legal basis for this work could well be the present sad plight of the Pima Indians, who are the wards of the National Government. For 300 years these Indians have been the friends of the white man. They can properly be called agriculturists. Long before the formation of this Government they had builded long canal lines and were using the Gila River waters for irrigating fields of corn, cotton, and vegetables. Lieut. Michler's report to Maj. Emory, July 29, 1856, says of the Pima Indian country on the Gila:

> As we journeyed along this portion of the valley of the Gila we found lands fenced in and irrigated by many miles of acequias and our eyes were gladdened with the sight of rich fields of wheat ripening for the harvest—a view differing from anything we had seen since leaving the Atlantic States. They grow cotton, sugar, peas, wheat, and corn.

Within the past few years the settlers on the upper river, especially in Graham County, have, somewhat innocently but still in fact actually, appropriated the Gila River flow which has belonged to the Pima and Lower River Indians for hundreds of years.

The long score of injuries which the American Indian has suffered in the past from the hands of the white man, can never be balanced, but it is certainly true at this time that the people of the United States do not care to make the score worse, and in such a case as this would undoubtedly prefer to treat them fairly no matter what the money cost might be. The

PALESTINE EROSION.

Geikie, in modern times writing of a certain portion of the Holy Land, says:

The ride from Eriha to the Jordan is about 5 miles over a stony plain, on which there is no vegetation. Year by year the winter rains sweep down the slope and wash away a layer of the wide surface, carrying it to the Jordan, there being little to check them but copses of the zukkum tree and Spina Christi. Yet seven monasteries once stood on this now desolate tract; three of them still to be identified by their ruins. Until we reach the edge of the Jordan, only the stunted bushes I have mentioned, unworthy of the name of trees, and a few shrubs with dwarfed leaves, are to be seen after leaving the moisture of Sultan's Spring. Not a blade of grass softens the dull yellow prospect around.

In the Wady Kelt a violent rain fills the upper and narrower parts of the gorge, in half an hour, to the depth of from 8 to 10 feet, and the lower, broader parts to the depth of 3 or 4 feet, so that the wady is at times entirely dry, and at others impassable. The question, however, often forced itself on me, how there could be such a vast quantity of broken rock and bowlders in every torrent bed, and over all the hill slopes throughout the country; for the whole land appears as if it were buried beneath a universal rain of ballast, large and small.

A heavy rainstorm falling on these bare stones, protected by no coating of turf as in England, completes the wreck. The deluge rushes down every hill slope as our storms pour down the roof of a house, and sweeps away the loosened rock with incredible violence into the wadys and over the plains, far and near, leaving the hills clear for a repetition of the same process of breaking up and subsequent washing away.

A gully that starts in these mountain valleys may be but a few inches deep, but it lowers the level of discharge by a corresponding amount and gains a damaging leverage in its attack on the whole slope. Once secured this advantage is never lost unless man intervenes and initiates corrective measures.

Any permanent and satisfactory control of the Colorado River through the Yuma and Imperial Valley reach is quite out of the question while the Gila River flash floods can carry into that stream (from so short a distance above) more than 150,000 cubic feet per second, which was the case in 1916.

The Gila River flood flows of the future under present retrograding conditions in the watershed will handicap and menace investments in and retard and minimize the development of that almost empire to an extent not now realized. This element in the study of Gila River control should be kept in mind when considering the local situation on the Graham County front or in the mountain watershed.

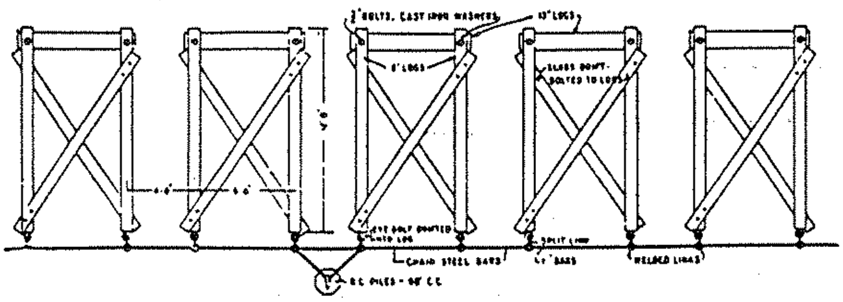
PREVIOUS FLOODS IN GILA WATERSHED.

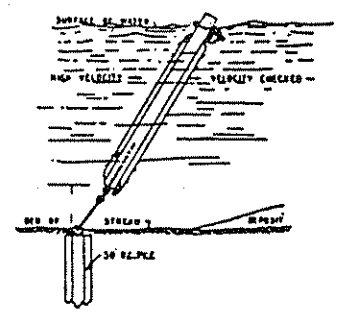
From the best data available there have been during the past 12 years seven major floods or more than one every other year. It is believed that in the previous 12 years there were only two of these major floods, neither of which did any such damage as those of the later cycle. It has been stated that there is no relief from violent run-off conditions except surface storage reservoirs, and that any system of retardation cuts so little figure that it can not be depended upon to materially improve flood risks. This is quite true when referred to the arrival on the scene of the great flood flows that sweep down through and over the lower valleys of our great rivers. To stand in a small canyon during a great storm, as the writer has done, and watch the mountain waters as they laugh and sing and pitch themselves down to join with their fellows in creating these lower river floods, is to become convinced that at this point in the development of a flood a great deal can be accomplished if the machinery has been previously provided to delay and retard the arrival below of a certain proportion of these many little rivulets, allowing the others to rush on ahead.

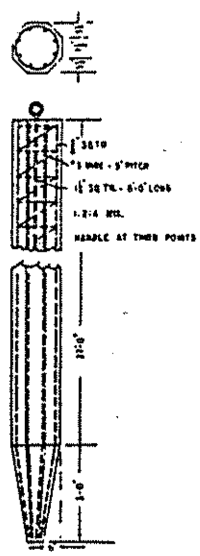
Man is virtually impotent to successfully combat fire or water where the velocities and intensities of either are such that the ordinary restraints confining them become assistants to their fury rather than limits. In observing great conflagrations or mighty flood movements, man feels humiliated and ineffective, but we know in a case of fire that any momentary impression that man is the servant and the predestined victim of this force of nature would not be true. Neither is it true of water. In either case we have got to combat it vigorously where it starts, and master it, and not in either case furnish avenues where the enemy can roar and wreck at will.

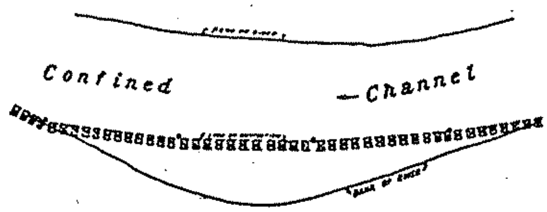
RAIN MOVEMENTS.

Rains over the Gila River watershed fall principally during the summer months and the secondary maximum from December to March. The winter precipitation follows a general storm movement over the entire district of southwestern New Mexico and southern Arizona induced by the low areas that develop over the Gulf of California and the lower Colorado Valley. The amount of rain varies in the watershed somewhat directly with the elevation above sea level. On the lower Gila not over 5 inches. Where the elevation is about 1,000 feet above datum the rainfall is nearly twice as great. Where the elevation averages 3,000 feet the annual mean precipitation is about 12 inches. Above 5,000 feet, 14 inches or more; and above 7,000 feet over 20 inches.

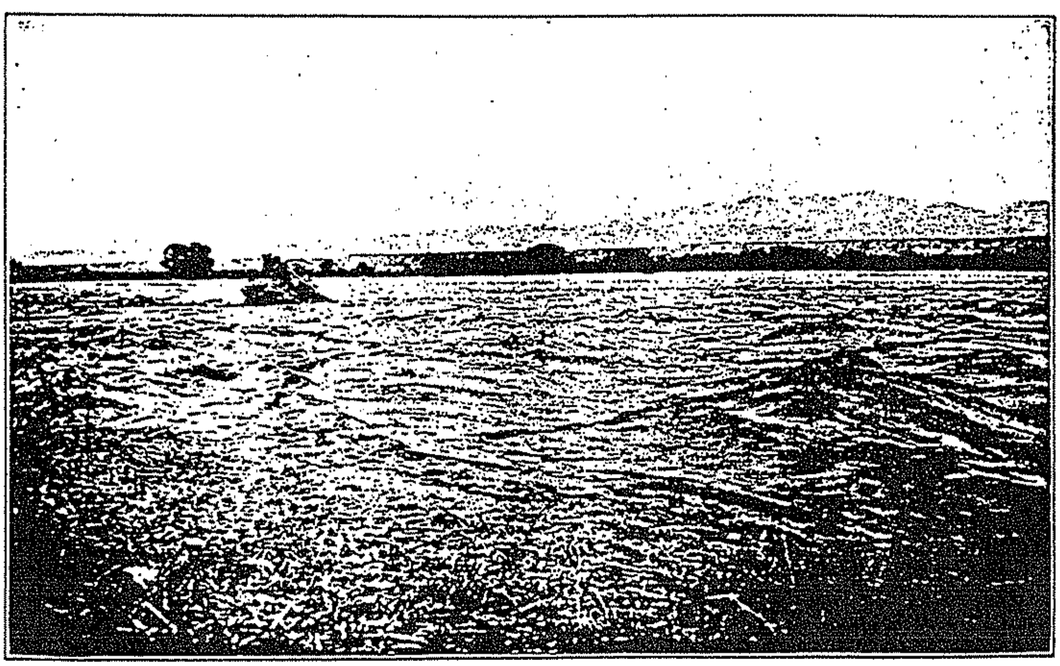






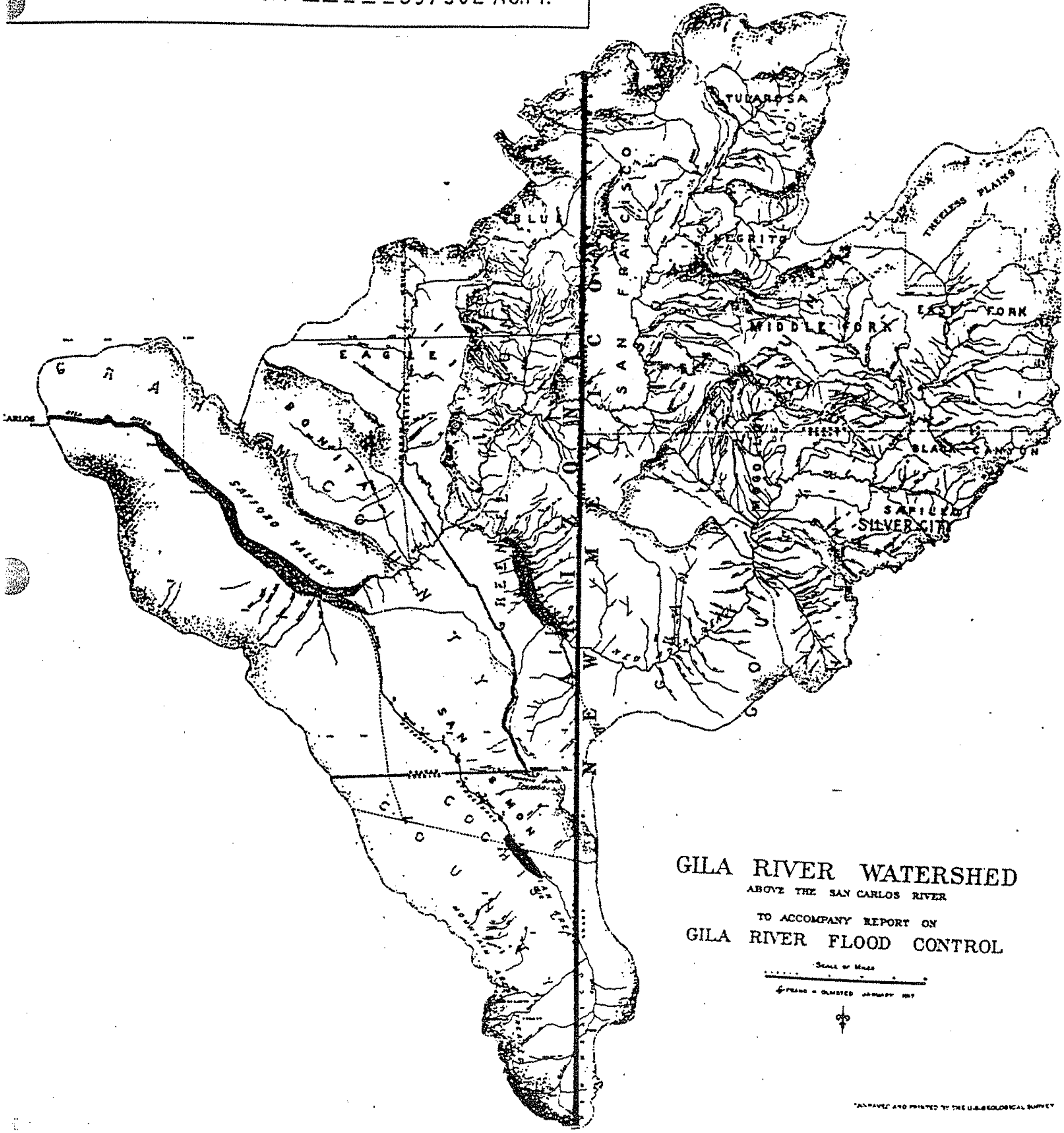


GILA RIVER FLOOD CONTROL
PLANS
BANK CONSTRUCTION DESIGN
along
Graham County Reach
in
ARIZONA
To accompany report
FRANK H. OLMSTED
1917



GILA RIVER BELOW SAFFORD, 8 A. M. OCTOBER. 14, 1916.

TOTAL AREA - - - - - - - - - - - - - - 12020 SQ. MILES
AVERAGE ANNUAL RAIN-FALL - - - - - - 14.52 INCHES
AVERAGE ANNUAL RUN-OFF - - - - - - 397562 AC.FT.



GILA RIVER WATERSHED
ABOVE THE SAN CARLOS RIVER
TO ACCOMPANY REPORT ON
GILA RIVER FLOOD CONTROL

Senate Doc. No. 436, 65th Cong., 3d Sess.

EROSION CHECKED.

attacking the result instead of inquiring into the causes and remedying them. A photograph is hereby submitted showing this street, and in it a drop structure, which answered for a time, as lower river works generally do, but in one of the floods occurring later (a picture of which is shown, but the exact date when taken not being ascertained), the works and the whole street went out and is now a chasm over a hundred feet wide and 37 feet deep, into which hotels, stores, residences, and human hopes have floated down into the discard.

FLOODS OF LAST TWELVE YEARS.

It has been thought that the floods of the past 12 years could be entirely explained by reference to the rainfall records themselves, but to the writer it is unbelievable that for hundreds of years there could have been no sufficient rain in the upper Gila watershed to produce wreckage below, but that at once after man's interference with the ignored detail conditions in the mountain cachement area began there should be such a difference in the quantity or nature of the rainfall or both as to change the whole physical run-off effect.

RAINFALL CYCLE.

Discharge diagram of Gila River at San Carlos herewith submitted, shows quantities of water available for proposed San Carlos Reservoir for the years 1895 to 1912. It can be assumed for the purpose of this study that there is a nine-year old cycle somewhat normal to the run-off of the Gila River, and the rainfall records at Fort Apache bear this out. At Fort Apache we have nearly continuous rain records for 40 years, and as this station is believed to be fairly indicative of the rainfall over the upper Gila watershed, is used herein as a base to represent mountain rainfall over the headwaters of the Blue, San Francisco, and upper Gila.

COMPARISON TWO TWELVE-YEAR RAINFALL CYCLES.

The breaking point in this 9-year cycle is in 1903–4, and taking the 12-year period instead of nine to bring the review up to the beginning of 1916 the following facts appear: The last 12 years have had a mean rainfall at Fort Apache of 18.23 inches. During no month was there as much as 8 inches rainfall; no months with 7 inches; two months exceeding 6 inches; two months exceeding 5 inches; seven months exceeding 4 inches; and seven major floods.

The preceding 12-year period had a mean annual rainfall of 15.74 inches, no months exceeding 8, 7, or 6 inches; two months exceeding 5 inches; six months exceeding 4 inches; with two major floods.

For the 12-year period preceding the last, or from 1880 to 1891, inclusive, there was a mean annual rainfall at Fort Apache of 21.58 inches; one month over 8 inches; two months over 7 inches; two months over 6 inches; and seven months over 5 inches; nine months over 4 inches; and no reliable means for knowing how many floods, but knowing this: That neither the number of these floods nor their intensities were sufficient to produce extensive erosions, either in the upper tributaries or in the Safford Valley, as has been shown (so far as the Safford Valley conditions are concerned) by the records heretofore submitted in this report, and particularly by the plate showing comparative river channel conditions in Safford Valley in 1903 and 1916, both being taken from plane table surveys made by Government engineers of two distinct departments and assembled by the writer for use in this study. The precipitation for 1905 (33.15 inches) was the heaviest recorded for any one of the three cycles above referred to, but this was only slightly more than in the year 1881 of the earlier cycle (31.12). The latter, however, had a heavier monthly precipitation, that of August (8.31 inches), as against August, 1905 (6.79 inches).

From this record, eliminating everything nonessential and not quibbling about the cycle used or anything else except the broad and plain inference to be drawn from a comparison of two 12-year cycles, 12 years apart, the earlier records showing rainfall conditions (so far as we can at this time pass upon them) decidedly worse as apparent flood producers than those of the last 12 years; with damages from floods in the later interval much worse and of which we have definite and indisputable data; the earlier 12-year period with so much heavier average annual precipitation and appreciably heavier monthly precipitation, as well as being the successor and inheritor of the preceding cycles showing virtually no erosion during all these countless years; this latter being patent from the fact that the lower river now requires some ten times the channel capacity that the ancient stream flows demanded, even a generation ago.

FLOOD CONDITIONS DEPENDENT ON WATERSHED REGULATION AS WELL AS RAINFALL.

Does not this all prove conclusively that the difference is not due to God's rains that fall on both the wise and the unwise, but to the local conditions in the upper watershed that originally regulated, but now no longer regulate, the delivery of these rain waters to the lower channel?

SILT.

From investigations made for the writer, it is certainly true that in almost every tributary of the Gila, except East Fork and Black Canyon, there are very large eroded areas, and in consequence large quantities of silt delivered during flood periods to the lower river and probably at no other times.

That with ordinary means a small rivulet, 6 inches deep, 15 inches wide, running full during a flood period, can be checked in velocity, delayed, and hindered from shunting itself down with unimpeded speed to join with great numbers of similar units, is quite evident, but it seems too simple to mean much as flood prevention. It is not the first time in human affairs when the simple thing right at hand has been underestimated and overlooked.

EVAPORATION.

From the tabulation herewith submitted for the Gila River run-off at San Carlos it is seen that the average annual surface flow of the Gila for this period, 1895 to 1915, inclusive, is 397,562 acre-feet, whereas the average annual amount precipitated over the 12,020 square miles of contributing drainage area is 9,327,000 acre-feet, or stated differently, the measured run-off of the whole Gila River watershed above San Carlos is 4.3 per cent of the total average rainfall precipitated for the period from 1895 to 1915, inclusive. Certain of the average monthly flows have had to be estimated, but the line of general averages can be assumed to correctly represent the facts. After the upper watershed has been generally improved as a result of the execution of the plans herewith proposed there may be an unimportant diminution of this total annual run-off, but this will be compensated for, in that the dry weather flow will be uniformly larger and the diminution only indicated by the diminished flood crests.

Of this 4.3 per cent annual delivery to San Carlos of all the rain falling on the upper Gila watershed, there is an undue proportion discharged during flood periods and too small a portion during the balance of the year.

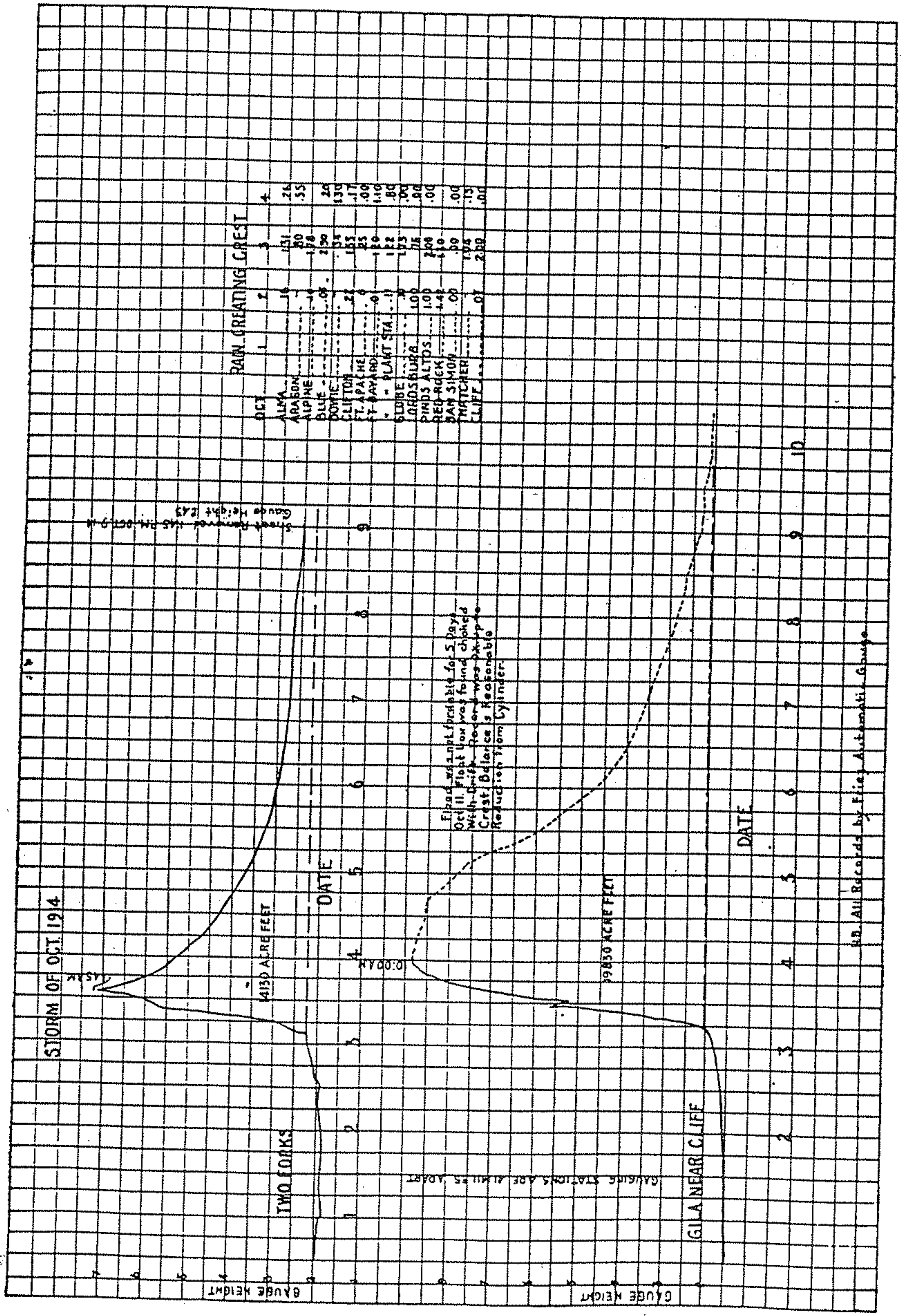
CYLINDER RECORDS.

A study has been made of the available cylinder records of floods in the upper Gila watershed. Unfortunately there are but few of these which have any bearing upon questions affecting this investigation. Everything of this nature in either the United States Water Resources Branch of the Geological Survey or the State engineer's office at Santa Fe, N. Mex., was studied. The particular make of clock cylinder generally used has been disappointing in that after properly recording fluctuations of flow up to point of crest, the instrument then is usually put out of commission by the drift. The writer would strongly recommend a change to some less delicate type of instrument.

In studying these cylinder records we find, first, that in almost every case there is a nearly vertical rise as the floods reach the station. As soon as the crest point is reached there is a more gradual tapering off of the curve. A somewhat detailed analysis is submitted for the flood of October 4, 1914, this record being chosen because the rainfall conditions creating this flood appear to be less confusing than those connected with any other available parallel records. The rainfall producing this flood is shown by the following tabulation:

Rainfall producing flood of Oct. 4, 1914.

	Oct. 2.	Oct. 3.	Oct. 4.		Oct. 2.	Oct. 3.	Oct. 4.
Alma	0.16	1.31	0.26	Fort Bayard planting station	.11	1.22	.80
Aragon		.80	.65	Fort Apache			
Alpine				Globe			
Blue				Lordsburg	1.00	0.75	0.00
Bowie				Redrock			
Clifton				Pinos Altos	1.00	2.00	.00
Cliff	.07	2.00	.00	San Simon	.00	.00	.00
Fort Bayard	.01	1.20	1.10	Thatcher		1.04	.15


STORM OF OCT 1914
TWO FORKS
GILA NEAR CLIFF
DATE
DATE
GAUGE HEIGHT
GAUGE HEIGHT
RAIN CREATING CREST
GAUGING STATIONS ARE 41 MILES APART

We have no hourly record of just the way these rains fell, but the flood crest produced by them reached Two Forks (junction of East and West Gila, mile 214, above San Carlos) at 1.45 a. m., October 4. The crest reached Cliff, 42 miles down the river, at 10 a. m. of the same day. The crest traveled 221,760 feet in 495 minutes, or 449 feet a minute, or 7.5 feet a second. The crest passed the Two Forks station on a crest gauge height of 7.1 and the Gila station, 42 miles down (near Cliff), 8 hours and 15 minutes later, at crest gauge height 8.9. Interpreting this rainfall for the upper station by taking the precipitation of Alma, Blue, Fort Bayard, and Pinos Altos as fairly significant of the average over the contributing basin (1,677 square miles), we find that there were 26,832 acre-feet precipitated on October 2; 156,700 acre-feet on October 3, and 34,350 acre-feet on October 4, making a total of 215,882 acre-feet for the total rainfall of these three days. From the cylinder record, as interpreted by the rating curve, there passed the Two Forks station from 6 p. m., October 3, to midnight October 10–11, 1914, an accumulated flow of 14,130 acre-feet, or 6.7 per cent of the total amount precipitated by the storm.

Taking the lower station, Gila (near Cliff, mile 172), we find that the rainfall in the basin above it can best be estimated by averaging the recorded rainfall for stations Alma, Blue, Fort Bayard, Pinos Altos, Cliff, Redrock, and Clifton. As a result of this average rainfall there was precipitated in the basin above Gila on October 2, 41,069 acre-feet; on October 3, 249,984 acre-feet, and on October 4, 37,500 acre-feet, making a total of 328,553 acre-feet for the total rainfall of these three days. From the cylinder records, as interpreted by the rating curve, there passed the Gila station from 6 p. m., October 3, to midnight, October 10–11, an accumulated flow of 19,830 acre-feet, or 6.1 per cent of the total amount precipitated.

The drop in percentage for the area above Two Forks to that noted for the area above Gila is 0.6 per cent, or 0.0143 per cent per running mile of channel. For the 214 miles to San Carlos there would be on this basis of precipitation for normal run-off at that point of 3.7 per cent for this flood unit. This would make the average for the reach between these two points, 214 miles apart, 5.2 per cent. Projecting this proportion into the upper watershed above Two Forks would make a mean for the whole watershed of 5.5 per cent of the total rainfall precipitated as immediate run-off.

The normal equilibrium and balance existing in nature over such a unit of territory as this, is very delicate, and a distinction between a 4.3 per cent as a normal relation of total run-off to total water precipitated and 5.5 per cent that for a minor flood, indicates, in all probability, conditions that seriously need improvement, although the one is only 28 per cent greater than the other. In the major floods that sweep down the Gila drainage higher than the 6-foot gauge, it is entirely probable that at least half their volume should be retained in the upper watershed sufficiently long to finally pass any station under this 6-foot gauge.

From the Tucson experiments, Mr. J. B. Lippincott derived the following monthly evaporation losses for the San Carlos Reservoir, expressed in percentages of the annual:

January	3.4	June	13.8	November	5.0
February	4.3	July	12.7	December	4.0
March	6.9	August	10.7		
April	9.4	September	9.8	Total	100.0
May	11.9	October	8.1		

The Army board in their report on the San Carlos used 60 inches annual evaporation loss from water surfaces on the Gila as a sufficiently close approximation to the results obtained from the Salton Sea experiments when modified for a minimized excess temperature above the freezing point as compared to that station.

GILA RIVER CHANNEL EVAPORATION.

Taking 60 inches then as a fair evaporation loss for water surfaces and 30 per cent of this, or 18 inches, as that from the river bed channels not water covered, and allowing for the range of conditions by a corrected figure (3 inches) for the average monthly loss, we obtain the following results:

From San Carlos at the initial mile for this work to the gauging station near Solomonville at the head of the Safford Valley, mile 66.6, the river channel having a mean width of 2,000 feet and covering an area of 16,091 acres, there would be an average evaporation loss of 4,025 acre-feet each month, or 67 cubic feet per second constant flow.

From the Solomonville Narrows, mile 66.6, to mouth of Bonita Creek, mile 69.4, distance of 2.8 miles, average channel width, 300 feet, covering an area of 102 acres; average evaporation loss, 25.5 acre-feet each month, or 0.43 cubic feet per second constant flow.

From mouth of Bonita Creek, mile 69.4, to mouth of Eagle Creek, mile 78.6, a distance of 9.2 miles, average width of channel, 200 feet, covering 223 acres; the average evaporation losses, 55.6 acre-feet each month, or 0.94 cubic feet per second constant flow.

From mouth of Eagle Creek, mile 78.6 to mouth of San Francisco, mile 81.2, a distance of 2.6 miles, average channel width of 200 feet, covering area of 63 acres; average evaporation losses, 15.75 acre-feet each month, or 0.265 cubic feet per second constant flow.

From mouth of San Francisco, mile 81.2, to Guthrie, mile 91.5, a distance of 10.3 miles, average channel width 300 feet, covering 375 acres, having evaporation losses 93.75 acre-feet each month, or 1.575 cubic feet per second constant flow.

From Guthrie, mile 91.5, to Duncan diversion dam, mile 127, distance of 35.5 miles, average channel width 700 feet, covering 3,012 acres, having average evaporation losses 753 acre-feet each month, or 12.65 cubic feet per second constant flow.

From Duncan diversion dam, mile 127, to mouth of Bear Creek, mile 172, distance 45 miles, channel width 175 feet, covering 950 acres, having evaporation losses of 237.5 acre-feet each month, or 4.02 cubic feet per second constant flow.

From mouth of Bear Creek, mile 172, to the mouth of Sapillo, mile 200, distance of 28 miles, with an average channel width 180 feet, covering an area of 611 acres, having average evaporation losses of 153 acre-feet each month, or 2.56 cubic feet per second constant flow.

From mouth of Sapillo, mile 200, to junction of East and West Forks, mile 214, distance of 14 miles, channel width 100 feet, covering 170 acres, having average evaporation losses 42.5 acre-feet each month, or 0.714 cubic foot per second constant flow.

By adding these results we find that from San Carlos to the X. S. X. ranch at the junction of the East and West Forks of the Gila, distance 214 miles, with an average channel width of 744 feet, covering an area of 21,600 acres, has a total average evaporation loss of 5,400 acre-feet each month, or 90 cubic feet per second constant flow, or an average diminutional flow over the whole reach of 0.42 cubic foot per second per linear mile of river channel.

This 90 cubic feet per second lost by evaporation from the junction of the East and West Forks to San Carlos can be diminished by thorough patrol of the stream to see that during low-water periods the channel is in as good shape as a reasonable amount of care can place it.

PATROL OF RIVER.

It is a singular thing that in the West where water is so valuable that nowhere is there any feeling of responsibility about evaporation loss conditions of river channels. From the headworks of an irrigation channel down, there is always efficient patrol and men and means wherever needed for repairs and generally for improvements, but above the headworks the conditions come under the head of acts of Providence and it is a no-man's land and a no-man's job. As a fact, many times there is no other place on an irrigation system, or lack of system, showing greater remedial losses than the main-stream bed above the heading. After floods have passed, the Gila should be systematically patroled and rerouted where unnecessary losses are occurring. At the Solomonville Narrows there are many times when the supply is limited, even in September and October, to 100 or 200 cubic feet per second. Such a flow can often be temporarily deflected and confined where advisable without prohibitive expense.

The construction proposed for accomplishing this result might be in some places merely the rock and brush diversion dam so familiar to western irrigation practice for returning a truant branch of a stream to its main artery, but more often would be accomplished by a rock-filled cylinder inclosed in wire mesh. These continuous cylinders, 3½ feet in diameter or, if triangular, 4 feet on a side, can be built generally for $1 a running foot where the rock is at hand. This construction will last for years when the wire mesh is galvanized, or better of ingot iron, so called, and in the writer's opinion is the best type of bank protection yet used on western streams where the river-bed conditions are those of the mountain section and not deep quicksands.

Photographs are submitted showing the slightly disfigured rock cylinders which saved the town of Santa Paula, Calif., a few years ago from a calamity by holding the river waters back from tearing through the town when everything above it—piling, concrete work, and rock levees—were washed out. This curtailment of the evaporation losses on the Gila River may offset any water losses from increased plant consumption due to the artificial supercharge of the slopes of the upper watershed drainage lines recommended in this report.

SILT INTERFERENCE WITH ABSORPTION.

There are no figures that the writer knows of directly bearing on the increased absorption of ordinary mountain and foothill areas affected by canyon stream flow due to small heads, say, from 2 to 10 feet. The writer has observed many times in his practice in building mountain retardation structures that the zone of moisture under the influence of these small heads has been wonderfully enlarged over the original conditions. In addition to this increase in the absorbing ability of the side slopes of long drainage lines artificially obtained, there is the indisputable advantage which the checking system will yield in the increased absorption throughout the whole lower river system from producing a greatly diminished silt content in the water.

The spreading of flood waters on the bowlder cones of southern California streams to augment irrigation supplies has shown that when the crest waters are diverted the silt soon fills up the interstices of the soil or gravel, and the absorption soon diminishes to one-half of what it would be if the waters were clear. The low-water flow in the lower Gila can be materially increased by any system which will store flood waters in the upper watershed. The advantages of ground storage are not as apparent as those of imposing storage reservoirs, but the writer believes the results in the Gila River watershed from spending a definite amount of money would be better in the case of ground storage than that of surface storage.

There is no chance whatsoever of getting water out of a watershed that has not come from the precipitation within the drainage area. Neither is there any reasonable doubt but that after making sane deductions for plant consumption and evaporation losses, the run-off in the lower river, surface and subsurface, is as sure and certain as anything in this world. This being true, any increased absorption into the ground extracted from the flood crest that otherwise would pass the lower river lands when not needed will be a direct asset for the average flows throughout the entire year, and will constitute an important factor in standardizing the flow of the Gila, diminishing flood losses, and increasing the potential wealth of the Nation.

How often in the past has it happened that the real solution of difficult problems has come from close attention to matters supposedly only affected by the workings of some mysterious Providence? Panama fever was a visitation of Providence until detail study connected up the fever and the mosquito. Modern surgery is only possible because of the simple insistence on absolute cleanliness. All the appliances, instruments, and improvements of the surgeons counted often for little until antiseptic processes were adopted. It seems to me that when we realize that floods are to be conquered and that man can do it, that the experimenting with the symptoms in the lower rivers will cease and that efficient control in the upper watersheds will begin.

The partial standardization of the upper Gila will permit of floating down logs and timber from the forested areas for use on the protection works below.

The average channel width of the Gila from X. S. X. ranch to San Carlos is 744 feet. This should be reduced in the orderly progress of a sane flood-control program to something not over 500 feet and the evaporation losses appreciably modified. The spreading of the Gila flood waters over thirsty flats can not be considered until the erosion has been checked and the river flows at all times run fairly clear. When that has been accomplished it is expected that reinforced absorption will be practical if it is then desirable. The reach from the center of contributing watershed is so far distant from the lower river diversions that care must be taken to interfere as little as possible with the low water flow. This can best be accomplished by having a reasonably well aligned river channel of only moderate width and the low water absorption and the evaporation losses proportionately minimized.

FORESTRY.

It must be clearly understood that the basis for all of the work proposed for regulating run-off and in itself of more importance than any other feature, is the general condition of the watershed ground surface so far as its sod, brush, and timber conditions are concerned. This subject is more properly one belonging to the forestry people, and upon which the writer would not feel qualified to pass either upon the extent of or the nature of the remedies practicable to apply for improving the conditions.

REFORESTING PRACTICAL.

The United States forest planting station at Fort Bayard, N. Mex., under charge of H. C. Turner, was visited by the writer, and the young growth inspected. The record for six years of the proportion of trees living at the end of the first year after planting, in the case of western yellow pine is particularly reassuring. This record is hereby submitted and it is believed that where it shall seem best to reforest burned-over or barren slopes on the Gila River watershed the results may be expected to be good.

Year planted.	Mean annual rain.	Duration of dry period.	Rain in this period.	Mean temperature.		Rain from Jan. 1 to arid fore-summer.	Per cent of western yellow pine living in mountains at end of first year.
				May.	June.		
1908	11.66	May 4 to July 13	0.55	53.03	69.18	4.77	....
1911	19.13	Apr. 26 to June 11	.00	61.40	68.30	5.09	[1] 30
1912	16.74	Apr. 14 to July 11	1.63	58.80	67.80	3.87	86
1913	17.65	Apr. 24 to July 13	.48	60.40	66.40	3.11	34
1914	23.63	No. M. and J	2.33	61.40	68.80	2.10	87
1915	17.34	May 1 to July 11	.02	56.80	69.80	4.44	53
1916	....	May 2 to July 5	T.	59.60	72.00	4.66	25

[1] This would have been much better if planting had been in January in place of December.

In studying the persistence of pine growth in some places in the upper Gila watershed and its absence in others one can not but observe how uniformly the pines are associates with the drainage lines, on account of the improved moisture conditions, as compared with general conditions elsewhere over almost any area observed.

DATA.

The effort has been made in this report to limit the tabulation of data to those matters directly pertinent to the study.

DATA EXISTING BUT NOT AVAILABLE.

In initiating this investigation it seemed at first that the Gila watershed was a district peculiarly lacking in reliable and definite map data and that the topography, rainfall, run-off, and surface ground condition, were all uncertain and incapable of definition. In the Index to the United States Topographical Sheet of the Geological Survey there appeared to be only the Morenci, Mogollon, and Silver City quadrangles and the Clifton special, comprising but 25 per cent of the watershed and no other good maps in detail of the balance of the territory, with which the writer was familiar.

As a fact this apparent situation was not true for there existed among the various Government departments in separated units most everything that was needed for this study. This is only referred to here as an illustration of the disadvantage of not having better coordination in the work of the different governmental bureaus, especially where the practical benefits from large Federal appropriations can only come often by assembling quickly the scattered results of the studies of many investigators in these various departments as a basis for some definite constructive plan under which conservation works can be built. Intermittent stream measurements or undigested tabulations of any nature in themselves have little if any value. It is only when analyzed in connection with all other data and exact observation in the same watershed, that Weather Bureau records, stream gauging, forestry reconnaissances, and even topographical sheets themselves, can fully warrant the appropriations which financed their production in so far as hydrography is concerned.

RAILROAD COMPANIES' ASSISTANCE.

The three railroad companies operating in the territory, the Southern Pacific Railroad, the Arizona Eastern Railroad, and the Arizona & New Mexico Railroad, proved obliging in furnishing map and profile data in connection with their lines.

RECOGNITION OF ASSISTANCE.

The United States Geological Survey and the Indian Service both furnished me advance copies of incomplete maps, without which the work would have proceeded with the greatest disadvantage. The State engineer's office of New Mexico and all of the United States weather observers who were seen interested themselves in advancing this work. The Reclamation Service and Water Resources Branch of the United States Geological Survey furnished copies of results of water measurements before they had been published. The Forest Service officials, from supervisors to remotely located forest rangers, were particularly obliging in the matter of giving full information with regard to all pertinent data within their knowledge. In fact the writer can truly say that among all the United States officials with whom he came in contact during the progress of this investigation there was uniformly evinced the greatest friendliness and helpfulness possible in carrying out the writer's work. This to an outside engineer temporarily employed speaks well for their loyalty to the interests of the Government.

ACKNOWLEDGMENT OF SERVICES RENDERED.

The writer takes pleasure in making the following acknowledgments for services rendered and favors given in the progress of this investigation and report. First of all there is gratitude due to the kind providence that permitted the field parties to be on the ground during one of the major floods of the Gila watershed.

The success of the work has been largely owing to the work of Mr. C. H. Southworth, C. E., United States Indian Service, principal assistant. Mr. Southworth's familiarity with the Safford reach of the Gila River made it practicable to finish up the field work in less than three months which might otherwise have been impossible.

To Mr. E. Valjean and Mr. Harry F. Olmstead, the latter the writer's son, must be credited the major part of the data secured as to the hydrography and physical conditions in the upper Gila watershed. The writer is indebted to Mr. B. R. Metcalf, associate member American Society of Civil Engineers, for his theoretical analysis of rock-fill dams, flood flows (checked and unchecked) and a condensed statement of the writer's experiments at the Los Angeles Experiment Station. The writer is particularly indebted to Mr. O. A. Stone, construction engineer, for his skill and patience in outlining, modifying, redrafting, and again modifying the writer's ideas for bank protection until satisfactory results were obtained.

To Messrs. Andrew Gunn, William Humans, H. Stiner, and H. B. Lewis must be credited the drafting. To Lawrence Donnelly, computer, and V. R. Lisman, stenographer, is given credit for valued assistance.

The work was greatly advanced through the kind offices of Mr. Hugh P. Coultis, United States disbursing officer, by his helpfulness in handling the accounts and saving the time of the writer for prosecuting the technical work.

LOCAL DRAINAGE INTO SAFFORD VALLEY.

The mountain areas directly cross draining into Safford Valley, contributing to the Gila flood flows as well as to the water supply of Safford Valley, are from the south slopes of the Gila Mountains north of the river and the foothills and northern slopes of Turnbull and Graham Peaks on the south side of the river.

These washes are similar in that they all carry considerable detrital matter which is frequently delivered as far as the river, causing the Gila current to be deflected from one side of the river channel to the other.

Intensive rainfall or cloudbursts are responsible for many of the high discharge rates. The rain storms are localized and where one drainage area is in flood the adjoining one may be dry.

The beds of all these washes consist principally of sand, gravel, and usually some fairly large rock. The sand in nearly every wash is clean and suitable for concerte.

The upper reaches of the streams coming in from the south are generally covered with yellow pine, mixed Douglas and white fir, Engleman spruce, white pine, and cork-bark fir; and lower down with occasional clumps of Arizona cypress, oak, pinon, and juniper. Granite uplifts have caused the main Graham Mountain and Turnbull Mountain range, while dikes of porphyry occasionally intrude.

The lower-lying benches immediately flanking the agricultural lands of Safford Valley are in the main composed of conglomerate which extends in places well up into the older formations. The grades of the mountain slopes south of Safford Valley ranges from 20 to 5 per cent and canyons are frequently deep and precipitous. None of the Graham Mountain slopes have permanent flow extending beyond the forest boundary. Some of these streams, notably Tripp, Bear Springs, Cottonwood, Cliff, Central, Thatcher, Safford, and Sand Wash, flow clear to the Gila during wet seasons and throughout the year in unusually wet seasons. Near the crest of the range there are apt to be found cienegas or mountain meadows with alder and willow growth and sometimes dense spruce woods.

The mesa areas on the north side are from 3 to 6 miles wide and larger than their corresponding areas on the south side of the Gila. These mesa lands have a varying thickness of soil and generally scant vegetation. The ordinary greasewood and cacti are the only brush growth of note.

In the order found from west to east upstream from San Carlos, the following detail analysis ese direct feeders into the Gila is given, with the works proposed for flood control, between Carlos and Solomonville Narrows (on north, or right, bank of Gila):

first stream coming into the Gila above San Carlos is Triplet Wash, having a length of 10.5 miles, an area of re miles, and a maximum flood flow as indicated by the high water marks of 1,260 cubic feet per second. Works sed, none.

alt Creek, area 68 square miles, length of stream channel 19 miles, with a maximum flood flow from the October, flood of 3,900 cubic feet per second. This wash delivers a large volume of silt, sand, and detritus into the Gila at the bridge crossing and will always menace the permanency of bank-protection works at that point until this is controlled. For preventing erosion by channel improvement work and retardation structures in the upper es of the stream, for works proposed, $30,000.

one Spring Wash, area 29.5 square miles, length of channel 12 miles, maximum flood flow October, 1916, flood cubic feet per second. Works proposed, none.

orth side Bylas Creek, area 29 square miles, length of channel 13 miles, maximum flood October, 1916, 4,440 feet per second. For works proposed, $20,000.

Stream No.	Area.	Channel length.	Maximum flood.	Cost of treatment works.
	Sq. mi.	Miles.		
	53.0	11.0	6,200	(1)
	30.0	12.5	[2] 5,760	(1)
	20.0	9.5	395	(1)
	23.0	10.5	740	(1)
	18.5	11.0	[2] 4,690	(1)
	17.0	8.5	[2] 5,220	(1)
27	19.0	8.5	2,240	(1)
25	21.0	10.0	[2] 6,000	(1)
17–10	28.0	9.0	2,940	(1)
15	24.0	8.5	2,920	(1)
11	7.5	4.0	1,230	(1)
5	3.3	2.0	1,060	(1)

[1] Not to be improved. [2] October, 1916.

Summary of work proposed for correcting lateral flood flows for north side of Gila River between San Carlos and nonville Narrows, $50,000.

Works proposed for correcting lateral flood feeder canyons on south or left bank of Gila between San Carlos and nonville Narrows (from San Carlos up):

Stream No.	Area.	Channel length.	Maximum flood.	Cost of treatment works.
	Sq. mi.	Miles.		
	7.0	4.0	3,060	....
	20.0	8.0	[1] 6,500	$2,000
	15.0	8.5	900	....
	14.0	9.0	1,680	....
	24.4	9.0	[2] 450	....
	20.4	7.0	1,020	2,000
	64.0	11.5	6,528	11,000
	78.0	14.5	2,184	14,000
	49.0	18.0	1,120	10,400
	84.0	20.0	4,100	34,000
	71.0	20.0	2,330	30,300
	39.0	15.0	1,000	8,300
30	20.5	12.0	500	....
28	25.5	14.0	1,272	$5,400
26	38.2	16.0	1,980	32,600
Sand wash	128.0	19.0	[2] 3,330	55,000
Total				205,000
Right bank brought forward				50,000
Total				255,000
Engineering, contingencies, and overhead, 15 per cent				38,250
Grand total				293,250

[1] Checks. [2] October, 1916.

The estimate previously given in this report, $1,109,242, as the cost of the channel protec-n works on the Gila River between San Carlos and the Solomonville Narrows, added to this imate of $293,250 for controlling cross streams coming into the Gila between these same points, es us a total of $1,402,492, which the writer believes will protect the Graham County lands arian to the Gila River both from the action of Gila River floods and from any local flood n-offs from the lateral streams along this reach of the river.

In case the works on the upper watershed herein recommended are not executed, then it ll be advisable, after the river itself has built up the area comprised between the present nk lines and the new official channel lines, to construct a continuous earth levee (except at oss-drainage lines) 4 feet high parallel with the official channel lines and 100 feet back there-om, this being designed as a protection against overflow and deposits of silt on the agricultural nds.

TOTAL ESTIMATE, GRAHAM COUNTY IMPROVEMENT.

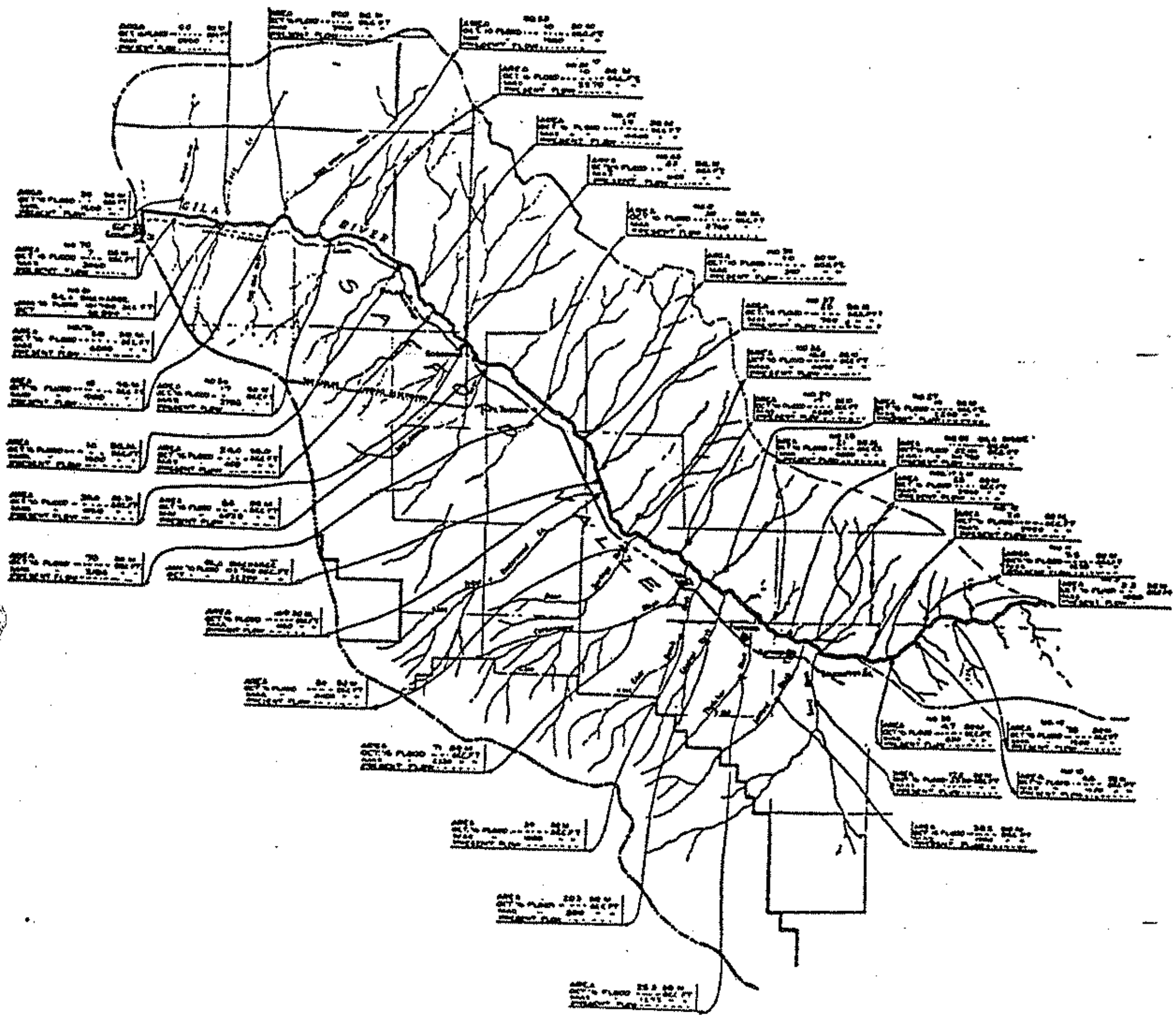
This proposed expenditure, $1,402,492, amounts to 28 per cent of the $5,000,000 valuation aced upon the Graham County property menaced by the Gila floods. This is an overestimate what the work will actually cost unless undertaken immediately, while the unit price of aterials is still abnormally high from war conditions. It is perfectly safe to say that two years o, if the logs had been floated down the Gila River, the total improvement would not have ceeded one-half the amount now estimated. The annual loss of the Graham County agricultural lands in itself may not seem at first a national peril, but it surely represents what is a very vital menace to our national life that looms large and dark upon the horizon of our internal affairs.

RESERVOIRS.

The San Carlos storage reservoir proposition, to hold some 700,000 acre-feet of water, and to cost over $5,000,000, is probably the most attractive storage proposition on the Gila.

The writer believes the silt factor can be largely eliminated by the works herein recommended.

There are many good dam sites in the upper Gila, but very few good reservoir propositions, and the only satisfactory combination, that of Guthrie, is unfortunate in being on that branch

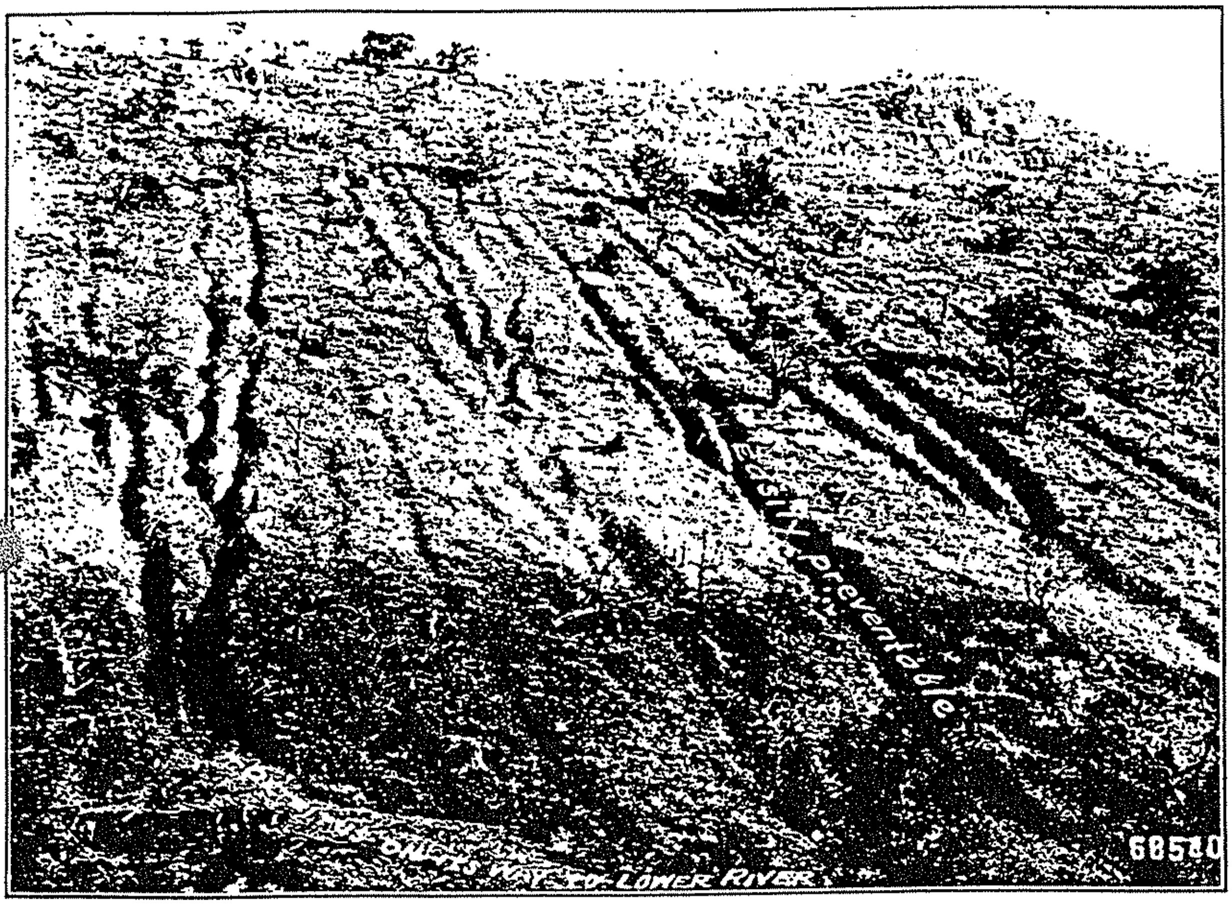


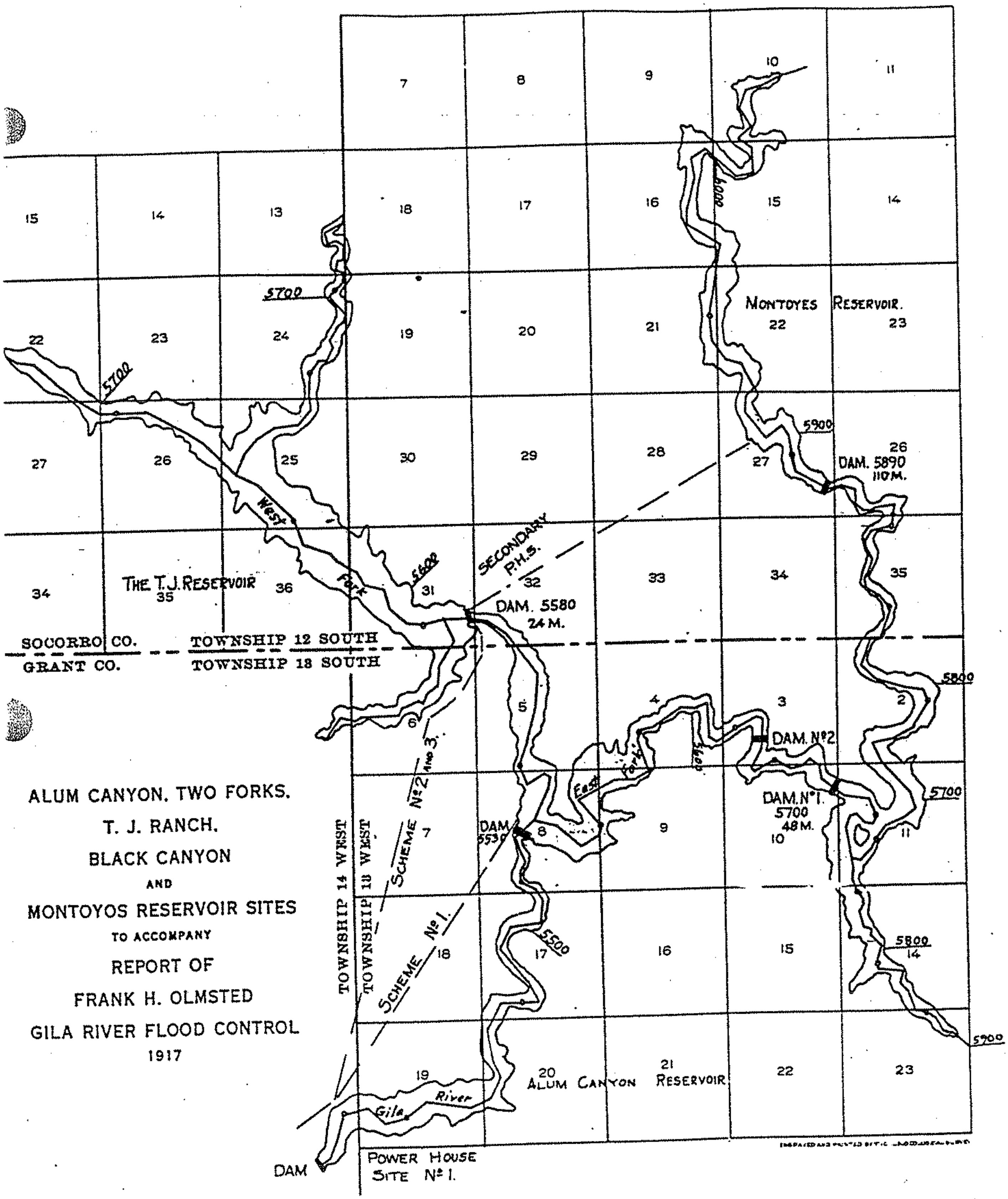
DIRECT DISCHARGE INTO GILA IN GRAHAM COUNTY

of the Gila having less pronounced flood flows, as well as the fact that the reservoir site has been occupied by the Arizona & New Mexico Railroad.

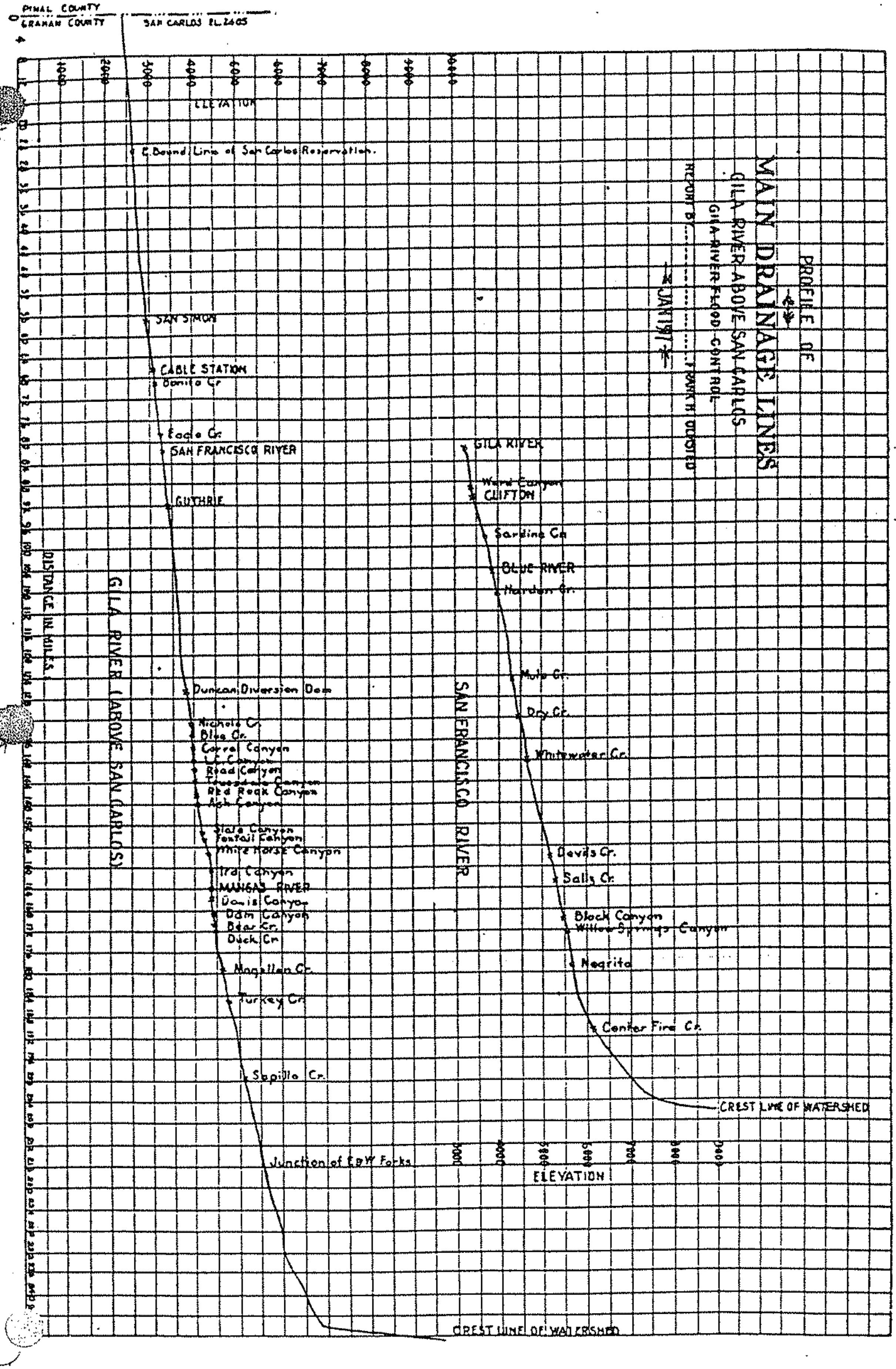
The following sites have been reported upon, and might later be considered practical if the watershed above them were treated and erosion checked.

Location.	Acre-feet.	Height (feet).	Estimated cost.	Location.	Acre-feet.	Height (feet).	Estimated cost.
Guthrie	255,800	140	....	Two Forks	82,000	150	$1,310,000
Redrock	80,000	100	....	T. J. ranch	73,000	150	840,000
Dix Creek (San Francisco River)	12,000	110	....	Black Canyon	45,000	200	1,710,000
Alma (San Francisco River)	135,000	150	....	Montovos	28,000	150	1,000,000
[illegible]n Canyon	38,000	150	$12,455,000	D. D. Bar	18,000	100	630,000


preventable
LOWER RIVER
68540



Senate Doc. 436; 65th Cong., 3d Sess.


PINAL COUNTY
GRAHAM COUNTY
SAN CARLOS EL. 2605
ELEVATION
E. Bound Line of San Carlos Reservation
PROFILE OF
MAIN DRAINAGE LINES
GILA RIVER ABOVE SAN CARLOS
GILA RIVER FLOOD CONTROL
REPORT BY FRANK H. OLMSTED
SAN SIMON
CABLE STATION
Bonita Cr.
Eagle Cr.
SAN FRANCISCO RIVER
GUTHRIE
GILA RIVER
CLIFTON
Sardine Cr.
BLUE RIVER
DISTANCE IN MILES
GILA RIVER (ABOVE SAN CARLOS)
SAN FRANCISCO RIVER
Duncan Diversion Dam
Mule Cr.
Dry Cr.
Nichols Cr.
Blue Cr.
Corral Canyon
Road Canyon
Red Rock Canyon
Ash Canyon
Whitewater Cr.
Slate Canyon
Foxtail Canyon
White Horse Canyon
Devils Cr.
Ira Canyon
MANGAS RIVER
Davis Canyon
Salls Cr.
Dam Canyon
Bear Cr.
Duck Cr.
Black Canyon
Willow Springs Canyon
Negrita
Mogollon Cr.
Turkey Cr.
Center Fire Cr.
Sapillo Cr.
CREST LINE OF WATERSHED
Junction of E & W Forks
ELEVATION
CREST LINE OF WATERSHED

The six last-named reservoirs are included in the power project of a private corporation, and while at the present time dormant might later be revived. The writer is convinced that certainly for the present and perhaps for long years there will be no sufficient demand for power within feasible distance to warrant these expenditures, and for flood relief or an increased irrigation water supply there is at hand a surer and better solution.

GILA SILT CONTENT, OCTOBER, 1916.

Our own determination of the silt content of the Gila in the October, 1916, flood is good evidence that it is not the normal Gila River that makes the silt problem serious but the flood flows themselves. These particular silt observations were made by Mr. C. H. Southworth as follows:

Silt samples Nos. 1–A and 1–B were taken from Pima Bridge about 3 p. m. or six hours after crest, October 14, 1916. No. 1–A was taken near midstream on south end. No. 1–B was taken at the end of the last span to north approach. From this latter point to shore, 100 feet distant, had been washed out.

Determination of silt sample No. 1–A.

	Grams.
Weight of sample and bottle	759.7
Weight of bottle alone	399.4
Weight of sample	360.3
Weight of silt	12.58

$\frac{12.58}{360.3}=$ 3.49 per cent by weight.
2.8 per cent by volume of 80 pounds per cubic foot of soil.

Determination of silt sample No. 1–B.

	Grams.
Weight of sample and bottle	821.4
Weight of bottle alone	437.9
Weight of sample	383.5
Weight of silt	13.58

$\frac{13.58}{383.5}=$ 3.51 per cent by weight.
2.8 per cent by volume of 80 pounds per cubic foot of soil.

Silt samples Nos. 2–A and 2–B were taken below Safford at 9 a. m., 24 hours after crest October 15, 1916.

Determination of silt sample No. 2–A.

	Grams.
Weight of sample and bottle	753.4
Weight of bottle alone	392.5
Weight of sample	360.9
Weight of silt	16.2

$\frac{16.2}{360.9}=$ 4.48 per cent by weight.
3.5 per cent by volume of 80 pounds per cubic foot of soil.

Determination of silt sample No. 2–B.

	Grams.
Weight of sample and bottle	801.2
Weight of bottle alone	408.7
Weight of sample	392.5
Weight of silt	10.3

$\frac{10.3}{392.5}=$ 2.62 per cent by weight.
2 per cent by volume of 80 pounds per cubic foot of soil.

Average per cent by volume for 2–A and 2–B equals 2.75.

In this determination it is thought that the first sample is too high; probably bucket dragged on bottom.

Silt samples Nos. 3–A and 3–B were taken below Safford, 7 a. m., October 16, or 46 hours after the crest.

Determination of silt sample No. 3–A.

	Grams.
Weight of sample and bottle	389.9
Weight of bottle alone	414.1
Weight of sample	375.8
Weight of silt	16.05

$\frac{16.05}{375.8}=$ 4.27 per cent by weight.
3.4 per cent by volume of 80 pounds per cubic foot of soil.

Determination of silt sample No. 3–B.

	Grams.
Weight of sample and bottle	820.5
Weight of bottle alone	439.9
Weight of sample	380.6
Weight of silt	15.88

$\frac{15.88}{380.6}=$ 4.18 per cent by weight.
3.3 per cent by volume of 80 pounds per cubic foot of soil.

Silt samples Nos. 4–A and 4–B were taken 9 a. m., October 17, or 72 hours after the crest.

Determination of silt sample No. 4–A.

	Grams.
Weight of sample and bottle	791.8
Weight of bottle alone	421.4
Weight of sample	370.3
Weight of silt	13.5

$\frac{13.5}{370.3}=$ 3.65 per cent by weight.
2.8 per cent by volume of 80 pounds per cubic foot of soil.

Determination of silt sample No. 4–B.

	Grams.
Weight of sample and bottle	806.4
Weight of bottle alone	442.5
Weight of sample	363.9
Weight of silt	9.56

$\frac{9.56}{363.9}=$ 2.63 per cent by weight.
2 per cent by volume of 80 pounds per cubic foot of soil.

Silt samples Nos. 5–A and 5–B were taken at 9 a. m., October 20, 6 days after crest of flood, or 144 hours after crest.

Determination of silt sample No. 5–A.

	Grams.
Weight of sample and bottle	794.9
Weight of bottle alone	405.6
Weight of sample	389.3
Weight of silt	.42

$\frac{0.42}{389.3}=$ 0.1 per cent by weight.
0.08 per cent by volume of 80 pounds per cubic foot of soil.

Determination of silt sample No. 5–B.

	Grams.
Weight of sample and bottle	813.6
Weight of bottle alone	445.0
Weight of sample	368.6
Weight of silt	.45

$\frac{0.45}{368.6}=$ 0.12 per cent by weight.
0.08 per cent by volume of 80 pounds per cubic foot of soil.

From the foregoing analyses it will be noted that the 48-hour period after the crest gave the highest silt content. This seems to be in agreement with the observed conditions. The greatest erosion took place about this time. While the river was flowing bank full during its first period no great amount of the erosion took place. When rapid recession was taking place and when the stream body or main current was directed at the banks the greatest erosion occurred. It should be mentioned, however, that these samples were necessarily taken from the bank, and it may be possible that this part of the stream carried a higher silt content than would be found near its axis.

At Cliff on the upper Gila, 10 a. m., October 14, 1916, a single silt sample showing 4 per cent silt volume after 24-hour settlement confirms the evidence, otherwise indisputable, that a large proportion of the Gila River silt carried by the lower river comes from the high mountain area.

There may come a time after the erosive forces now in full play on the upper Gila have been halted when these small reservoir propositions will prove attractive, but that is not yet, and the regulation of flow for the lower river if attained must be secured by careful attention to the minute detail conditions in every lateral tributary of the Gila River system now showing erosion.

This is practical and not prohibitive as to cost when the vast influence of the accomplished work is given its proper weight and value.

The benefits derived from alone protecting the Graham County land we have estimated at $5,000,000. There might be added to this an indirect credit from the lower districts for minimizing the silt deliveries due to the caving banks of the Graham County front, but to restore the whole Gila watershed to its ancient condition is of such far-reaching consequence that no man's imagination even can compass it.

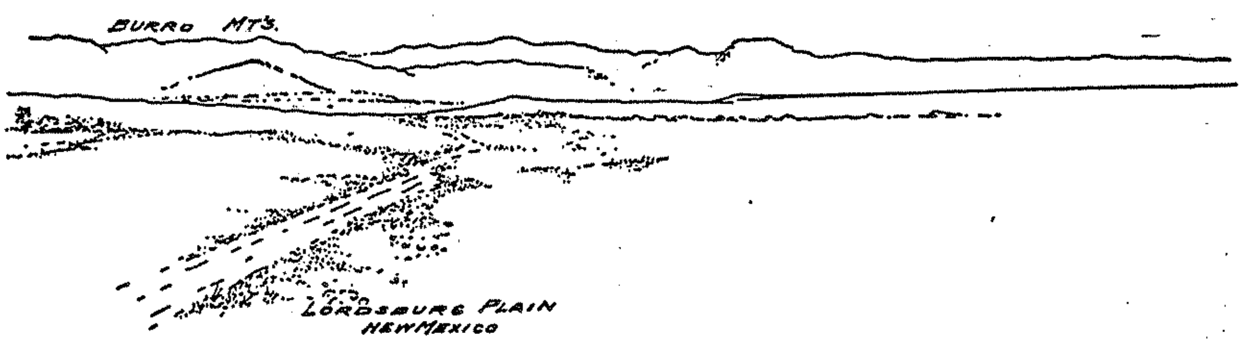
FLOOD CANALS.

Lordsburg flood canal.—A large flood relief canal could be taken out of the Gila River to irrigation advantage between Cliff and Redrock and carried to the Lordsburg plain, where fertile lands are abundant and a water supply lacking. The canal itself would be long and expensive, and from the broken character of the country traversed difficult to maintain. No surveys are available for estimating the proposition or its cost, but this is certain, that under present circumstances the water supply of the Gila River available for the prior Indian irrigators and the settlers in the Safford Valley, including both pump-water and gravity-water demands, is entirely inadequate to warrant such an expenditure or to be legally defensible.

There are many dormant possibilities on the Gila River if the flood crests can be reduced and the silt content lessened. When these conditions have been secured and the river in its lower reaches confined to a definite channel, many extended uses for the Gila River waters will develop. Otherwise there are no possibilities but those of greater discouragement and larger loss. With this conviction firmly in mind the writer is emphasizing certain relief measures for improving the fundamental conditions in the watershed now naturally growing worse year by year.

Where to start retardation works.—The cost and character of the system planned for in this report are both capable of being satisfactorily adjusted to the varying conditions of different localities and to the greater or less ability to provide funds without jeopardizing the whole expenditure. Every dollar spent in retardation works wisely planned is a permanent investment, for the construction should start at the headwaters and proceed downstream, so that there is only the restrained flow to come against any unit of the work. Stopping the work for 1 year or 10 years may delay results and may not in consequence improve lower river conditions as rapidly as desired, but the whole previous expenditures would not be wasted lacking fresh appropriations, as has often been the case under the present system of river improvements.

Drift.—During flood periods there are sometimes great quantities of trees, brush, and tree roots swirled down the Gila River from the mountain area and deposited in the lower river channel. These obstructions in the channel in later floods menace the bank by diverting the

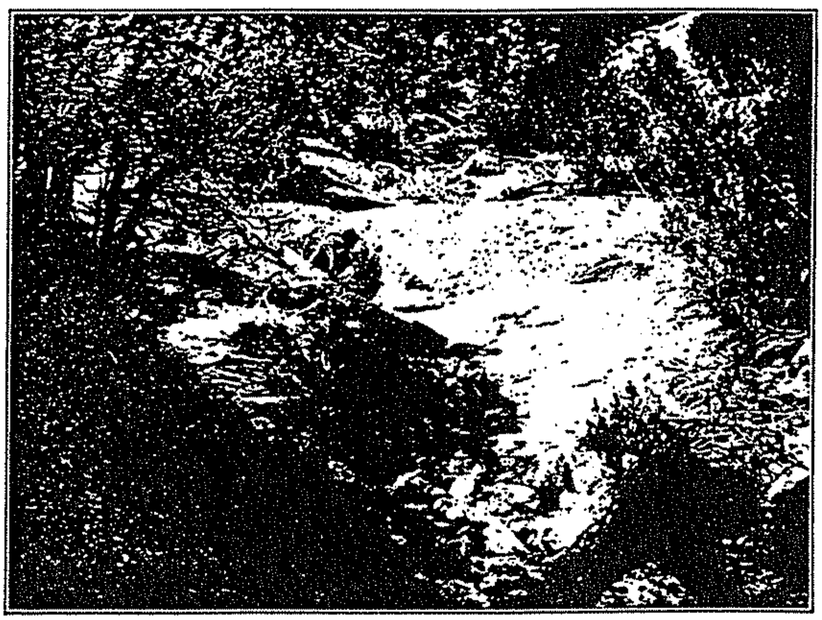


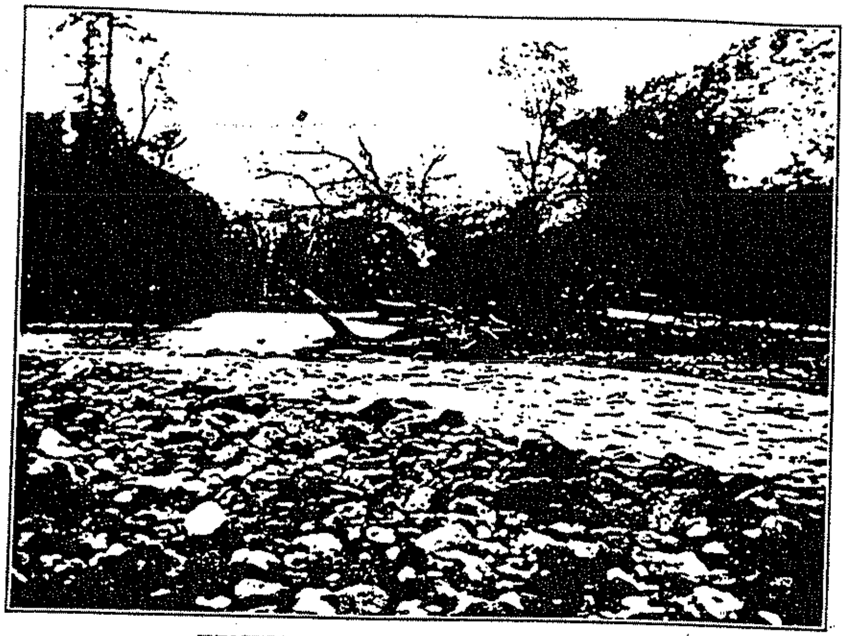
current against them. Logs and tree roots especially form centers of deflection and set up cross currents wherever they become temporarily or permanently bedded in the channel. To relieve the lower river channel from this risk there has been planned log cross structures on many of the main upper tributaries which will hold back a considerable portion of the drift at points where the drift itself later will help to restrain future flood waters and prevent the passage of drift. These log cross structures will prove economical to build, for they are located where there is convenient timber to build them with, and the logs themselves constitute the entire construction material. There may be locations where these structures will be needed but where there will be no timber convenient, in which case a system of wire cable may be used.

Uncertainty incident to flood flows and underground storage supplies.—No certainty exists as to the exact results to be secured in any given instance in this retardation program. Just how much it will diminish a flood peak and just how much it will improve the flow during a succeeding dry season no one can now say. The study partakes to an extreme degree of the uncertainty surrounding all questions pertaining to flood flows and underground water supplies.

Hundreds of water measurements and estimates of flood flows have been made in the upper Gila watershed under the writer's direction, and a careful study made of actual conditions on the main streams and the lateral tributaries in an effort to come at the significance of these data so as to intelligently plan the retardation works. There has also been made a purely theoretical study of flood flows and an analysis and diagram submitted in this report. In fact, nothing that has promised to throw any light on the subject has been neglected. The actual experiments generally show up much better than any theoretical analysis yet advanced. The surprising success of very simple appliances in practice would indicate that there is some unknown factor which results in a degree of desynchronization or perhaps extraordinary absorption which can not be theoretically explained.

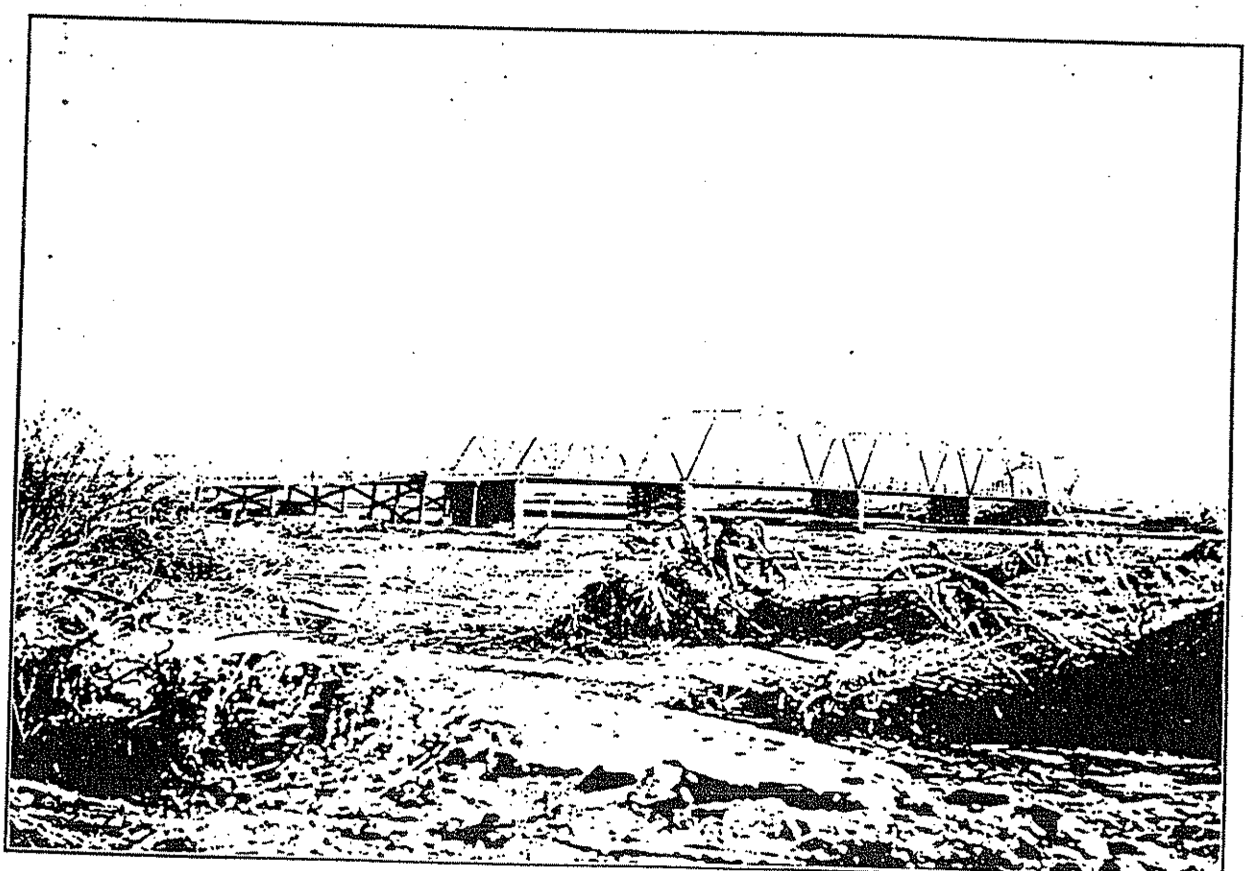
Anyone inclined to criticize the admission that the basis for this proposed work is somewhat tentative and uncertain should keep distinctly in mind that this uncertainty is incident





JUNCTION OF BLACK CANON AND GILA.

Note drift ready to start its journey to Lower River.



LOWER GILA RIVER DRIFT.

CHECK DAMS.

CHECK DAM NEEDING REPAIR.

they laugh and sing and pitch themselves down to join with their fellows in creating these lower river floods is to become convinced that at this point in the development of a flood a great deal can be accomplished if the machinery has been previously provided to delay the arrival below of great numbers of these little rivulet discharges, allowing others to rush on ahead.

Checking just a little of the velocity diminishes the débris-carrying power of the current a great deal (to either the fifth or sixth power). It also increases absorption owing to the greater clarification of the water; it increases absorption due to increased time of discharge; it increases absorption due to increased head produced by the bays back of the check structure; it increases the absorption by increasing the wetted perimeter of the stream; in fact, it enables nature to recover herself from the spoliation of the forces of waste and to build up again the fern and willow growth and to recreate the moisture-filled soil storage that all through the dry season should be furnishing its little quota of flow to the river below.

CHECK DAMS.

The building of the small retarding structures must proceed without plans and specifications and preferably should be handled by force account, using young, active men interested in conservation work. If there could be a great army of the youth of the Nation encamped in the glorious mountains of the upper Gila and in the wonderful canyon lines of the Mogollon, Black, San Francisco, and Tularosa Mountains for, say, one year, under competent instructors and subjected to drill and obedience not alone in the use of arms but of tools and in building some hundreds of thousands of these little structures, the young men would be better off and the Nation wonderfully enriched. There would be recreation and sport of occasionally killing a black-tailed deer or a wild turkey or the gray squirrels, which we saw almost every hour of every day while in this region. Our national life would not only be reinforced through a pronounced conservation achievement along material lines, but the spirit of true national defense would have a new birth.

The little picture shown herewith gives a better idea than words can of the simple and inexpensive character of many of these structures. In the Los Angeles experiments it has been found that even where perishable materials have been used in this class of construction that nature herself with this help quickly recovers the lost equilibrium normal to canyon run-off, and in a short time the complete decay of the structure itself would not materially interfere with the improvement. The cost of making surveys, drafting plans and specifications, and making estimates would generally be double that of actually building the work which is wanted.

The structures are estimated by vertical foot of rise and the average cost has been found to be approximately $1 for doing this work under average conditions in southern California.

The stability required in these small dams, and their cost, has been fairly well demonstrated by the Clear Creek and Haines Canyon experiments in Los Angeles County. Structures that would be indefensible from an engineering standpoint placed in an uncontrolled stream are perfectly secure when located in line below a string of structures that have subdued the velocities above to not over 4 feet a second.

Although there can be no definite specifications for these check structures, still the general requirements can be stated.

GENERAL REQUIREMENTS FOR CHECK DAM CONSTRUCTION.

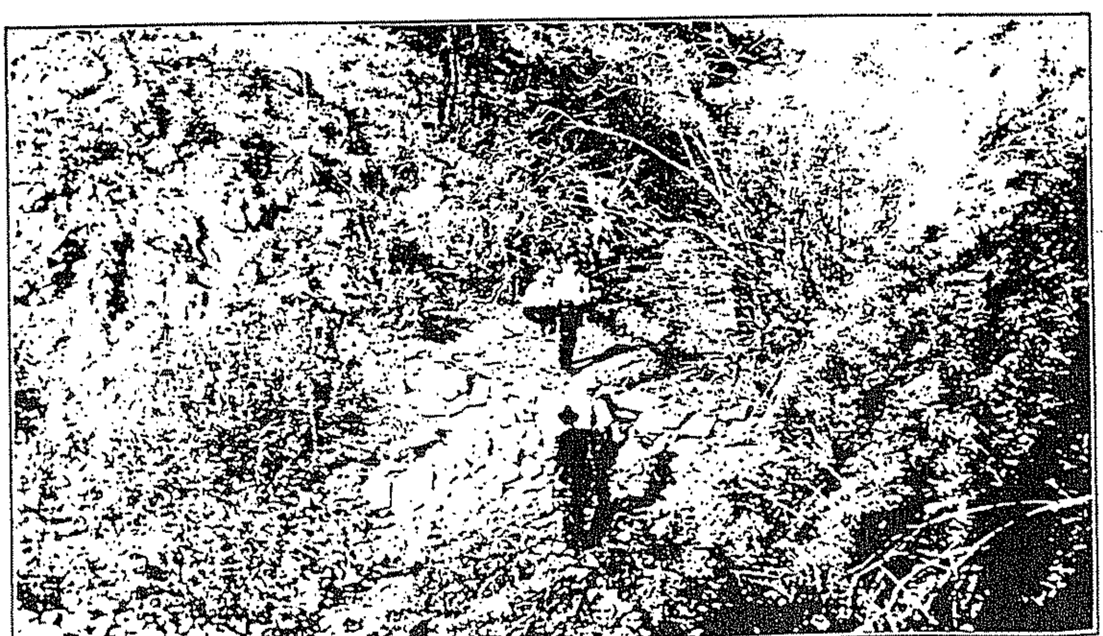
In any ravine or canyon selected for treatment there shall be a fixed reduction of grade and the location of the individual structures shall conform as nearly as may be to a uniform horizontal interval between them, but this shall be waived to secure narrower cross sections so that the work may be flanked and anchored against projecting rock points if possible.

The material right at hand shall be utilized in the construction of these checks; rock preferably if easily secured, then logs and especially dead timber so that fire risk may be lessened.

The axis of the little structures is to bow upstream when not made of logs and be appreciably lower on center line than at the abutments. Frequently rock in place or large boulders may be keyed to, or keyed in by locating dams at such places.

There is to be as little interference with the side slopes as may be to anchor the dams. Other things being equal, the structures should be located at the foot of bad slides.

The Los Angeles experiments, so-called, are the only attempt, the writer believes, ever made in this country to utilize or develop the idea of flood prevention through stream-retarding devices. For this reason there is included herein a brief review of that work. The work was initiated in response to a general demand of the people of Los Angeles County that further flood damage, after the 1914 flood, should be prevented if paying engineers for investigating the subject could bring that result. A board of engineers was named with Mr. H. Hawgood, member American Society of Civil Engineers, member I. C. E., as chairman of that board,



CHECK DAMS.

and the writer as one of the members, to the latter being apportioned the task of investigating the conditions in the San Gabriel and Los Angeles River watersheds where the floods which wrought such havoc had originated.

Through the intelligent cooperation of the chairman of the Los Angeles County board of supervisors, R. W. Pridham, and Mr. F. A. Woodley, supervisor, having general committee charge of flood matters, there was secured an appropriation which in the end amounted to something like $25,000 for conducting a series of experiments that would make some practical test of the efficiency of what lacking a better name was called the Swiss flood prevention system. This experiment was confined to two mountain canyons, the first one, Haines Canyon, affording the opportunity for building some 400 small check structures to observe just what diminution of flood crests there might be from the expenditure of a known amount of money on a stream which had a larger run-off per square mile of cachement area up to that date than any other of which record could be had in Los Angeles County; the other being Clear Creek where the opportunity existed of building a small reservoir, rock-filled dam with concrete core, holding about 25-foot head of water against the structure and discharging between 700 and 1,000 cubic feet per second on the instantaneous release of a collapsible gate having a sill set at the original level of the floor of the stream.

A detailed description of these Los Angeles experiments is as follows: A so-called official channel 1,100 feet long was laid out below the main impounding dam, and gauging stations or observation stations were located at 263 feet, 535 feet, 669 feet, 864 feet, and 1,100 feet below the main dam. This laid the channel off into five different divisions of the following lengths—263 feet, 272 feet, 134 feet, 195 feet, and 236 feet. There was a total of 14 experiments performed over this channel, four of which were performed over the unchecked channel in order to get its action under natural conditions, and the remaining nine experiments were performed after the check dams were installed. As these experiments were performed with varying heads of water in the main dam, they show quite definitely the percentage of reduction of original velocities due to any given amount of obstruction (check dams) in the channel.

The method of conducting an experiment was as follows: An observer was stationed at each observation station. It was the duty of each observer to take the time to the hour, minute, and second, of the arrival of the so-called "first water," the crest or peak of the flood, and the moment of the first signs of receding water.

In order that all observers might know the exact moment of the water leaving the dam, a charge of dynamite placed up on the hillside was fired by an electric current at the time of the tripping of the gate. The opening was 5 feet wide by 7 feet high and the gate which closed it was built of wood in four sections and collapsed and floated out the opening when tripped.

After each experiment the data of each observer was collected and corrected by any difference that might have existed between his timepiece and that of the observer at station No. 1.

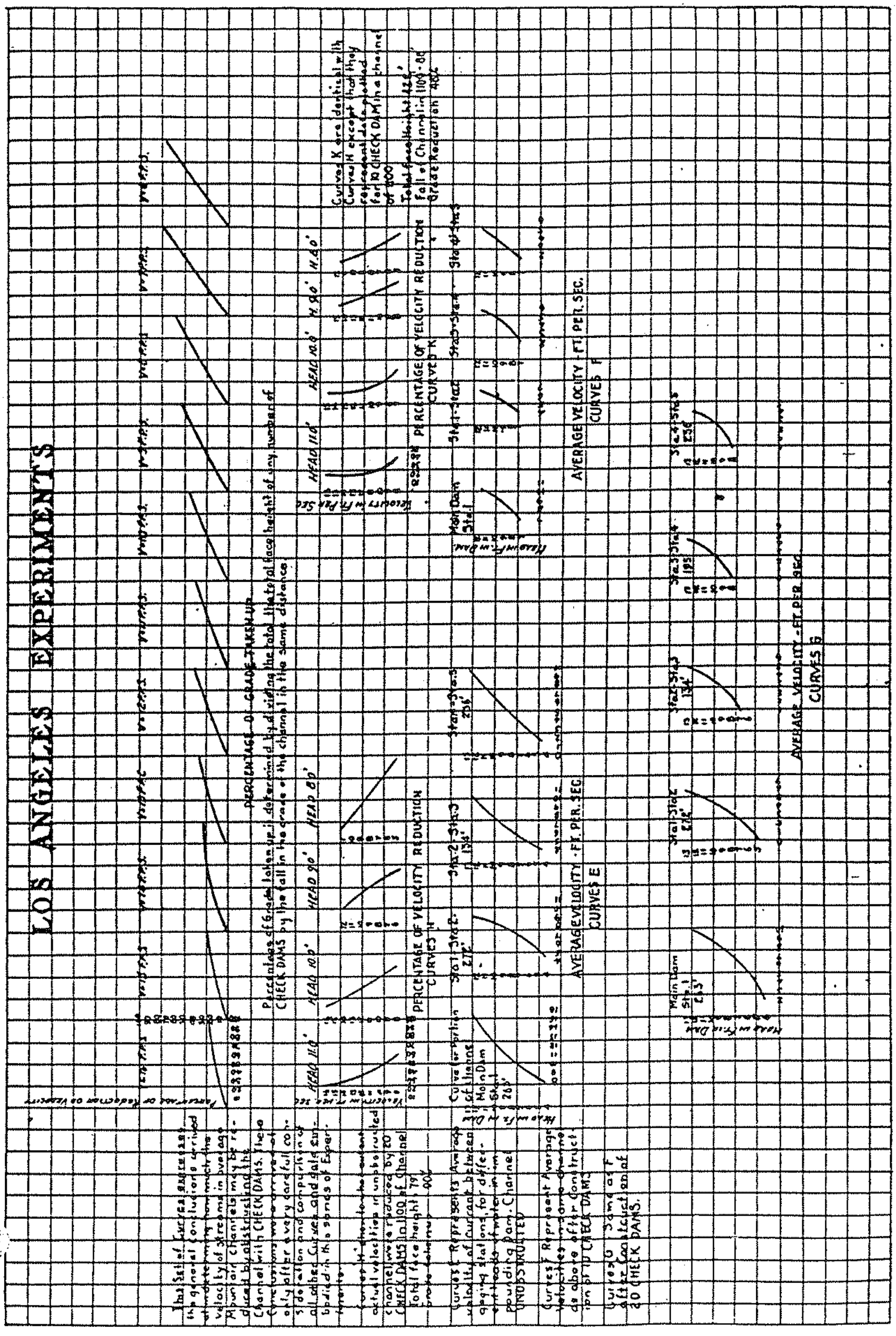
When the 14 experiments had been concluded, the data was worked up and platted by curves in the following way:

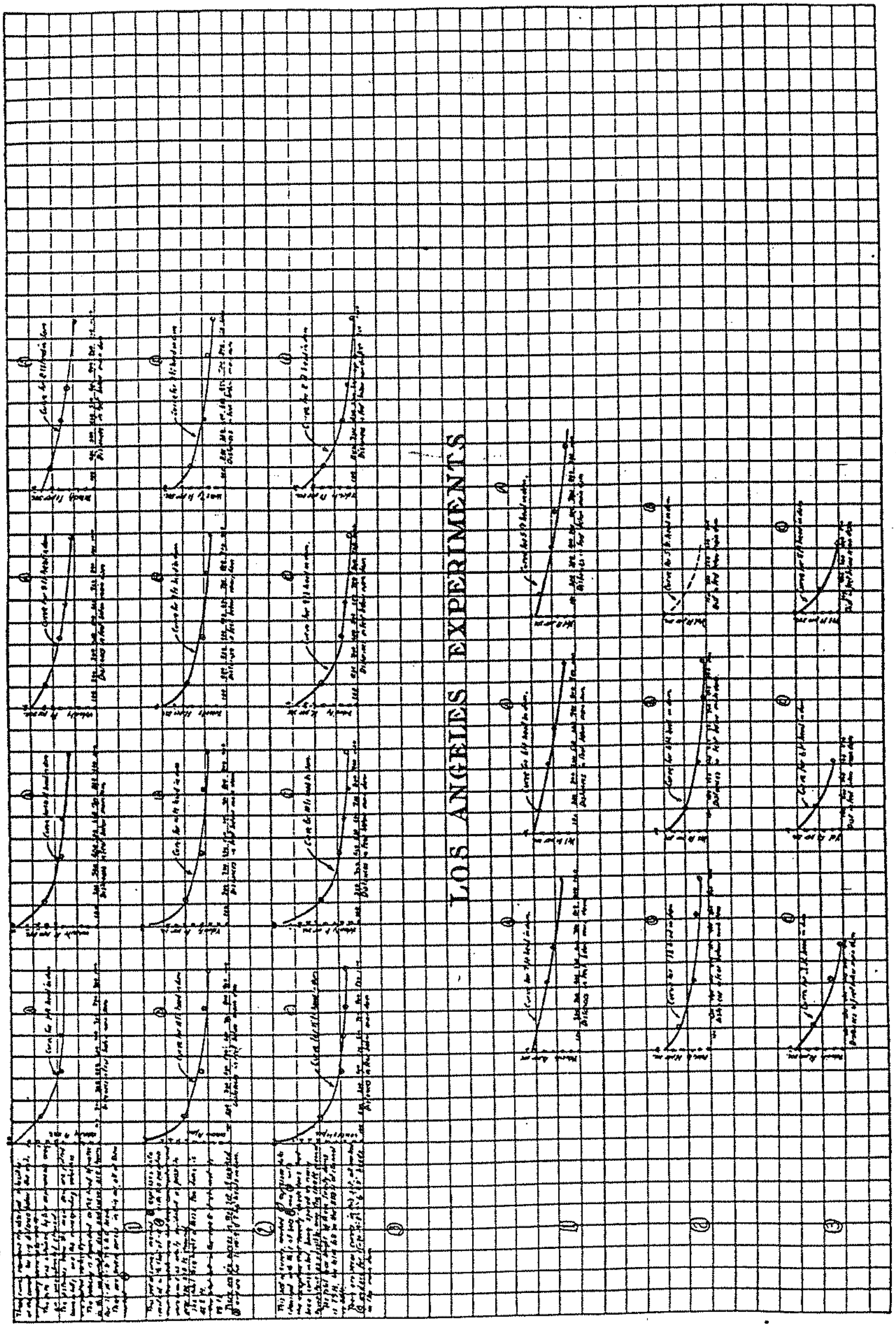
The distances between all the gauging stations are known. From the time taken by the observers was obtained the elapsed time of the crest as it passed the different stations. Knowing the time and distance, the average velocity was directly obtained for each division of the official channel for each of the 14 experiments. As stated above, the lengths of the five different divisions of the official channel, beginning at the main dam, are 363 feet, 272 feet, 134 feet, 195 feet, and 236 feet, and the mid-points of each of these divisions in order are the following distances below the main dam: 131 feet, 399 feet, 602 feet, 766 feet, and 982 feet.

If for any given experiment the average velocity for each and every division is platted at a distance below the main dam equal to the distance below the dam of the mid-point of that division, and a curve is passed through these points, this curve will be one of actual velocities. The reason for this is that this curve will cross the upper end of each division at a higher actual velocity than the average velocity for this division and cross the lower end of division at a lower actual velocity than the average. By this means we are able to translate average velocities in the channel to actual velocities for any given part of channel.

This is illustrated by three sets of curves marked "No. 1," "No. 2," "No. 3." Each set has seven curves in it, covering depths of water in the dam ranging from 5 feet to 11 feet. Set No. 1 deals with the channel with no check dams; set No. 2 shows the reduction of actual velocities when 10 check dams had been built and the grade (7½ per cent) had been taken up [illegible] per cent; and set No. 3 shows the reduction in actual velocities when 20 check dams had been built and 90 per cent of the grade taken up.

In these three sets of curves, those curves having the same depth of water in the dam are shown one below another for direct comparison purposes. These three sets of curves—No. 1, No. 2, and No. 3—are derived from sets No. 4, No. 5, and No. 6, in which are shown the average velocities for each division of channel corresponding to the various heads in dam.


LOS ANGELES EXPERIMENTS
PERCENTAGE OF GRADE TAKEN UP
PERCENTAGE OF VELOCITY REDUCTION
CURVES H
PERCENTAGE OF VELOCITY REDUCTION
CURVES K
AVERAGE VELOCITY - FT. PER. SEC.
CURVES E
AVERAGE VELOCITY - FT. PER. SEC.
CURVES F
AVERAGE VELOCITY - FT. PER. SEC.
CURVES G


LOS ANGELES EXPERIMENTS

From the set of curves marked No. 1, No. 2, and No. 3 (which show the reduction in actual velocities due to use of check dams), by comparison we are able to obtain the percentage of reduction of velocity, which is the kernel of the whole affair. This was done by tabulating the actual velocities for every 50 feet of channel, for the three conditions of no check dams, partially checked, and fully checked. Curves No. 7 and No. 8 show this data platted in the form of curves in terms of original velocity and percentage of reduction of velocity. Curve No. 7 gives the data for 10 check dams, or 48 per cent reduction of grade, and curve No. 8 gives the data for 20 check dams, or 90 per cent reduction of grade.

From a combination of curves No. 7 and No. 8 curve No. 9 was obtained, which expresses the final results of the experiments.

This set of curves shows that with velocities ranging from 6 feet to 16 feet per second in any natural channels what the percentage of reduction of these velocities would be by introducing any given percentage of obstruction in the form of check dams into these channels.

This is the basic idea of the reduction of peak flows by means of check dams, for in the reduction of the velocities in the natural channels the period of gathering and afterlag of storm run-off is greatly increased with a corresponding reduction of peak flow. The application of this theory is developed in an analysis of flood flows from Chase Creek, beginning on page ——.

There are many places in the upper headwaters of Gila River where there are not only occasional narrow gorges, but frequently miles of them. In some of these places we have designed loose-rock dams in series to accomplish the same retarding effect in connection with the stream flows of larger unit size that is accomplished on the rivulets with inexpensive check dams.

In connection with the writer's work in the Los Angeles experiments previously referred to, Mr. B. R. Metcalf, associate member American Society of Civil Engineers, analyzed the probable action of a flood crest of 2,400 cubic feet per second coming out of a small mountain ravine and maintaining its gauge for this delivery for approximately six hours. That analysis is herewith submitted as being pertinent to this study.

At narrow points in the canyons where plenty of durable rock may be obtained at an elevation of, say, 40 to 50 feet above the bed of the canyon, great quantities of rock are blasted down to the bed.

This rock is allowed to lie just as it falls, no attempt being made to move it again. In this way a mass of loose rock is built up in the bed of the canyon, the intention being to give it a top width of 20 feet, an end slope of 2.1, and ranging in height of from, say, 20 to 50 feet, the height depending largely on the storage capacity to be gained.

This mass will be composed of pieces of broken rock of varying sizes, the largest probably not exceeding 3 to 4 feet in least diameter. Whole pieces larger than this will probably be shot out, but the fall will be likely to reduce them to the sizes mentioned above. It can be safely assumed that loose broken rock falling in this manner will have 40 per cent of its volume void.

If 40 per cent of its volume is void, then 40 per cent of the average vertical section of which the mass is composed will be void.

By this argument the amount of water that would be discharged by any dam would depend upon the area of a vertical cross section taken at right angles to the direction of the canyon and at its narrowest point. The vertical height of the section to be considered at any time would equal, of course, the depth of the water at that particular moment. Forty per cent of the area of that section would be open to the passage of water at first, later being somewhat diminished by the voids retaining solid matters carried to the dam by the current.

The passage of the water through the mass will depend upon two factors—the forward force due to the head of water behind the dam and the resisting force due to the size of openings and friction of the surrounding particles. That the size of the openings remain for long periods fairly open may be inferred from the fact that in the San Antonio tunnel through a slide the voids were so considerable that with 150 feet of superincumbent material the draft was so great that a candle placed near the roof of the tunnel would be sucked upward and out by the draft.

The head is a definite force tending at all times to drive the water through voids of the rocks.

The resisting force is dependent principally on the coefficiency of roughness and the length and crookedness of the channel.

The object now is to determine what the size of these openings on an average might be expected to be and the number in a given area.

The unit of area to be considered will be 10 feet square or 100 square feet. Of this 100 square feet I may now take 40 per cent, or 40 square feet, as void, and the balance, or 60 square feet, as solid matter.

We consider the 60 square feet to consist of circles of 1 foot, 2 feet, and 3 feet diameter.

Diameter.	Circumference.	Area.	Number necessary to equal 60 square feet.	Wetted perimeter in linear feet.
1 foot	3.14	0.785	77	242
2 feet	6.28	3.142	19	120
3 feet	9.42	7.07	8.5	80
				3)442
				147

One hundred and forty-seven linear feet equals average wetted perimeter for 1-foot, 2-foot, 3-foot circles. Consider the 60 square feet to consist of squares of 1-foot, 2-foot, 3-foot sides:

Side.	Perimeter.	Area.	Number necessary to equal 60 square feet.	Wetted perimeter in linear feet.
1-foot	4	1	60	240
2-foot	8	4	15	120
3-foot	12	9	6.67	80

From this average wetted perimeter for 1-foot, 2-foot, 3-foot squares equals 147, the same as for circles.
Now, considering the same for triangles:

Altitude.	Perimeter.	Area.	Number necessary to equal 60 square feet.	Wetted perimeter, in linear feet.
1 foot	3.48	0.58	103	358
2 feet	6.9	2.3	26	179
3 feet	10.38	5.19	11.5	119

The average wetted perimeter for 1-foot, 2-foot, and 3-foot triangles will be 218.
Circles, squares, and triangles are taken because most of the rock can be roughly classed as one of them.
Now take the 60 square feet above mentioned to consist of equal parts of each of the three shapes and equal parts of the three sizes. This is done by taking the average of the above averages, and the result is 170 linear feet of wetted perimeter in the 10-foot square section.
Going back to the circles, and with the different sizes, take the number necessary to equal 60 square feet and arranging them in the form of a square, count the openings between them.
They are found to be as follows:

81 openings for 1-foot circles.
16 openings for 2-foot circles.
9 openings for 3-foot circles

3)106

35 average in 10 feet square section.

For squares:

64 openings for 1-foot squares.
16 openings for 2-foot squares.
9 openings for 3-foot squares.

3) 89

29⅔, say, 30 for average.

For triangles:

100 openings for 1-foot triangles.
25 openings for 2-foot triangles.
9 openings for 3-foot triangles.

3)134

45 average for triangles.

35
30
45

3)110

37

The average of the averages just found gives 37 openings in a 10-foot square section between the stoness of the size discussed. These 37 openings aggregate 40 per cent, or 40 square feet of void, making it 40 openings, each one having an area of 1 square foot.
From the above we have the average linear feet of wetted perimeter:

$$170' - \frac{170}{40} = 4.25' = \text{wetted perimeter per opening of 1 square foot area.}$$

$$\frac{\text{Area}}{\text{Wetted perimeter}} = \frac{1}{4.25} = 0.236 = \text{hydraulic radius.}$$

The computations are now based on a conduit of 1 square foot area and hydraulic radius of 0.236.
By examining the worst possible condition, that of the opening between bowlders being exactly opposite the middle of the adjacent bowlder, we find that the actual distance to be covered equals twice the straight-light distance.

By averaging the size of the bowlders, we find there will be one right-angled bend for every foot of distance.

The loss of head in a 1-foot pipe due to a right-angled bend is equivalent to 16 feet of straight pipe.

This is based on a bend, the radius of which is three times the diameter of the pipe and is a bend of minimum resistance. The conditions we have to deal with are considerably more extreme than this, but will use this to be on the safe side.

The right-angle bends around the bowlders will be of short radius. There will be cross currents, eddies created, and interference of the stream lines, so that the resistance taken will be less than the actual.

By summing all this up, the actual distance traveled and the effect of the bends, the loss of head while passing through the dam will be equivalent to passing through eighteen times that distance of straight pipe.

Heretofore the force tending to drive the water through the dam has been in terms of head. The intention is now to convert that force so it can be used in the formula $V=C\sqrt{RS}$.

The total head is composed of the entry head, the friction head, and the velocity head. By reducing the total head by the velocity head $\frac{(V^2)}{2g}$ and dividing this by eighteen times the mean distance through the dam for the depth of water we are considering, we obtain a slope which can be used in the $V=C\sqrt{RS}$ formula. However, the velocity head is so small that in this work it can be neglected.

The head used, though, to obtain this slope is not the full depth of the water, but is equal to one-half that depth.

For instance, if we were computing the velocity due to a 5-foot depth of water, we could not use a head of 5 feet, because all of that vertical section is not under a 5-foot head. The upper 1 foot is under a 1-foot head, the upper 2 feet are under a 2-foot head, etc. This is true when considering a vertical section equal to the depth of the water.

In order to determine what head to use for any given depth of water, I took 10 pipes of 1 foot diameter, considered one on top of the other horizontally, and computed the individual velocity in each pipe at its own individual head. The average velocity of all these pipes was equal to the velocity of the middle pipe. In other words, the quantity of water passed by these 10 pipes, lying horizontally and parallel one on top of each other, and the water standing 10 feet deep behind them was equal to the amount that would be discharged by all of them lying side by side at the same level and all under a head of 5 feet.

So far this argument has not touched on quantity but merely on the velocity through our typical openings.

Velocities were computed at water depths of 2 feet, 4 feet, 6 feet, 8 feet, etc.

For instance, when the water stood 8 feet deep in back of a dam, I would take the mean distance equals the actual distance through the dam·4 feet from the bottom and multiply that by 18. The head was half of 8, which divided by 18 times mean distance gave me my slope for the $V=C\sqrt{RS}$ formula.

Going back I figured that each 100 square feet contained 40 such openings of 1 square foot area each; therefore 1 square foot of vertical cross section would contain 0.4 of an opening at this ratio, which will equal 0.4 of a square foot.

We will take a 50-foot dam, with the water 28 feet deep behind it. Under these conditions the velocity per opening would be 2 feet per second.

Considering a section, then, 28 feet deep and 1 foot wide, the quantity would be $0.4\times2\times28=22.4$ cubic feet per second.

The 28 means 28 square feet of surface for the 1 foot wide and 28 feet deep; the 0.4 means 0.4 of an opening per square foot of face area, and the 2 means the velocity per opening over the whole vertical height when the water stands 28 feet deep behind a 50-foot dam.

If the dam averaged 20 feet wide at that depth the total quantity being discharged by the dam when the water was at the 28-foot level, would be $20\times22.4=448$ cubic feet per second.

The quantity discharged at any depth would be the amount per foot of width for that depth multiplied by the average width for that particular depth.

The discharges have to be figured differently for the different heights of dam, for water 10 feet deep behind a 50-foot dam will have to travel a greater distance than water 10 feet deep behind a 30-foot dam.

By computing the quantity discharged for any dam at any 2-foot interval, the data is obtained from which a discharge curve may be drawn which will give the quantity passing through dam at any desired depth of water.

A graph is submitted which enables one to take out direct the discharging capacities of various heights of these rock-fill dams per foot width of dam as deduced from the above analysis.

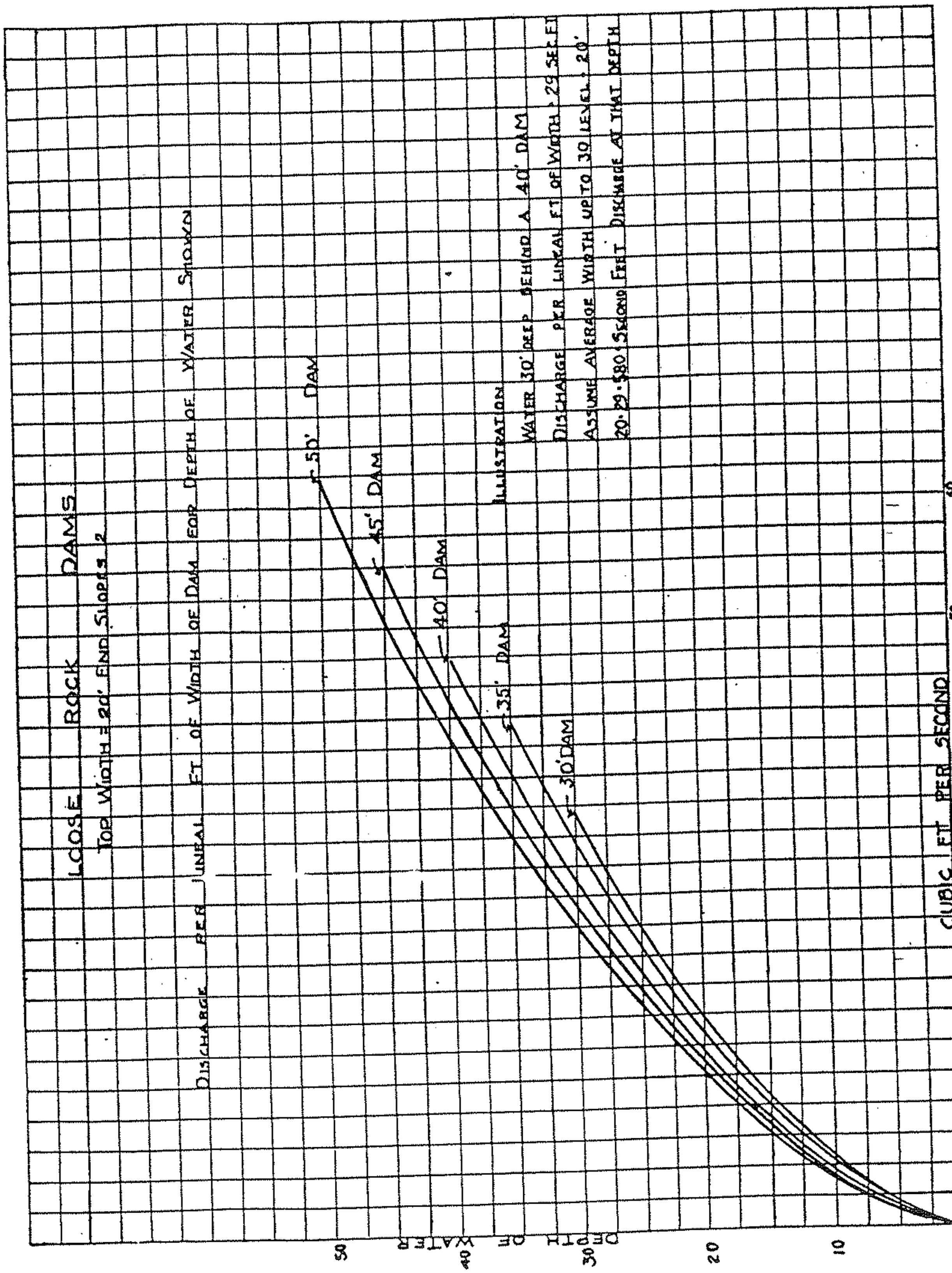
REDUCTION OF PEAK FLOWS AND EROSION BY THE USE OF CHECK DAMS.

It is the purpose of this analysis to show in what degree the probable maximum flood flow from Chase Creek[1] under present conditions might be reduced by introducing small check dams into the stream beds of its small feeders or tributaries. We use an assumed hourly rainfall record, the maximum hourly intensity of which we believe equals that of any rainfall which the Gila watershed has experienced within the historic period. The writer is justified in assuming such a rainfall, for there are no two storms which are exactly alike, and a storm is as likely to occur as our assumed record shows as in any other way. This rainfall record is shown on the diagram with the two calculative curves showing the rates of run-off, one for the condition of no-check dams and the other assuming the use of check dams.

A tracing was first made of Chase Creek drainage area (containing 28 square miles) which happens to be somewhat the size and shape of a large number of the minor tributaries of the Gila River. It also has the advantage of a definite relation to the actual topography accurately mapped, and has a known relation to the Gila River system.

On this tracing all the small contributing feeders of Chase Creek were outlined for their own separate consideration, for it must be remembered that each of these small feeders, even though very small, has its own peak flow, which bears the same relation to Chase Creek that Chase Creek does to the San Francisco and the San Francisco does to the Gila.

[1] Chase Creek was chosen as the area for these comparative analyses because there was considerable detail data at hand concerning the size and nature of its own watersheds, and also because Chase Creek is a feeder of the Gila River and might be considered typical of other feeders of the same size.


LOOSE ROCK DAMS
TOP WIDTH = 20' END SLOPES 2
DISCHARGE PER LINEAL FT OF WIDTH OF DAM FOR DEPTH OF WATER SHOWN
50' DAM
45' DAM
40' DAM
35' DAM
30' DAM
ILLUSTRATION
WATER 30' DEEP BEHIND A 40' DAM
DISCHARGE PER LINEAL FT OF WIDTH = 29 SEC FT
ASSUME AVERAGE WIDTH UP TO 30 LEVEL = 20'
20 · 29 = 580 SECOND FEET DISCHARGE AT THAT DEPTH
CUBIC FT PER SECOND
10
20
30
40
50
60
DEPTH OF WATER
10
20
30
40
50

From the United States topographical maps the elevations of the ridges and mouths of these small contributing areas were obtained, also the lengths of their longest feeders. In this way the average grade for a typical channel was obtained which could be used at any place over the Chase Creek watershed. This grade was necessary to calculate velocity upon which depended the gathering period for peak flows.

The grade of the typical channel being determined as outlined above, it was next necessary to know what would be the maximum contributing area to such a channel. From a detailed study on the ground of the ridge lines dividing the small watersheds and also the ridges dividing the Chase Creek watershed from the larger adjacent ones, it showed that the headings of rivulets or channels of an appreciable size occurred on an average of once every thousand feet of ridge line or oftener. Sketching in these rivulets or channels and dividing the areas of the small watersheds by the number of rivulets in each case, the average contributing area per rivulet for the total area of Chase Creek watershed was found to be approximately 30 acres per rivulet. These rivulets are thought to be large enough to be adaptable to the check dam treatment.

We now have a typical channel of V section with known grade and maximum contributing area taken at 30 acres. In calculating the run-off from given rates of rain, the constant ratio of run-off to rainfall was taken at 75 per cent. While this may be too large for the smaller rates of rain, it would also be small for the heavier rates of rain, especially in a country where the slopes are exceedingly steep and having a large percentage of bare rocks. It was therefore used as an average for all rates of rain. Inasmuch as this factor of 75 per cent was applied in both cases of no check dams as against check dams, whatever error might be present would be of a balancing nature and would not affect the relative comparisons in the two rates of run-off curves for Chase Creek for no check dams as against check dams.

Knowing the contributing area for our typical channel with the percentage of run-off taken at 75 per cent, and referring to our hourly rainfall chart, we can immediately calculate the run-off in second-feet. In calculating any run-off it always simplifies these calculations to remember that when the rate of rain is 1 inch per hour the run-off will be 1 cubic foot per second per acre, taking the run-off at 100 per cent. This of course represents all of the water delivered to the ground by the rain and is simply a basis to start from. For our calculations in this analysis we use an area of 30 acres (see above), take the run-off at 75 per cent, and refer to our rainfall chart for the rate of rain.

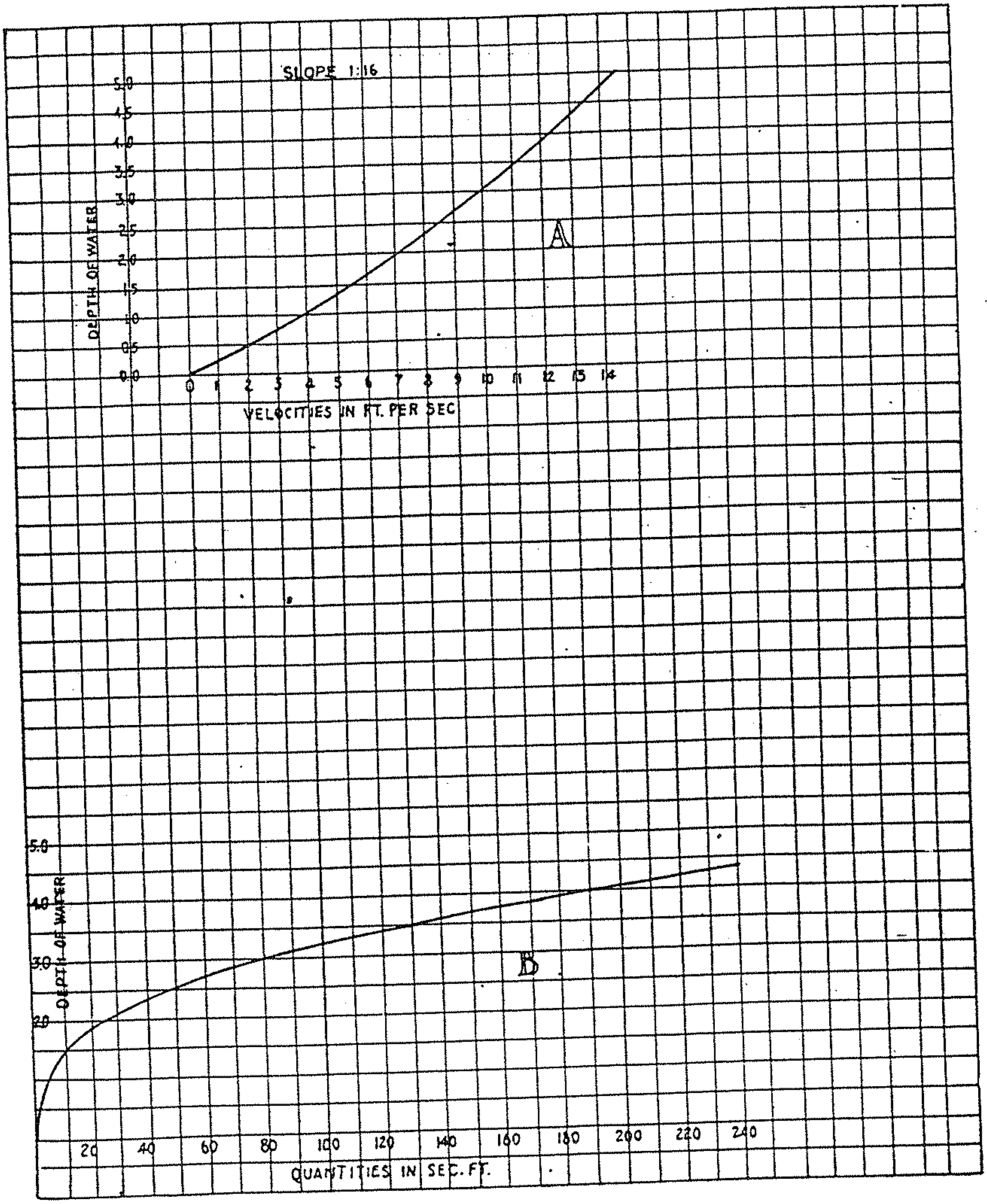
Knowing the quantity Q in second-feet that will run in our typical unchecked channel for the various rates of rain, and knowing the grade and cross section for the channel by Kutter's formula, we can determine what the velocity must be to give us the run-off or quantity Q which we know to be flowing.

In order to readily give us what these velocities were, two curves (A and B) were platted in this manner. The slope of our typical channel is 1 to 16. The cross section was taken as V-shaped with side slopes of 1 to 1. The water was assumed to vary from 3 inches to 3 feet deep. The hydraulic radius for each different depth was calculated and using Kutter's formula the velocity and quantity Q was obtained for the individual depths. Two curves were platted, one for depths of water in the channel and the corresponding quantity Q, and the other for depths of water and corresponding velocity. From the contributing area, percentage of run-off, and rate of rain the quantity Q can be determined. Referring to curve B with this quantity Q we find the depth of water. This same depth on curve A shows the velocity in the channel. In this way we establish the velocities in these small unchecked feeders for the various rates of rain. Dividing the length in feet of the longest tributary of the smaller watersheds by the velocity that would obtain for the various rates of rain, we determine the gathering periods for these smaller watersheds for these same various rates of rain.

By the gathering period we refer to the length of time that elapses after the beginning of rain, or change of rate of rain, until the whole of a watershed is contributing its run-off, and the condition or stage of full flood has been attained at the mouth of each of these small feeders. This moment constitutes the peak flow for that particular watershed. In this way we have established velocities and gathering periods for our assumed storm for the watershed unchecked.

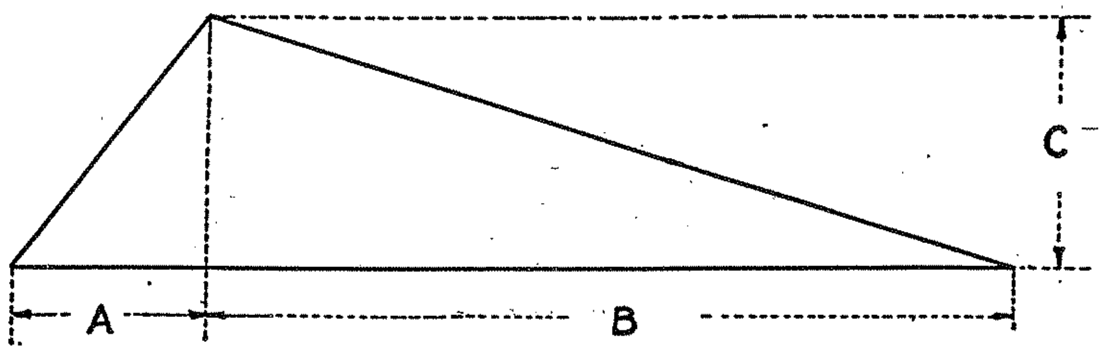
It was our object to compute what the maximum flow under these conditions would be at Clifton. The distances of the mouths of all these smaller watersheds from Clifton were obtained. A constantly increasing velocity was given the water from these smaller watersheds during its passage from the point of its entering into the main srteam called Chase Creek to Clifton.

While it is a fact that the slope of these stream beds while still within the mountainous territory is flattening out similar to the curve of a parobola, the hydraulic radius due to the flows coming in from the side feeders is increasing more rapidly than the decrease in slope. Hence the continually increasing velocities down the main channel. These velocities in these analyses were arbitrarily selected in the different reaches of the main channel and were based upon the study and observations of actual flood flows. These velocities increase from 5 feet per second in the upper tributaries to 20 feet per second at Clifton.


SLOPE 1:16
DEPTH OF WATER
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
VELOCITIES IN FT. PER SEC.
A
5.0
4.0
3.0
2.0
DEPTH OF WATER
B
20 40 60 80 100 120 140 160 180 200 220 240
QUANTITIES IN SEC. FT.

Having now a gathering period for the various rates of rain and a traveling velocity in the main channel, we are able to chart the lapse of time from the falling of the rain to the arrival at Clifton of the peak flows from each of these small watersheds. This chart with its corresponding run-off curve is shown on the diagram and was obtained in the following way: The storm was taken as being of a general nature and covering an area much larger than that of the Chase Creek watershed which is under consideration. Under these conditions the various rates of rain would obtain simultaneously over the Chase Creek watershed.

Small triangles were used to represent the flows from the small feeders. The altitude of the triangle representing the maximum rate of flow and the horizontal distance from the left end of the triangle to a vertical line passing through the peak or tip representing the gathering period to the maximum flow, and the remaining length of triangle representing the period of after-lag. The area of the triangle represents quantity in cubic feet of run-off per hour from any given feeder for any given hour's rain. The left end of each triangle was placed on the chart at a point which represents the time required for the water to pass down the main channel to Clifton from its point of entry into Chase Creek. Each individual feeder has a triangle for each individual hour's rain. The total of the vertical distances through these triangles on any given vertical line represents the rate of flow at Clifton at that particular moment.



EXPLANATION OF TRIANGLE.

The area of the triangle represents the quantity of water in cubic feet that would run off from any given feeder for any given hour's rain.

The distance A represents the length of time required after the beginning of rain or change of rate of rain for the maximum flow to arrive at mouth of small feeder.

The distance B represents the after-lag or the length of time after the peak flow has passed or the actual storm has passed out of small watershed.

The distance C represents the maximum rate of flow, depending upon the hourly rate of rain and contributing area.

The length of time A was accurately determined in each case (see elsewhere in report). Since the area of the triangle (quantity of run-off) is known, also the height C or maximum rate of run-off, these factors determine the length of time or distance B.

The length of time A is of course much shorter for any given rate of rain for a short feeder than for a long feeder.

All the foregoing is in reference to the storm and run-off as we would expect to find it when there are no check dams installed. We will now discuss this from the check-dam standpoint.

The definition of a check dam may be given as an artificial obstruction of stone or logs, or any combination of stone and logs which completely obstructs the bed of the stream. If the height of the front face of the check dam be made approximately three times the depth of the unobstructed stream, it will cause the sheet of water to fall nearly vertically over its face, thus traveling nearly at right angles to its former horizontal direction.

This means that at the face of each dam all motion in a forward direction is checked and has been translated into a vertical direction; and by these vertical drops the elevation of the watershed or the grade of the channel is being overcome step by step. The energy of its fall is dissipated on a rock cushion at the foot of the dam. In this manner of repeated checks and drops rain water falling on a watershed at any elevation above sea level (and to which level most of it must again ultimately return) may be stepped down in an orderly manner from one level to another below, finally reaching the flattened slopes of the lowlands.

The basic idea of the check dam is to greatly flatten the slopes of the channel which in its natural state is so steep as to cause rapid and destructive storm run-off. Inasmuch as large numbers of them are required for a channel, they must be constructed in such a manner and of such material as will reduce the unit cost to a minimum. For this reason they are usually made of bowlders and loose rock found within a short radius of the dam. The height of check dams vary from 4 to 8 feet, depending upon the condition of the side rock and bed rock as well as upon the grade of the channel.

There is no cement used in their construction, but the bowlders and flat stones are roughly fitted together and shingled one on top of another. The courses are pitched backward and downward and being somewhat locked together the whole forms a stable dam capable of resisting not only the flow of the water but the thrust of detritus which eventually collects behind them. The channels where they can be used to the best advantage are those which have a more or less V-shape section and those whose bottom widths do not exceed more than 15 to 20 feet and which have side slopes of 1 to 1 or 1½ to 1. This will throw them into a zone constituting approximately the upper two-thirds of the watershed. It also happens that this is where the precipitation is generally the heaviest and where the grades are the steepest. This combination of heavy precipitation and heavy grades tends to accelerate the bulk of the run-off into the region of lighter rains and lighter grades. It is by some such method as check dams that we hope to curb the floods at their point of origin. Flood prevention is the first step to flood control.

Generally speaking, the check dam should be located at narrow places where there is something of a basin above it, for the temporary storage of water though small is of some value; and later when this basin is filled with detritus it will constitute a sponge holding large quantities of moisture and encouraging the growth of trees and brush. The root system of this brush growth will in turn act as a binder for the soil of the stream bed. While it has been stated above that the basic principle of check dams is the flattening of the slopes, the reduced velocities in the small feeders used in the following part of this discussion were not calculated from the reduced slopes but were taken from data gathered by experimental work with actually constructed check dams. The experiments referred to are the Los Angeles experiments which were described above. A record of these experiments in the form of curves and descriptive data is on file in the surveyor's office of Los Angeles County.

We now refer back again to the velocities of the unchecked channels of Chase Creek. It has been shown that the gathering periods are directly dependent upon these velocities. Now, if by means of check dams the velocity of the run-off in the channels for any given rate of rain is, for example, cut in half, the length of the gathering period must be doubled, for it will take the run-off from the farthest end of the longest tributary just double the time to arrive at the mouth of the smaller watershed. In this analysis we found that by means of check dams the gathering periods for maximum run-off were increased from two to five and six times what they were for the unchecked channels, with corresponding reductions of peak flows.

In our chart showing the reduction of peak flow by means of check dams we represented the run-off from the individual feeders by triangles the same as we did for the unchecked channels. We also used the same general method for computing the peak flow at Clifton. The difference in the peak flow at Clifton for the two curves is due to the difference in the shapes of the triangles in the two charts. The difference in the shapes of the triangles is explained in this way. Assume if you will that the length of the base of any triangle picked at random from those representing the flow of an unchecked feeder is 3 inches, the altitude is 2 inches, and the area is 3 square inches. Now, by means of check dams the velocity in the channel of this feeder is reduced so that the gathering period and after-lag is, in this instance, doubled. Since the base of the triangle represents this period and in our first example is 3 inches long, in our second triangle it is doubled or is 6 inches long. The quantity Q of run-off must be practically the same in both cases of check dams and no-check dams (since we use the same rates of rain in both cases) and therefore the area of these triangles must be the same, or 3 square inches. A triangle with an area of 3 square inches and base of 6 inches must have an altitude of 1 inch. In our first triangle we had an altitude of 2 inches. We see in this way that our altitude has been decreased 50 per cent, and inasmuch as these altitudes represent the maximum peak flow, we are shown graphically how the peak flow in this instance was reduced 50 per cent. In this way the flow from each feeder was calculated and charted and the resulting flood flow at Clifton obtained. A comparison of the two curves shows that the application of check dams in the feeders reduced the maximum peak flow at Clifton by 28 per cent. This is the result that would obtain by a fairly uniform use of check dams over the whole watershed, without any attempt made of the desynchronization of the peak flows from the small feeders. This desynchronization is worthy of much serious study. When all the feeders of the small water-

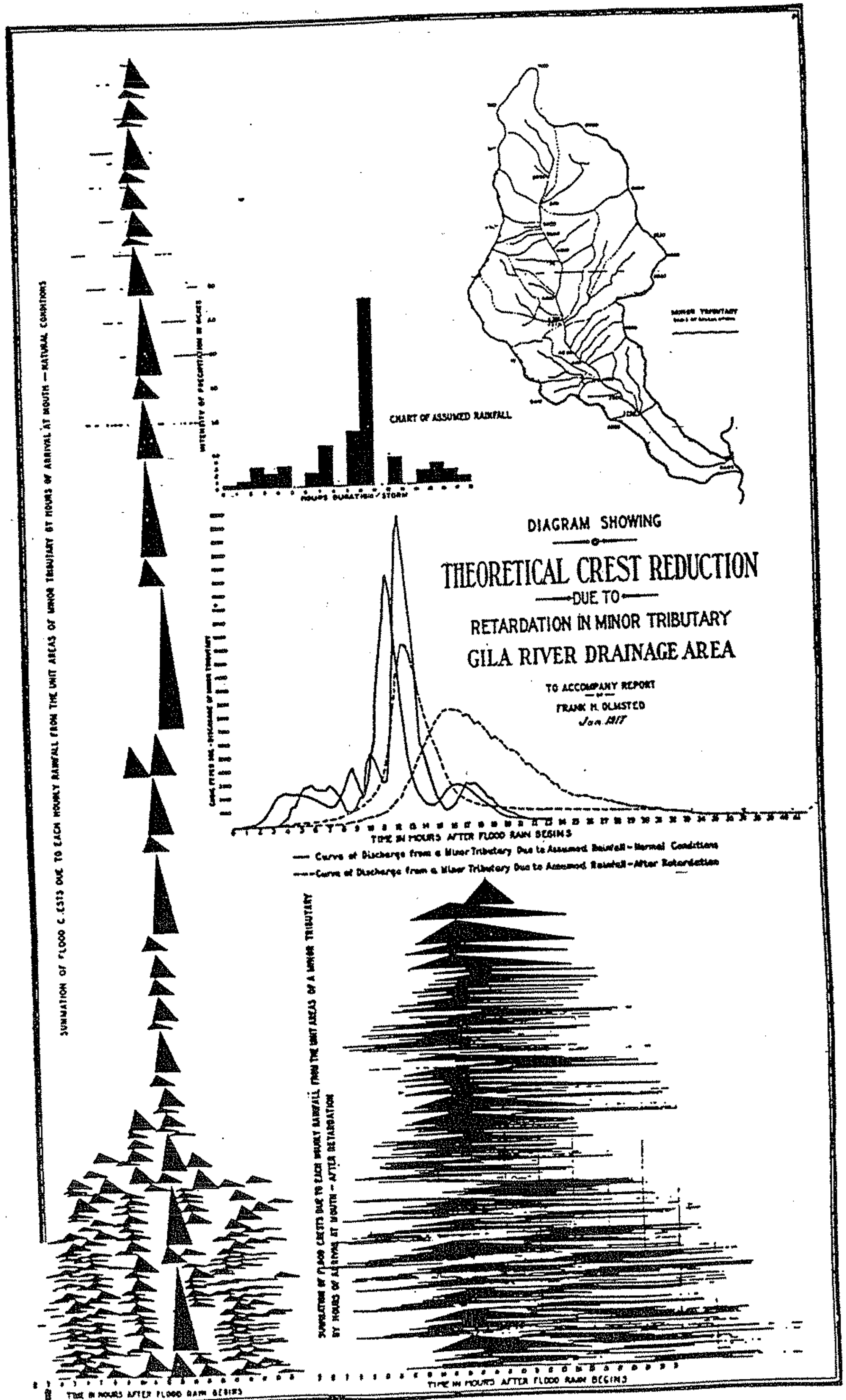
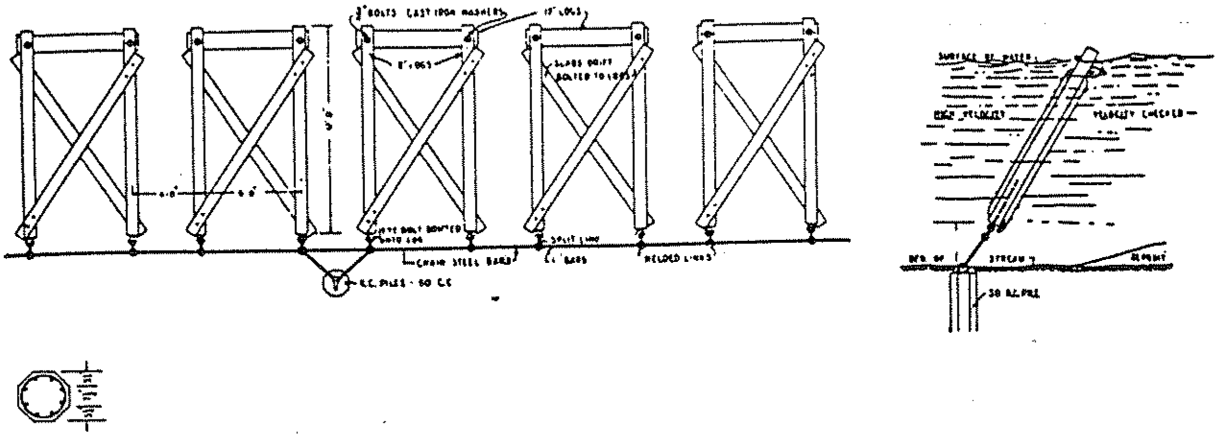
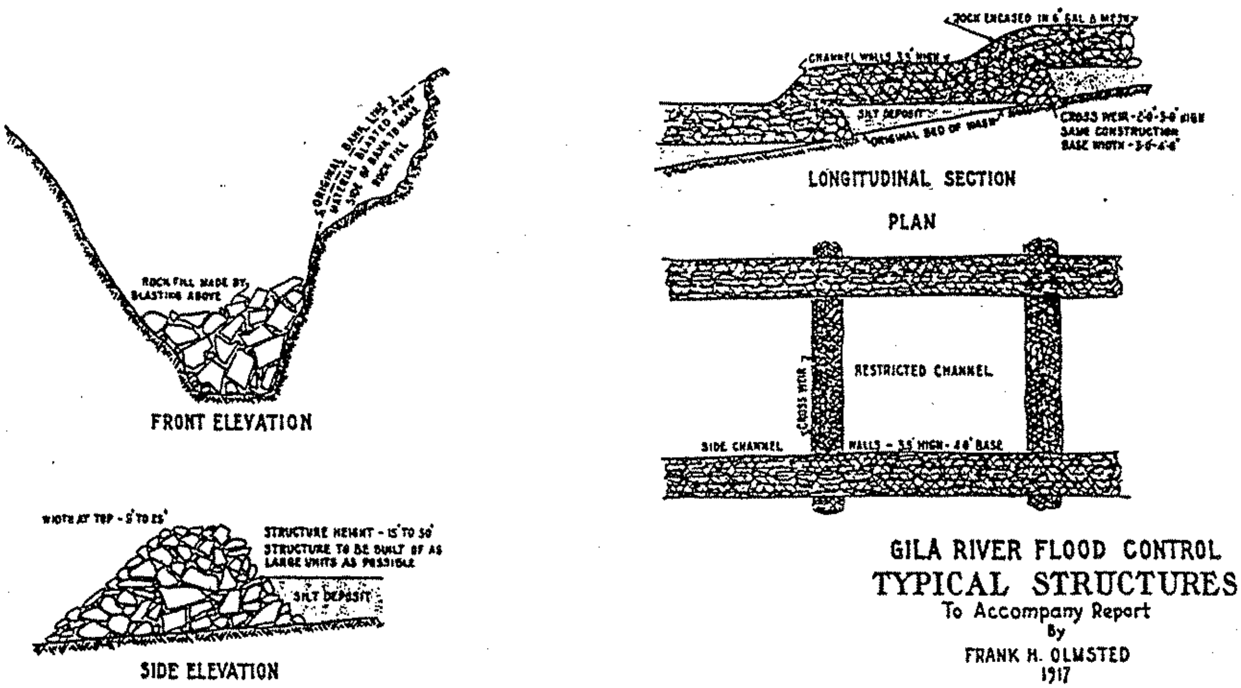


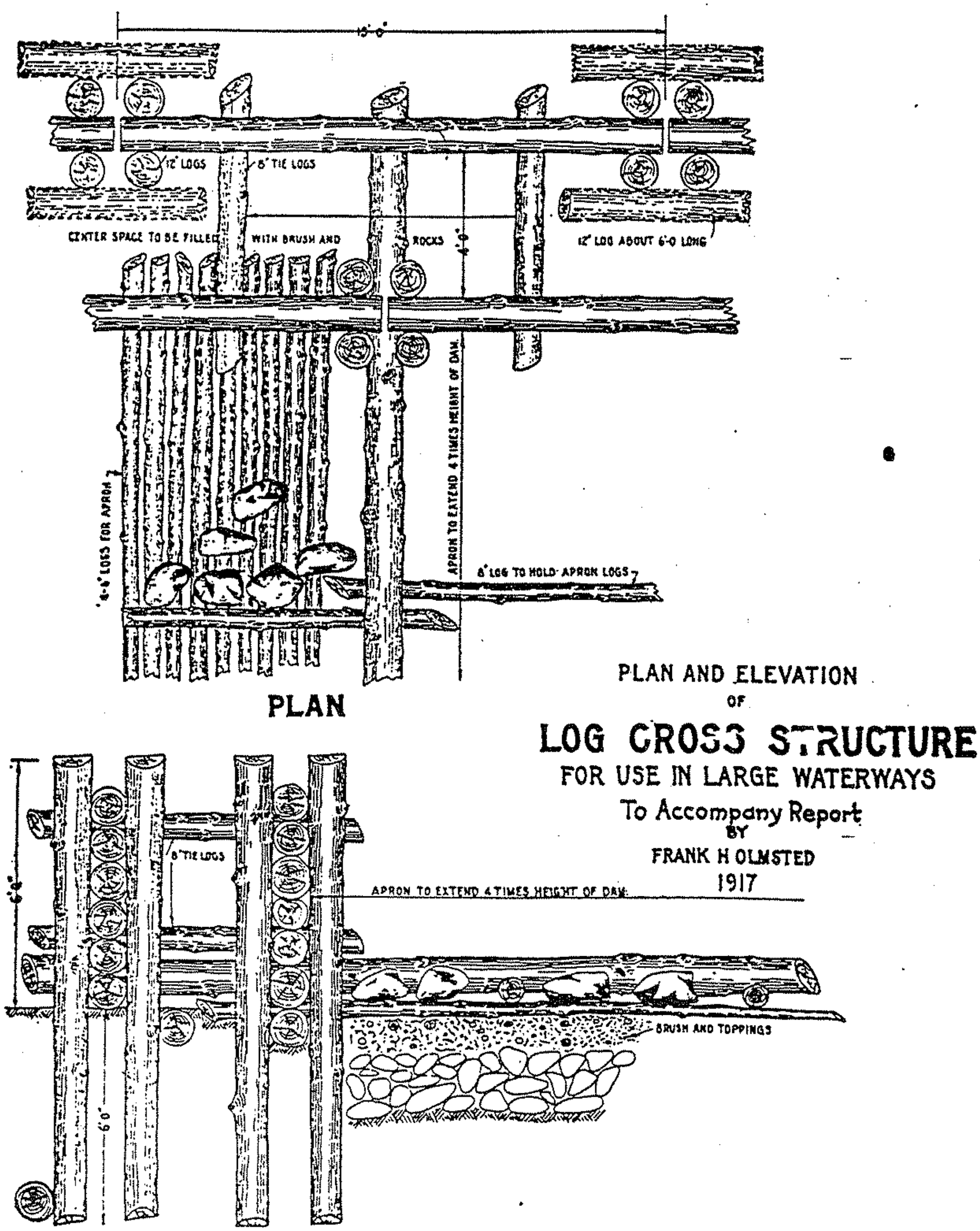
CHART OF ASSUMED RAINFALL
DIAGRAM SHOWING
THEORETICAL CREST REDUCTION
DUE TO
RETARDATION IN MINOR TRIBUTARY
GILA RIVER DRAINAGE AREA
TO ACCOMPANY REPORT
FRANK H. OLMSTED
Jan. 1917
TIME IN HOURS AFTER FLOOD RAIN BEGINS
Curve of Discharge from a Minor Tributary Due to Assumed Rainfall—Normal Conditions
Curve of Discharge from a Minor Tributary Due to Assumed Rainfall—After Retardation
TIME IN HOURS AFTER FLOOD RAIN BEGINS
TIME IN HOURS AFTER FLOOD RAIN BEGINS



A.


LONGITUDINAL SECTION
SILT DEPOSIT
ORIGINAL BED OF WASH
PLAN
RESTRICTED CHANNEL
CROSS WEIR
SIDE CHANNEL
FRONT ELEVATION
ROCK FILL MADE BY BLASTING ABOVE
STRUCTURE HEIGHT - 15' TO 50'
STRUCTURE TO BE BUILT OF AS LARGE UNITS AS POSSIBLE
SILT DEPOSIT
SIDE ELEVATION
GILA RIVER FLOOD CONTROL
TYPICAL STRUCTURES
To Accompany Report
By
FRANK H. OLMSTED
1917

B.



PLAN AND ELEVATION
OF
LOG CROSS STRUCTURE
FOR USE IN LARGE WATERWAYS
To Accompany Report
BY
FRANK H OLMSTED
1917

shed are uniformly checked, their peaks will be greatly flattened out, but will arrive at their individual mouths at relatively the same time. If, however, every alternate feeder is checked and the remainder left in their natural state, the effect is similar to having two separate watersheds with a common drainage line, for the unchecked channels would discharge their flows first, followed at a later period by the flows coming in from the checked channels. Partially checking one-third of the feeders, wholly checking one-third of them, and leaving the remaining third in their natural state, might prove the best combination for securing the greatest reduction of peak flows.

This analysis shows that the theory and application of the use of check dams in reducing maximum flood flows is entirely tenable. Both the theory and application are in their infancy; and if the application or use of check dams is accompanied and guided by a proper amount of study, we will soon see the development of a very valuable agent in flood prevention.

FORESTS.

The Gila watershed includes portions of Apache, Gila, Datil, Chiricahua, and Crook National Forests.

The woodland area within the Gila drainage limits is approximately as follows (the particular definition of the forested areas can better be seen from the forest map):

	Square miles.		Square miles.
Bear	34	Sapillo	103
Blue	270	San Francisco	1,278
Eagle	57	Tularosa	408
East Fork	562	Turkey	26
Mogollon	74	West and Middle Forks	266
Miscellaneous	135		

The total watershed has 2,535 square miles, or 1,622,400 acres in woodland. Approximately 58 per cent of this area carries commercial timber.

The study has included the woodland with the areas carrying yellow pine and other commercial timber for the reason that for run-off effects and for construction use in building retardation works the former is often as valuable as the latter.

No general valuation can be made of forest growth as a protection against erosion and rapid run-off. Nothing probably is better than a forest of conifers underlaid with a heavy mat of needles, but there are many pine forests which do not prevent run-off as well as certain woodland areas with good sod and brush accompaniments.

East, west, and north slopes generally carry heaviest woodland growth on account of the more humid conditions due to slower run-off. The checking system will in time materially increase the forest area and improve its character. On the San Francisco and Tularosa Mountains heaviest commercial timber is found on north facing sides on the Mogollon Mountains; the Alpine species are heaviest on the east and on the Black Mountains (Continental Divide) as the west slopes.

Taking the whole watershed into consideration and remembering the desert conditions which are present over most of the contiguous territory, the forest growth is surprisingly fine, and it is hoped under the wise administration of the Forest Service and the carrying out of some such program as here outlined the Gila watershed forest supplies may become a great national asset.

The Datil Forest as a whole with 1,853,317 acres has 1,359,261 acres of woodland including 941,033 acres timberland. The Gila National Forest as a whole has 1,599,530 acres with 1,249,128 acres woodland including 717,895 acres commercial timber. The San Francisco watershed comprises 1,852,800 acres, has 817,920 acres woodland including commercial timber and 381,700 acres timberland.

The rainfall data utilized herein has been largely taken from United States Bureau sources.

Rainfall tabulation.

[U. S. Weather Bureau.]

SAN CARLOS, GILA COUNTY, ARIZ.

[Elevation, 2,456 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1881						0.00	4.13	5.93	1.94	0.93	0.06	0.52	
1882	1.24	0.93	0.55	0.00	0.71	1.09	1.98	6.05	0.58	0.00	1.58	0.66	15.37
1883	1.60	2.07	0.71	0.00	0.53	0.00	2.48	1.11	0.11	1.13	0.00	2.47	12.21
1884	1.00	3.53	3.97	0.84	0.32	0.49	0.37	1.24	0.83	1.49	0.55	5.48	20.41
1885	0.05	1.39	1.28	0.03	0.22	0.47	1.25	1.22	0.34	0.34	0.70	0.90	8.19
1886	2.88	1.29	0.82	0.14	0.00	0.00	0.03	3.49	0.87	0.46	0.46	0.00	10.44
1887	T.	1.12	0.00	0.23	0.06	0.31	2.49	1.56	0.88	0.08		1.45	
1888	0.52	1.03	1.93	0.00	0.10	0.00	2.10	0.40	0.63	1.73	1.76	2.84	13.04
1889	1.62	1.33	2.15	0.25	0.00	T.	1.83	0.87	2.05	0.60	0.40	2.30	13.40
1890	2.11	1.66	1.03	1.31	0.00	T.	2.29	3.41	0.77	1.32	2.15	2.57	18.62
1891	0.96	5.55	0.51	0.00	1.04	0.06	0.57	1.00	0.75	0.00	0.00	1.44	11.88
1892	1.80	3.51	1.22	1.03	0.08	0.00	1.30	1.90	0.00	0.65	0.34	0.22	12.05
1893	0.50	0.55	2.96	0.00	0.67	0.00	0.80	3.78	2.56	0.00	0.34	0.37	12.53
1894	0.63	1.37	1.14	0.11	0.31	0.00	0.81	2.06	0.09	1.05	0.00	2.58	10.15
1895	2.16	0.45	0.18	0.00	0.04	0.05	0.32	2.39	1.94	3.01	3.42	0.45	14.41
1896	0.43	0.04	0.50	T.	0.00	T.	3.78	0.88	2.67	4.56	0.67	0.35	13.88
1897	2.77	0.71	0.77	0.00	0.30	0.03	0.66	1.20	0.52	0.35	0.00	0.59	7.90
1898	1.85	0.00	0.00	0.60	0.00	0.20	2.65	1.41	0.00	0.00	0.25	0.80	7.79
1899	1.80	0.00	0.05	0.00	0.00	0.90	1.65	0.35	0.62	0.35	0.30	0.15	6.17
1900	0.15	0.40	0.85	0.87	T.	0.00	0.32				2.86	0.00	
1901	2.05	2.74	0.78	0.11	0.37	0.00	3.24	1.46	1.93	0.95	0.20	0.00	13.83
1902	0.80	0.20	0.23	0.00	0.60	T.							
1903						0.46	1.09	1.32	2.44	0.00	0.00	0.20	
1904	0.25	0.43	0.16	T.	0.35	T.	1.31	2.36	0.21	0.14	0.00	1.44	6.65
1905	3.46	5.03	3.30	3.34	0.08	0.25	0.53	0.56	1.85	0.01	4.04	0.98	25.43
1906	0.88	0.79	2.33	0.63	0.12	0.00	2.01	5.04	0.20	0.12	0.75	3.92	16.79
1907	2.00	0.24	1.07	0.70	1.58	0.06	0.56	9.80	T.	3.60	0.63	0.04	20.28
1908	0.84	3.55	0.73	0.57	0.12	0.19	2.94		0.55	0.30	0.31	3.01	
1909	1.55	1.64	2.23	T.	0.00	0.00	1.23	1.95	1.04	0.00	0.18	0.88	10.70
1910	1.06	0.06	0.43	0.09	T.	0.07		1.92	T.	0.95	1.82	0.41	
1911	2.42	1.38	1.47	0.35	0.00	0.49	2.99						
Total	50.21	43.29	33.35	11.20	7.60	5.12	47.71	66.66	26.37	24.12	23.77	37.02	302.12
Mean	1.73	1.49	1.15	0.39	0.26	0.17	1.65	2.47	0.94	0.86	0.85	1.28	13.14

CLIFTON, GREENLEE COUNTY, ARIZ.

[Elevation, 3,584 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1889									1.71	1.22	0.66	0.55	
1890	1.23	0.21	0.48	0.47	0.18	0.00	2.56	4.93	2.04	1.80	0.53	1.51	15.94
1891	1.10	3.50	0.30	0.00	1.60	0.00	0.55	1.40	1.15	0.00	0.00	1.30	10.90
1892		1.16	1.06	0.00		0.00	0.82	2.10	0.23	1.18	T.	0.30	
1893	1.14	0.58	0.80	0.00	1.80	0.00	3.93	2.47	1.26		T.	0.27	
1894	0.15	1.53	0.67		[illegible]	0.00	0.82			0.79	0.00	1.16	
1895	2.04	0.80	0.14		0.71	0.22	3.44	2.64	3.31	0.70	1.60	0.61	
1896	0.31	0.45	0.00	0.00	0.00	1.18	2.26	2.21	1.52	4.30	0.34	0.42	12.99
1897	1.58	0.17		0.36	0.13	0.24	2.07	1.65	3.66	0.83	0.00	0.33	
1898	1.45	0.00	0.98	1.52	0.06	2.60	2.38	2.15	1.79	0.00	1.08	2.13	16.14
1899	0.40	0.18	0.38	0.16	0.00	0.72	4.51	0.80	0.72	0.41	0.80	0.29	9.37
1900	0.32	0.58	1.10	0.75	0.00	0.10	0.34	1.49	5.36	0.64	0.62	0.00	11.30
1901	1.64	1.79	0.96	0.13	0.55	0.00	1.54	1.00	1.08	1.51	0.80	0.00	11.00
1902	0.52	0.59	0.07	0.00	0.47	0.44	0.89	1.86	2.00	0.04	1.36	2.22	10.46
1903	0.09	0.48	1.05	0.10	0.20	2.40	0.99	6.20	3.17	0.00	0.00	0.21	14.89
1904	0.12	0.11	0.13	0.00	0.73	0.05	0.70	2.75	0.52	1.17	0.00	2.45	8.73
1905	3.61	6.22	6.07	2.35	T.	0.27	1.25	2.00					
1906		2.21	1.38	0.35	T.	0.00	1.11	4.64	0.32	0.05	1.72	5.95	
1907	2.65	0.80	0.09	0.94	1.20	0.26	0.75	3.18	0.94	3.33	1.14	0.03	15.31
1908	1.44	3.46	0.94	0.53	0.14						0.24	1.62	
1909	0.50	1.26	1.60	0.00	T.	T.	1.77	2.37	0.66	0.00	0.02	0.71	8.89
1910	0.60	T.	0.04	0.51	0.01	0.28	2.22	2.65	0.25	0.26	1.52	0.33	8.67
1911	1.60	1.52	0.95	0.66	0.12	1.03	4.19	0.29	1.08	3.47	0.00	0.23	15.14
1912	0.34	0.38	2.98	0.24	T.	0.63	5.21	1.10	T.	0.90	0.00	0.35	12.13
1913	0.93	2.35	0.32	0.29	T.	T.	3.63	3.57	0.62	0.10	2.12	1.38	15.31
1914	0.13	0.78	0.48	0.00	0.90	0.87	5.78	2.99	2.20	2.99	1.29	3.45	21.38
1915	1.58	1.64	1.20	0.65	0.00	T.	3.73	1.95	1.63	0.00	0.84	2.02	15.24
Total	25.47	32.75	24.14	10.01	9.12	11.29	57.44	58.39	37.22	24.62	16.58	29.82	234.24
Mean	1.06	1.26	0.97	0.42	0.36	0.45	2.30	2.43	1.55	1.03	0.64	1.15	13.01

CLIFF, GRANT COUNTY, N. MEX.

[Elevation, 4,470 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1894						T.	1.15	1.93	0.23	1.44	0.00	1.53	
1895	2.14	0.64	0.21	T.	0.38	T.	1.62	3.14	1.10	0.57	2.19	0.42	12.41
1896	0.14	0.31	0.33	0.01	0.17	1.33	3.93	3.39	2.18	5.27	0.44	0.37	17.87
1897	2.11	0.26	0.87	T.	0.07	0.15	1.73	2.42	5.26	1.38	T.	0.19	14.44
1898	1.83	0.08	1.58	1.04	0.22	1.39	3.18	2.48	1.16	T.	0.74	1.52	15.22
1899	1.03	0.54	0.21	0.18	T.	1.04	5.15	1.26	1.17	1.00	0.46	0.56	12.60
1900	0.41	0.72	1.33	0.81	T.	T.	2.14	1.10	5.55	1.22	1.40	0.30	14.98
1901	1.38	2.19											
1905					0.10	0.15	2.70	2.45	2.40	0.20	4.29	1.38	
1906	0.34	1.53	0.95	0.25	0.05	0.00	1.41	3.00	0.64	0.00	1.01	4.86	14.04
1907	2.51	0.65	0.08	0.81	0.78	0.48	3.41	2.86	1.73	2.31	0.67	0.00	16.29
1908	0.65	1.66	0.23	0.11	0.36	0.00	2.36	4.72	0.92	0.00	0.72	1.14	12.87

Rainfall tabulation—Continued.

CLIFF, GRANT COUNTY, N. MEX.—Continued.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1909	0.00	1.00	1.22	0.00	0.00	T.	2.13	2.32	1.82	0.33	0.20	0.50	9.52
1910	0.32	0.00	0.00	0.84	0.15	1.10	2.47	2.27	0.87	0.41	0.20	0.35	8.98
1912	......	......	......	......	0.05	1.20	5.38	1.50	0.10	1.58	0.00	2.05	......
1913	0.73	0.87	0.34	0.43	0.22	0.39	1.99	1.72	0.95	1.17	3.40	1.95	14.16
Total	13.59	10.45	7.35	4.48	2.55	7.23	40.75	36.56	26.08	16.88	15.72	17.12	163.38
Mean	1.05	0.80	0.61	0.37	0.18	0.48	2.72	2.44	1.74	1.13	1.05	1.14	13.62

ALMA, SOCORRO COUNTY, N. MEX.

[Elevation, 5,500 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1894	0.44	0.77	0.77	T.	0.32	0.00	1.42	2.71	0.53	2.01	0.00	1.24	10.21
1895	1.21	0.33	0.26	0.04	0.49	0.51	3.25	2.03	3.27	1.99	2.65	0.48	16.51
1896	0.21	T.	0.14	0.03	T.	0.30	1.70	4.88	1.24	5.97	0.27	0.35	15.09
1897	2.33	0.47	0.57	0.15	0.11	0.72	3.04	2.16	4.15	1.95	T.	0.38	16.03
1898	2.24	0.27	0.83	1.40	0.04	0.25	4.00	3.54	1.53	0.60	1.05	1.51	17.26
1899	0.36	0.11	0.58	0.31	T.	1.76	5.24	1.75	1.10	0.69	0.70	0.41	12.91
1900	0.29	0.50	0.81	1.81	0.03	T.	1.12	1.53	2.72	1.00	1.24	0.91	11.96
1901	1.46	1.02	0.92	0.10	1.75	0.00	4.87	2.03	1.75	1.68	0.68	0.13	16.39
1902	0.62	0.65	0.38	T.	0.80	......	......	......	......	......	......	1.61	......
1903	0.01	0.30	0.29	T.	0.25	1.21	1.46	2.72	2.91	0.00	0.00	0.10	9.25
1904	......	......	......	......	......	......	1.00	2.96	0.75	3.18	0.24	1.50	......
1905	1.44	6.05	5.35	2.40	0.00	0.40	1.85	2.80	2.70	0.45	5.80	0.85	30.09
1906	0.10	1.00	1.10	0.69	0.19	0.00	1.70	......	......	......	......	......	......
1910	0.93	T.	0.10	0.86	0.30	0.09	1.65	1.95	1.20	0.55	2.01	0.35	9.99
1911	2.23	1.96	1.13	0.42	0.40	1.44	3.50	1.99	2.65	2.72	0.00	0.98	19.42
1912	0.00	0.10	3.76	0.48	0.08	2.69	3.55	2.39	0.43	2.36	0.00	0.98	16.82
1913	0.65	1.87	0.66	T.	0.06	0.42	2.20	3.46	1.33	1.26	3.03	0.40	15.34
1914	0.02	0.67	0.83	T.	0.24	1.93	3.33	3.47	0.42	3.77	1.89	3.43	20.00
1915	1.45	1.60	0.90	1.68	0.20	0.30	5.27	1.71	1.83	0.37	0.85	1.65	17.85
Total	15.89	17.67	19.38	10.37	5.26	12.62	50.15	44.08	30.51	29.95	20.41	17.26	255.08
Mean	0.88	0.98	1.08	0.58	0.29	0.74	2.78	2.59	1.79	1.76	1.20	0.96	15.94

REDROCK, GRANT COUNTY, N. MEX.

[Elevation, 4,150 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1905	1.48	2.68	3.98	3.04	0.03	0.40	2.88	2.65	1.49	0.13	3.47	1.46	23.69
1906	0.38	0.83	0.62	0.21	0.11	T.	3.07	2.08	0.42	0.29	0.98	3.67	12.66
1907	1.79	0.45	0.03	0.28	0.30	0.10	0.88	5.37	0.38	1.70	1.45	0.00	12.73
1908	1.00	1.10	0.10	0.20	0.10	0.00	2.36	1.47	0.00	0.00	0.19	0.67	7.19
1909	0.46	1.38	1.05	0.00	0.00	0.05	3.37	3.97	1.52	0.07	0.10	0.62	12.59
1910	0.36	0.00	0.00	0.72	0.11	0.16	4.34	0.84	0.00	0.27	0.99	0.17	7.96
1911	1.63	1.33	0.61	0.00	0.34	1.09	3.00	1.71	3.05	1.94	0.00	0.91	15.61
1912	0.08	0.87	2.40	T.	0.00	0.36	3.51	2.47	T.	1.07	T.	0.98	11.74
1913	0.69	2.73	0.35	0.26	0.12	0.23	0.81	1.26	1.23	0.36	3.02	1.01	12.07
1914	0.23	0.63	0.15	0.00	1.17	0.95	4.34	2.27	0.36	2.83	0.65	3.12	16.70
1915	1.22	1.58	1.07	1.87	T.	0.00	6.02	1.29	0.72	0.09	0.52	1.02	15.40
Total	9.32	13.58	10.36	6.58	2.28	3.38	34.58	25.38	9.17	8.75	11.37	13.63	148.34
Mean	0.85	1.23	0.94	0.60	0.21	0.30	3.14	2.31	0.83	0.80	1.03	1.24	13.48

FORT BAYARD, GRANT COUNTY, N. MEX.

[Elevation, 6,152 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1867	0.71	1.25	0.67	0.20	T.	0.00	4.45	2.19	1.60	0.75	0.55	1.50	13.87
1868	1.35	0.50	0.58	0.43	0.90	0.00	4.81	2.52	2.66	0.05	0.35	1.08	15.23
1869	0.60	0.44	0.53	0.19	0.00	3.74	0.87	4.17	0.03	0.76	0.57	0.94	12.84
1870	0.38	0.32	0.33	0.02	0.00	1.10	2.96	3.57	0.73	0.01	0.00	0.65	10.07
1871	0.64	0.05	0.10	0.10	0.00	0.05	0.09	0.19	2.27	0.75	1.30	0.25	5.79
1872	0.85	0.72	0.27	0.66	0.11	1.26	2.85	3.37	1.25	0.15	0.04	2.08	13.61
1873	0.48	1.91	0.87	0.04	0.29	1.10	3.02	1.73	1.30	0.00	0.70	0.74	12.18
1874	1.79	5.68	1.72	2.32	0.90	0.30	2.09	2.38	0.83	1.00	0.65	0.72	20.38
1875	0.75	1.55	0.80	0.02	T.	0.04	7.22	2.08	5.90	T.	0.00	1.30	19.66
1876	0.98	0.08	0.24	T.	0.40	2.44	2.88	3.16	3.24	4.17	1.13	0.22	18.94
1877	0.38	3.54	0.29	0.60	0.47	0.00	2.84	1.71	0.97	0.61	0.17	1.54	13.12
1878	0.03	0.71	1.05	......	......	0.05	3.92	7.70	0.27	0.00	3.81	0.77	......
1879	2.78	1.12	0.32	0.01	0.00	0.08	1.37	3.85	2.41	1.06	0.28	0.49	13.77
1880	0.79	0.85	0.53	0.30	0.00	0.99	3.05	3.51	3.57	1.66	0.00	1.65	16.90
1881	0.02	0.73	0.91	0.48	1.01	0.43	9.62	8.69	3.89	3.21	1.55	0.28	30.82
1882	1.83	2.06	1.17	0.08	1.37	1.92	1.84	6.00	1.05	0.00	1.37	0.58	19.27
1883	1.68	0.63	1.57	......	......	......	4.69	7.67	1.06	......	......	......	......
1886	1.05	1.07	0.18	......	0.02	1.16	1.16	1.90	2.93	1.60	......	0.00	......
1887	0.08	1.51	0.90	0.01	0.06	0.25	1.57	3.64	4.30	0.55	0.00	0.27	12.24
1888	0.15	0.29	0.90	0.35	0.10	0.20	4.79	0.27	0.30	3.00	2.05	1.02	13.42
1889	0.50	0.41	0.18	T.	0.13	0.90	0.91	0.70	2.19	0.67	0.62	T.	7.21
1890	1.40	T.	0.11	T.	0.00	T.	4.17	3.86	2.17	0.52	2.56	1.07	15.86
1891	0.87	1.03	0.36	0.00	1.55	0.35	1.00	1.82	1.49	0.07	0.06	1.70	10.30
1892	0.91	0.87	1.48	0.30	0.00	0.10	2.27	1.27	0.13	0.47	0.39	0.61	8.80
1893	0.85	0.14	0.35	0.00	1.50	T.	3.76	4.90	3.88	0.00	0.09	T.	15.47
1894	0.00	1.04	0.05	0.00	0.00	0.00	1.99	3.29	0.10	1.40	0.00	0.80	8.67
1895	1.25	0.80	0.08	0.00	0.80	0.33	6.25	2.09	0.85	0.40	1.40	0.20	14.45
1896	0.25	0.10	T.	T.	0.10	0.20	7.25	2.35	2.35	6.15	T.	0.10	18.85

Rainfall tabulation—Continued.

FORT BAYARD, GRANT COUNTY, N. MEX.—Continued.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1897	1.10	0.20	1.05	0.10	T.	0.60	3.38	5.31	4.11	1.90	0.00	0.25	18.00
1898	1.25	0.00	0.96	0.57	0.00	2.37	6.56	2.45	1.05	0.00	0.30	0.70	16.21
1899	0.30	0.20	0.30	0.23	T.	1.33	4.66	1.30	1.23	0.90	0.33	T.	10.78
1900	0.15	0.58	1.55	0.41	0.17	0.01	2.49	1.35	4.40	0.49	0.85	0.16	12.61
1901	0.41	0.65	0.60	0.25	T.	T.	2.10	0.90	1.00	2.57	0.46	T.	8.94
1902	0.15	0.35	0.04	0.00	0.31	0.53	0.91	7.13	2.16	0.26	0.83	3.00	15.67
1903	0.78	0.52	1.27	0.16	0.17	1.75	0.45	3.87	3.36	T.	0.00	T.	12.33
1904	0.16	0.09	0.32	0.00	0.26	0.18	1.76	4.42	2.81	8.18	0.31	2.13	20.62
1905	3.07	4.26	4.33	2.93	0.07	0.75	3.84	2.33	4.07	0.35	3.66	1.51	31.17
1906	0.41	1.63	0.85	0.79	0.08	T.	2.68	4.84	0.86	0.23	1.93	4.18	18.48
1907	3.35	0.30	0.15	0.80	1.07	0.88	1.34	4.15	1.69	1.12	0.87	0.00	15.72
1908	1.94	2.05	0.37	0.74	0.51	0.14	2.38	2.85	0.81	0.00	0.21	0.52	12.52
1909	0.33	0.86	1.05	0.00	0.00	0.94	2.05	3.65	1.55	0.03	0.07	0.90	11.43
1910	0.64	T.	T.	0.55	0.32	2.40	1.45	0.90	0.35	0.43	0.95	0.30	8.29
1911	1.55	1.29	1.70	0.40	T.	2.20	4.59	2.02	2.94	3.31	T.	0.63	20.63
1912	0.19	0.85	2.81	0.15	0.02	1.80	2.42	4.47	1.17	1.04	0.01	0.73	15.66
1913	0.72	2.37	0.27	0.23	0.47	0.51	2.20	3.28	1.18	0.34	2.95	1.15	15.67
1914	0.42	0.49	0.83	0.01	0.64	1.03	7.40	3.54	1.02	3.40	1.05	4.57	24.40
1915	1.74	2.49	1.91	1.40	T.	T.	3.88	3.62	3.08	0.09	0.16	2.00	20.37
Mean	0.89	1.03	0.79	0.34	0.31	0.75	3.17	3.25	1.97	1.17	0.77	0.94	15.26

LORDSBURG, GRANT COUNTY, N. MEX.

[Elevation, 4,245 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1881	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.49	0.43	.....
1882	0.95	0.35	0.38	0.00	0.59	0.63	1.32	3.12	0.00	0.00	1.20	0.20	8.74
1883	0.33	0.37	0.00	0.00	0.00	0.00	1.00	3.45	0.11	0.56	0.40	0.20	6.42
1884	0.80	0.13	1.20	0.20	T.	0.00	2.20	1.30	2.35	2.55	0.00	1.46	12.19
1885	0.00	0.20	0.40	T.	0.40	0.39	0.75	0.35	0.05	0.20	0.55	0.70	3.99
1886	0.00	0.33	0.00	0.00	0.00	0.00	1.54	1.65	1.17	0.17	0.20	0.00	5.06
1887	0.00	0.12	0.00	0.00	0.10	0.30	3.17	2.67	1.31	0.00	0.32	0.70	8.69
1888	0.44	0.10	0.88	0.00	0.00	0.28	2.97	0.84	0.76	2.14	1.50	0.92	10.83
1889	4.07	0.45	0.10	0.20	0.00	0.25	1.70	1.28	1.76	0.41	0.02	0.10	10.34
1890	0.92	0.05	0.00	0.13	0.00	1.43	3.11	3.69	1.90	0.28	0.60	1.86	13.95
1891	0.10	1.52	0.65	0.00	1.01	0.00	0.00	1.10	0.88	0.00	0.00	0.40	5.66
1892	0.50	1.01	0.92	0.71	0.00	0.00	0.05	0.20	0.05	0.69	0.00	0.00	4.13
1893	T.	0.90	1.00	0.00	1.96	T.	0.90	2.38	2.15	0.00	0.00	0.05	9.32
1894	0.70	0.66	0.20	0.00	0.00	0.00	0.89	4.30	0.10	0.90	0.00	T.	7.59
1895	0.20	0.00	T.	0.00	0.45	0.40	1.22	0.45	0.84	0.40	1.38	0.10	5.44
1896	T.	T.	0.48	0.00	0.20	0.30	1.91	2.34	1.51	6.46	0.20	0.15	13.55
1897	1.21	0.20	0.12	0.00	0.05	0.12	3.95	1.25	4.50	1.75	0.00	0.18	13.33
1898	1.00	0.00	0.75	0.16	0.00	0.33	2.30	0.17	0.16	0.00	0.60	0.66	6.13
1899	0.33	0.08	0.18	0.04	0.00	0.70	2.62	0.50	1.18	0.00	0.10	T.	5.73
1900	0.24	0.10	1.25	0.49	0.00	0.00	0.38	1.25	2.71	0.12	0.45	0.00	6.99
1901	0.40	0.50	0.20	0.13	T.	0.00	2.30	0.95	0.00	2.17	0.76	T.	7.41
1902	T.	0.10	T.	0.00	0.00	0.20	0.85	2.55	0.40	0.13	0.52	1.12	5.87
1903	0.00	T.	0.90	0.00	0.27	0.58	0.45	0.70	0.93	0.00	0.00	0.21	4.04
1904	0.14	0.16	0.23	0.00	0.04	0.38	1.09	1.12	3.09	0.69	0.55	1.21	8.70
1905	1.57	3.25	3.24	1.27	0.12	0.56	2.10	0.92	2.59	0.32	2.93	0.53	19.50
1906	0.15	1.07	0.07	0.07	T.	0.00	1.67	1.80	0.02	0.00	1.31	3.42	9.58
1907	2.52	0.51	0.00	0.27	0.60	T.	2.20	4.05	T.	1.20	0.80	0.00	12.15
1908	1.75	0.71	0.34	0.68	0.20	0.00	1.61	0.97	0.65	1.10	0.35	1.30	8.66
1909	T.	0.20	1.30	0.00	0.00	0.05	4.22	2.36	0.95	0.70	0.00	0.40	10.18
1910	0.48	0.00	0.00	0.02	0.42	0.60	2.09	0.87	T.	0.00	0.26	0.02	4.95
1911	0.64	0.95	0.28	0.83	0.00	1.31	2.46	0.50	0.58	1.60	0.00	2.60	11.73
1912	T.	1.15	2.14	0.07	0.06	0.51	4.19	2.14	0.00	1.07	0.18	2.64	14.15
1913	1.00	2.43	0.51	0.35	T.	0.28	0.43	0.38	1.70	0.30	3.89	0.42	11.69
1914	0.88	0.62	0.45	0.00	1.17	0.93	2.63	4.06	1.00	2.81	0.69	4.46	19.70
1915	1.08	0.87	1.75	0.80	0.00	0.00	2.93	1.60	0.24	0.00	0.00	1.64	10.91
Total.	22.40	19.09	19.90	6.42	7.64	10.53	63.20	51.24	35.64	28.70	20.25	28.08	316.76
Mean.	0.65	0.56	0.59	0.19	0.22	0.31	1.86	1.68	1.04	0.84	0.58	0.80	9.32

BOWIE, COCHISE COUNTY, ARIZ.

[Elevation, 3,756 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1867	.....	.....	.....	.....	.....	.....	.....	2.67	1.70	T.	0.50	1.64	.....
1868	2.39	1.10	0.00	0.70	0.50	0.00	7.15	2.40	3.15	T.	0.70	0.00	18.09
1869	0.10	3.50	0.39	0.15	0.00	0.40	1.30	5.60	0.20	T.	1.45	0.15	13.24
1870	0.30	0.69	0.50	T.	0.00	0.60	4.50	5.42	1.00	0.00	T.	1.00	14.01
1871	0.50	.....	.....	.....	0.15	0.60	7.90	2.30	1.00	0.70	0.90	.....	.....
1872	.....	.....	0.00	0.25	0.20	1.04	1.67	3.36	0.77	T.	0.15	2.95	.....
1873	0.00	1.16	2.22	T.	1.09	0.14	0.50	1.34	0.01	0.03	1.12	2.02	9.63
1874	2.33	5.40	1.50	0.35	0.00	T.	2.66	3.12	0.06	1.40	1.45	0.46	18.73
1875	1.35	1.20	0.13	0.13	T.	0.65	4.22	1.77	3.19	0.00	0.25	0.83	13.72
1876	0.60	0.45	0.48	T.	T.	2.05	4.55	4.00	1.95	0.73	0.40	0.00	15.21
1877	0.14	2.70	0.12	0.14	0.90	0.00	1.24	0.18	0.16	0.00	0.00	2.04	8.62
1878	.....	0.50	2.83	1.00	0.20	0.20	4.92	7.44	0.07	0.07	1.50	1.09	.....
1879	3.00	0.63	0.40	0.02	0.00	0.00	1.01	0.20	2.00	0.60	0.10	0.50	8.46
1880	0.25	1.40	1.45	0.15	0.00	1.50	4.80	0.97	1.35	0.70	0.05	0.82	13.44
1881	0.00	0.20	0.79	0.05	1.10	0.06	5.53	5.16	2.27	1.15	0.58	0.03	15.92
1882	0.90	1.15	1.51	0.26	0.71	1.39	3.58	4.84	1.51	0.00	1.79	0.35	17.99
1883	1.49	1.33	2.84	0.00	1.50	0.33	2.21	1.73	0.72	0.20	0.39	1.12	13.86
1884	3.14	4.96	2.63	0.00	0.23	0.12	0.65	2.44	0.62	3.53	0.42	6.41	25.20
1885	0.53	1.81	2.19	0.00	0.19	0.66	1.83	2.19	0.44	0.00	1.42	1.74	13.00

Rainfall tabulation—Continued.

BOWIE, COCHISE COUNTY, ARIZ.—Continued.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1886	4.24	4.88	4.43	0.07	0.01	4.21	2.24	2.49	1.26	0.36	0.74	0.15	25.13
1887	0.13	2.11	0.00	0.23	T.	1.30	4.49	5.51	2.71	1.01	1.10	1.94	20.53
1888	1.11	1.50	1.92	T.	0.46	0.53	2.50	1.37	0.21	1.89	1.95	2.12	15.56
1889	1.38	1.62	1.58	T.	0.09	0.09	2.65	0.20	3.37	0.74	T.	0.51	12.23
1890	0.78	0.23	0.03	0.59	0.00	T.	4.85	4.26	2.15	1.60	0.65	2.51	17.65
1891	0.79	1.67	0.64	0.00	0.81	0.07	0.28	1.00	0.61	0.00	0.00	1.26	7.13
1892	0.81	3.36	1.62	0.41	0.00	0.50	1.12	2.65	0.00	1.80	0.30	0.60	13.17
1893	0.40	0.80	2.70	0.00	0.30	0.00	3.69	3.41	1.06	0.04	0.07	0.25	12.72
1894	0.65	2.55	1.07	0.01	T.	T.	1.07	4.80	1.06	......	......	......	......
1899	......	0.20	0.03	0.02	0.00	0.00	4.50	0.00	0.00	0.00	0.00	T.	......
1900	0.00	0.00	0.92	0.00	0.00	0.00	0.14	2.27	3.08	0.28	0.20	0.00	6.89
1901	1.16	1.53	0.75	0.06	0.13	0.00	3.79	2.00	1.00	1.20	0.30	0.00	11.97
1902	......	......	......	......	......	......	......	......	......	......	......	1.25	......
1903	0.05	0.61	0.07	0.00	0.00	0.70	0.25	2.53	1.14	0.00	0.00	T.	5.35
1904	0.02	0.26	0.27	0.00	0.46	0.46	1.19	3.02	0.00	2.15	0.40	2.05	10.28
1905	1.91	3.29	2.65	1.19	0.00	0.13	1.20	2.70	3.48	0.60	......	0.78	......
1906	0.62	1.13	0.21	0.00	T.	0.22	1.45	2.82	0.00	0.03	1.35	2.40	10.23
1907	3.53	0.60	0.25	0.07	0.58	0.00	1.42	5.28	0.00	1.50	1.50	0.00	14.71
1908	1.10	1.80	0.85	0.02	0.05	0.00	2.69	3.07	0.27	0.00	0.45	1.20	11.50
1909	......	1.30	0.54	0.00	0.00	0.98	3.21	4.66	0.40	0.00	0.60	0.78	......
1910	0.77	0.00	0.00	0.10	0.00	0.35	1.30	......	0.15	T.	1.18	......	......
1911	......	......	......	......	......	1.04	1.27	2.39	1.39	2.44	0.00	0.75	......
1912	0.38	0.70	2.53	0.00	0.71	0.48	4.20	2.88	1.10	0.63	0.10	0.16	13.57
1913	0.35	1.72	0.25	0.07	T.	0.64	......	1.03	0.72	T.	2.41	0.82	......
1914	0.42	0.53	0.42	0.00	1.94	T.	4.72	2.82	1.02	2.81	1.67	3.61	19.96
1915	1.36	1.20	1.31	0.86	0.13	0.00	3.26	1.06	0.47	0.25	1.40	1.44	12.74
Total.	38.98	61.77	45.07	6.90	12.50	21.44	117.70	121.35	48.82	28.49	29.54	47.53	460.74
Mean.	1.03	1.54	1.10	0.17	0.30	0.50	2.80	2.82	1.11	0.66	0.70	1.13	13.96

FORT APACHE, NAVAJO COUNTY, ARIZ.

[Elevation, 5,200 feet.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1872	1.10	......	......	......	......	......	......	......	......	......	......	......	......
1873	......	......	......	......	......	......	......	......	......	......	......	0.62	......
1874	......	......	......	......	......	0.00	......	......	0.00	......	......	0.65	......
1875	......	......	......	......	T.	0.10	1.50	......	......	0.00	0.90	0.33	......
1876	0.92	1.72	2.02	0.08	0.26	1.02	5.20	2.52	2.00	2.44	1.34	0.22	19.74
1877	0.36	0.94	0.72	0.96	1.15	0.00	3.11	1.20	0.99	0.81	0.19	2.07	12.50
1878	0.18	1.35	2.41	1.77	0.18	0.79	8.76	9.33	0.76	0.00	1.94	1.24	28.71
1879	1.89	1.17	0.03	0.12	0.00	0.05	3.92	3.06	1.52	2.64	1.77	2.41	18.58
1880	1.31	0.95	0.80	0.46	0.00	0.46	5.83	1.44	0.55	0.56	0.03	2.38	14.77
1881	0.20	1.17	2.45	1.53	0.35	T.	5.63	8.31	5.41	4.68	0.85	0.54	31.12
1882	2.82	2.85	1.09	0.91	0.94	3.27	4.79	7.36	1.02	T.	2.34	0.23	27.62
1883	0.85	2.46	2.03	0.22	0.86	0.02	5.46	4.26	0.60	1.39	0.02	3.48	21.65
1884	0.68	3.43	4.44	1.67	1.31	2.35	0.14	5.59	1.50	2.02	0.82	5.52	29.47
1885	0.52	1.00	2.05	0.52	1.12	0.82	2.60	3.16	0.44	0.38	1.56	1.41	15.58
1886	3.90	2.73	1.06	0.91	0.00	0.19	1.90	4.75	3.16	1.65	0.56	0.24	21.06
1887	0.59	2.16	0.04	0.81	0.15	1.70	3.29	3.92	2.23	0.55	1.83	0.57	17.54
1888	1.42	1.83	2.92	0.71	0.71	T.	3.24	......	0.32	1.23	2.63	2.58	......
1889	2.24	0.85	1.55	0.47	0.00	0.11	2.67	2.87	1.02	0.46	0.55	3.95	17.10
1890	2.26	2.40	0.82	1.39	T.	T.	5.00	4.44	2.37	2.17	2.85	3.02	28.72
1891	1.73	5.18	1.08	T.	1.17	0.24	0.98	1.22	1.81	0.00	0.00	0.65	14.06
1892	0.65	2.29	2.22	1.36	0.38	0.15	1.33	1.30	1.23	0.55	0.57	0.69	12.70
1893	0.28	1.10	2.45	0.00	2.18	0.00	2.57	3.43	2.65	0.04	0.28	0.10	15.08
1894	1.24	0.96	1.36	0.19	0.79	0.00	1.27	5.01	1.32	2.47	0.00	2.81	17.42
1895	1.89	0.72	0.02	T.	1.00	0.01	0.74	5.44	1.68	3.02	3.39	1.12	18.03
1896	0.16	0.33	0.86	0.34	0.00	0.52	4.31	4.36	1.34	2.42	0.77	0.68	16.09
1897	2.23	1.40	1.79	0.24	0.34	0.37	1.20	2.07	3.41	1.30	0.00	0.57	14.92
1898	2.76	1.50	1.08	0.50	2.70	2.60	4.33	3.59	0.12	0.00	0.57	0.50	20.55
1899	1.33	1.04	0.17	0.45	0.00	1.90	4.55	0.96	1.52	0.82	0.71	1.60	15.05
1900	0.30	0.29	1.15	1.75	0.10	0.00	0.82	1.31	2.79	0.77	4.86	T.	14.14
1901	2.87	2.60	1.20	0.20	1.15	0.00	3.38	1.45	0.45	1.22	0.65	1.80	16.97
1902	0.58	1.35	0.53	0.00	1.32	0.50	1.63	2.72	2.26	0.30	1.80	2.18	15.17
1903	0.20	1.30	2.05	0.20	0.70	2.00	0.72	3.00	1.85	0.00	0.00	0.20	12.22
1904	0.80	0.60	0.65	0.10	0.20	0.05	0.48	6.66	0.80	1.35	0.00	1.75	13.44
1905	3.45	4.31	6.79	5.00	0.19	0.30	1.66	1.96	3.10	T.	4.64	1.75	33.15
1906	0.34	0.73	3.07	1.54	0.10	0.00	2.46	3.71	2.53	0.45	2.02	4.72	21.67
1907	2.15	0.72	0.61	2.07	1.24	0.18	2.19	5.20	0.69	3.77	0.10	0.00	18.92
1908	0.23	3.50	1.30	0.14	0.20	0.00	3.50	0.51	0.46	0.50	0.46	3.10	13.90
1909	1.47	2.29	0.96	0.42	0.02	T.	1.73	2.98	3.06	0.00	0.84	1.03	14.50
1910	2.09	0.07	0.62	0.77	0.32	0.28	2.07	3.85	0.25	0.06	......	0.72	......
1911	2.74	2.34	1.81	1.02	0.00	0.44	4.88	1.42	3.86	4.41	0.03	0.63	23.58
1912	T.	0.03	4.76	1.08	0.00	0.14	4.02	3.81	0.72	2.68	0.02	0.09	17.35
1913	0.67	1.07	0.37	0.75	0.00	0.20	0.49	1.43	0.60	0.64	1.13	1.34	8.69
1914	0.78	0.34	0.06	0.00	0.03	0.27	3.10	1.46	0.04	0.88	0.71	1.96	9.63
1915	2.26	1.41	1.26	1.88	0.55	1.00	4.08	2.08	1.36	0.14	0.83	1.89	18.74
1916	9.03	1.02	1.84	0.93	0.37	0.00	3.21	2.05	2.60	......	......	......	......
Mean.	1.50	1.60	1.58	0.62	0.53	0.51	2.97	3.38	1.58	1.19	1.11	1.46	18.23

Climatological

MONTHLY AND ANNUAL PRECIPITATION FOR THE

NEW MEXICO SECTION.

	January.		February.		March.		April.		May.		June.	
	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.
Alma	[1] 0.13	+0.03	T.	−0.78	0.10	−0.79	0.86	+0.29	0.30	−0.04	0.09	−0.35
Aragon	2.30		0.60		0.75		0.71		0.55		0.30	
Fort Bayard	0.64	−0.17	T.	−0.96	T.	−0.66	0.55	+0.19	0.32	+0.04	2.40	+1.68
Luna	1.83		0.07		T.							
Redrock	0.36		0.00		0.00		0.72		0.11		0.16	
Lordsburg	0.48	−0.17	0.00	−0.47	0.00	−0.51	0.02	−0.13	0.42	+0.20	0.60	+0.34

ARIZONA.

Bowie	0.77	−0.30	0.00	−1.52	0.00	−1.06	0.10	−0.08	0.00	−0.24	0.35	−0.20
Clifton	0.60	−0.50	T.	−1.24	0.04	−0.87	0.51	+0.08	0.01	−0.39	0.28	
Fort Apache	2.09	+0.82	0.07	−2.12	0.62	−0.90	0.77	+0.02	0.32	−0.29	0.26	−0.28
Globe	1.45		0.07		0.74		0.19		0.13	−0.20	0.15	
San Simon	0.34	−0.07	0.00	−0.43			0.03	−0.07			0.02	−0.08
Thatcher	0.30		0.10				0.20		0.10		0.20	

MONTHLY AND ANNUAL PRECIPITATION FOR THE

NEW MEXICO SECTION.

Alma	2.23	+1.24	1.96	+1.24	1.13	+0.23	0.42	−0.14	0.40	+0.06	1.44	+0.93
Aragon	1.10		1.81		0.60		0.50		T.		1.35	
Fort Bayard	1.55	+0.71	1.29	+0.32	1.70	+1.01	0.40	+0.03	T.	−0.28	2.20	+1.44
Luna	1.32		2.87		1.59		0.25		0.00		1.39	
Redrock	1.63		1.33		0.61		0.00		0.34		1.09	
Lordsburg	0.64	−0.01	0.95	+0.46	0.28	−0.24	0.83	+0.66	0.00	−0.21	1.31	+1.02

ARIZONA.

Bowie	1.57	+0.48	2.65	+1.10	0.31	−0.73	0.38	+0.19	0.00	−0.22	1.04	+0.48
Clifton	1.60	+0.48	1.52	+0.28	0.95	−0.04	0.66	+0.22			1.03	+0.45
Fort Apache	2.74	+0.92	2.34	+1.23	1.81	−0.28	1.02	+0.26	0.00	−0.59	0.44	−0.10
Globe	3.10	+1.65	1.63	+0.35	1.19		0.51	−0.02	0.00	−0.30	1.28	+1.01
San Simon	1.27	+0.83	2.28	+1.78	0.11	−0.55	0.22	−0.73	0.00	−0.15	0.50	+0.38
Thatcher	1.13		1.97		0.42		0.28		0.00		0.95	

MONTHLY AND ANNUAL PRECIPITATION FOR THE

NEW MEXICO SECTION.

Alma	0.00	−0.94	0.10	−0.58	3.76	+2.68	0.48	−0.07	0.08	−0.25	2.69	+2.04
Aragon	0.00		0.60		3.37		0.90		T.		2.00	
Fort Bayard	0.19	−0.64	0.85	−0.12	2.81	+2.06	0.15	−0.21	0.02	−0.25	1.80	+1.01
Luna	T.		0.60	−0.79			0.25		T.		0.60	
Redrock	0.08		0.87		2.40		T.		0.00		0.36	
Lordsburg	T.	−0.63	1.15	+0.64	2.14	+1.59	0.07	−0.10	0.16	−0.15	0.51	−0.21
Silver City	0.10		0.70		2.83		0.27		0.02		2.28	

ARIZONA.

Alpine	0.12						1.48		0.01		1.60	
Blue											1.19	
Bowie	0.38	−0.71	0.70	−0.53	2.53	+1.49	0.00	−0.19	0.71	+0.49	0.48	−0.08
Clifton			0.38	−0.57	2.98	+2.07	0.24	−0.20	T.	−0.39	0.63	+0.05
Fort Apache	T.	−1.31	0.03	−0.77	4.76	+3.23	1.08	+0.32	0.00	−0.59	0.14	−0.40
Globe	0.00	−1.45	T.	−1.28	3.96		1.03	+0.50	0.59	+0.29	0.52	+0.25
San Simon	0.00	−0.44			0.60	−0.06						
Thatcher	0.00	−0.83	0.50				0.13		0.04		0.38	

[1] Incomplete or estimated.

report.

YEAR 1910, WITH DEPARTURES FROM THE NORMAL.

NEW MEXICO SECTION.

July.		August.		September.		October.		November.		December.		Annual.	
Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.
1.65	−0.69	1.95	−1.02	1.20	−0.75	0.55	−0.94	2.01	+0.78	0.35	−0.60	[1] 9.99	−4.86
1.14	.....	2.22	.....	0.35	.....	1.03	.....	1.30	.....	0.30	.....	11.55	.....
1.45	−1.55	0.90	−1.97	0.35	−1.57	0.43	−0.66	0.95	+0.26	0.30	−0.55	8.29	−5.92
1.70	.....	3.66	.....	0.30	.....	.....	.....	1.15	.....	T.	.....	.....	.....
4.34	.....	0.84	.....	0.00	.....	0.27	.....	0.99	.....	0.17	.....	7.66	.....
2.09	+0.35	0.87	−0.66	T.	−0.95	0.00	−0.64	0.26	−0.26	0.02	−0.57	4.76	−3.47

ARIZONA.

1.30	−1.59	1.69	−1.10	0.15	−1.02	T.	−0.60	1.18	+0.52	0.05	−1.06	5.59	−8.25
2.22	+0.43	2.65	+0.10	0.25	−1.42	0.26	−0.70	1.52	+0.90	0.33	−0.72	8.67	−4.28
2.07	−0.84	3.55	+0.43	0.25	−1.31	0.06	−1.09	2.36	+1.19	0.72	−0.76	13.44	−5.13
2.18	.....	2.99	.....	.....	.....	0.18	.....	2.34	.....	0.26	.....	10.68	.....
0.85	−0.06	1.48	−0.12	0.16	−0.60	.....	.....	0.87	+0.51	0.04	−0.40	3.79	−1.32
0.82	.....	1.65	.....	T.	.....	0.04	.....	1.21	.....	0.00	.....	4.59	.....

YEAR 1911, WITH DEPARTURES FROM THE NORMAL.

NEW MEXICO SECTION.

3.50	+1.08	1.99	−0.91	2.65	+0.66	2.72	+1.14	0.00	−1.15	0.98	+0.03	19.42	+4.41
3.70	.....	1.65	.....	2.75	.....	3.30	.....	0.00	.....	0.70	.....	17.46	.....
4.59	+1.55	2.02	−0.83	2.94	+0.99	3.31	+2.15	T.	−0.67	0.63	−0.21	20.63	+6.21
[1] 3.60	.....	[1] 1.82	.....	2.11	.....	3.78	.....	0.00	.....	0.72	.....	[1] 19.45	.....
3.00	.....	1.71	.....	3.05	.....	1.94	.....	0 00	.....	0.91	.....	15.61	.....
2.46	+0.69	0.50	−0.99	0.58	−0.36	1.60	+0.92	0.00	−0.50	2.60	+1.94	11.73	+3.38

ARIZONA.

1.27	−0.43	2.39	−0.39	1.39	+0.21	2.44	+1.78	0.00	−0.64	0.75	−0.35	14.19	+1.42
4.19	+2.33	0.29	−2.15	1.08	−0.56	3.47	+2.39	0.00	−0.59	0.23	−0.87	15.02	+1.96
4.88	+1.89	1.42	−1.67	3.86	+2.24	4.41	+3.17	0.03	−1.11	0.63	−0.80	23.58	+5.17
4.78	+2.32	1.33	.....	3.60	+1.91	3.27	+2.06	0.05	−1.31	0.62	−1.00	21.36	+6.60
.....	.....	.....	.....	.....	.....	1.50	+1.09	0.00	−0.34	2.15	+1.59	8.03	+ 3.9
3.40	.....	1.34	.....	2.25	.....	2.30	+1.55	T.	.....	1.36	.....	15.38	.....

YEAR 1912, WITH DEPARTURES FROM THE NORMAL.

NEW MEXICO SECTION.

3.55	+1.06	2.39	−0.49	0.43	−1.47	2.36	+0.74	0.00	−1.08	0.08	+0.02	16.82	+1.66
3.51	.....	0.65	.....	0.30	.....	1.42	.....	0.08	.....	0.51	.....	13.34	.....
2.42	−0.60	4.47	+1.58	1.17	−0.76	1.04	−0.12	0.01	−0.64	0.73	−0.10	15.66	+1.21
3.39	+1.10	1.52	−1.39	0.42	−1.29	[1] 1.19	−0.25	0.57	−0.51	1.25	−0.18	[1] 13.55	−2.50
3.51	.....	2.47	.....	T.	.....	1.07	.....	T.	.....	0.98	.....	11.74	.....
4.19	+2.34	2.14	+0.63	0.00	−0.91	1.07	+0.38	0.18	−0.31	2.64	+1.91	14.15	+5.60
5.40	.....	1.28	.....	0.41	.....	0.80	.....	T.	.....	2.35	.....	16.44	.....

ARIZONA.

3.33	.....	4.14	.....	0.70	.....	4.85	.....	0.60	.....	.....	.....	16.83	.....
4.48	.....	1.80	.....	0.41	.....	1.63	.....	0.00	.....	0.90	.....	[2] 10.41	.....
4.20	+1.50	2.88	+0.10	1.10	−0.08	0.63	−0.03	0.10	−0.54	0.16	−0.94	13.87	+0.46
5.21	+3.35	1.10	.....	T.	−1.61	0.90	−0.13	0.00	−0.59	0.35	−0.75	11.79	+0.85
4.02	+1.06	3.81	+0.72	0.72	−0.90	2.68	+1.44	0.02	−1.12	0.09	−1.37	17.35	+0.31
4.42	+2.06	2.60	−0.01	0.16	−1.53	2.46	+1.25	0.01	−1.30	1.52	−0.19	17.27	−1.41
.....	.....	.....	.....	0.25	−0.53	.....	.....	0.25	−0.09	.....	.....	1.10	−1.12
3.16	.....	1.15	.....	0.33	.....	0.67	−0.08	T.	−0.92	0.36	−0.44	6.72	−2.27

[1] 7 months.

Climatological

MONTHLY AND ANNUAL PRECIPITATION FOR THE

NEW MEXICO SECTION.

	January.		February.		March.		April.		May.		June.	
	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.
Alma	0 65	−0.25	1.87	+0.91	0.66	−0.44	T.	−0.54	0.06	−0.24	0.42	−0.27
Aragon	0.95	....	1 98	....	0.60	....	0 00	....	0.20	....	0.42	....
Cliff	0.73	−0.31	0.87	+0.07	0.34	−0.25	0.43	+0.06	0.22	+0.04	0.39	−0.09
Fort Bayard	0.72	−0.10	2.37	+1.36	0.27	+0.47	0.23	−0.13	0.47	+0.16	0.51	−0.25
Lordsburg	1.00	+0.36	2.43	+1.66	0.51	−0.04	0.35	+0.17	T.	−0.20	0.28	−0.02
Luna	0.75	−0.04	2.06	+0.85	0.75	−0.32	[1]0.30	−0.15	0.38	−0.10	0.38	−0.28
Redrock	0.69	....	2.73	....	0.35	....	0.26	....	0.12	....	0.23	....
Silver City	1.18	....	3.18	....	0.56	....	0.31	....	0.21	....	0.42	....

ARIZONA SECTION.

Alpine	0.29	....	1.03	....	0.50	....	0.19	....	0.05	....	0.30	....
Blue	0.50	....	2.19	....	1.01	....	0.30	....	0.16	....	0.21	....
Bowie	0.35	−0.74	1.72	+0.17	0.25	−0.79	0.07	−0.12	T.	−0.22	0.64	+0.08
Clifton	0.93	−0.19	2.35	+1.10	0.32	−0.59	0.29	−0.15	T.	−0.39	T.	−0.58
Fort Apache	0.67	−0.64	1.07	+0.27	0.37	−1.16	0.75	−0.01	0.00	−0.59	0.20	−0.33
Globe	0.58	−0.87	3.87	+2.59	0.08	−1.68	0.43	−0.13	0.00	−0.30	0.03	−0.27
San Simon	0.20	−0.24	0.90	+0.40	....	....	0.15	+0.05	T.	−0.15	T.	−0.12
Thatcher	0.53	−0.18	1.50	+0.40	0.26	−0.60	0.29	+0.02	0.08	+0.05	0.17	−0.07

MONTHLY AND ANNUAL PRECIPITATION FOR THE

NEW MEXICO SECTION.

Alma	0.02	−0.83	0.67	−0.28	0.83	−0.26	T.	−0.51	0.24	−0.04	1.93	+1.16
Aragon	0.75	....	0.40	....	0.45	....	0.00	....	1.28	....	0.58	....
Fort Bayard	0.42	−0.41	0.49	−0.51	0.83	+0.09	0.01	−0.33	0.64	+0.33	1.03	+0.27
Luna	0.34	−0.42	0.63	−0.54	0.39	−0.64	T.	−0.42	0.36	−0.11	0.25	−0.38
Redrock	0.23	−0.58	0.63	−0.57	0.15	−0.78	0.00	−0.52	1.17	+0.94	0.95	+0.62
Lordsburg	0.83	+0.23	0.62	+0.05	0.45	−0.10	0.00	−0.17	1.17	+0.94	0.93	+0.61

ARIZONA SECTION.

Alpine	1.31	....	1.29	....	0.50	....	0.13	....	0.64	....	0.48	....
Blue	0.10	....	0.72	....	0.50	....	T.	....	0.23	....	0.63	....
Bowie	0.42	−0.61	0.53	−1.05	0.42	−0.69	0.00	−0.16	1.94	+1.70	T.	−0.52
Clifton	0.13	−0.95	0.78	−0.48	0.45	−0.53	0.00	−0.43	0.90	+0.54	0.87	+0.42
Fort Apache	0.78	−0.53	0.34	−1.31	0.06	−1.40	0.00	−0.81	0.03	−0.51	0.27	+0.25
Globe	1.29	−0.05	1.50	+0.11	0.66	−0.95	0.09	−0.48	0.43	+0.12	0.73	+0.47
San Simon	0.20	−0.23	0.55	+0.05	0.55	−0.15	0.00	−0.11	T.	−0.14	0.40	+0.23
Thatcher	T.	−0.60	0.37	−0.58	0.25	−0.53	0.00	−0.27	T.	[illegible]	1.34	+1.07

MONTHLY AND ANNUAL PRECIPITATION FOR THE

NEW MEXICO SECTION.

Alma	1.45	+0.57	1.60	+0.62	0.90	−0.18	1.68	+1.10	0.20	−0.10	0.30	−0.44
Aragon	1.96	+0.83	1.14	−0.06	0.46	−0.51	0.90	+0.27	0.50	+0.11	0.25	−0.41
Fort Bayard	1.74	+0.85	2.49	+1.46	1.91	+1.14	1.40	+1.03	T.	−0.31	T.	−0.75
Lordsburg	1.08	+0.42	0.87	+0.29	1.75	+1.16	0.80	+0.61	0.00	−0.23	0.00	−0.31
Luna	2.50	+1.63	1.98	+0.76	0.99	−0.04	1.46	+0.69	0.26	−0.20	0.47	−0.15
Redrock	1.22	+0.37	1.58	+0.35	1.07	+0.13	1.87	+1.21	T.	−0.21	0.00	−0.30

ARIZONA SECTION.

Alpine	2.58	....	1.95	....	0.90	....	1.29	....	0.87	....	0.00	....
Blue	....	....	....	....	....	....	1.76	....	....	....	0.15	....
Bowie	1.36	+0.33	1.20	−0.35	1.31	+0.22	0.86	+0.71	0.13	−0.15	0.00	−0.51
Clifton	1.58	+0.54	1.64	+0.40	1.20	+0.24	0.65	+0.24	0.00	−0.38	T.	−0.47
Fort Apache	2.26	+0.95	1.41	−0.21	1.26	−0.17	1.88	+1.09	0.55	+0.02	1.00	+0.49
Globe	4.52	+3.18	2.92	+1.52	1.10	−0.43	2.15	+1.62	0.61	+0.26	0.25	−0.04
San Simon	0.70	+0.27	0.91	+0.41	0.62	−0.07	0.30	+0.20	0.00	−0.14	0.00	−0.18
Thatcher	1.29	+0.69	0.81	−0.10	0.61	−0.13	1.67	+1.42	0.07	−0.02	T.	−0.34

[1] Incomplete or interpolated.

report—Continued.

YEAR 1913, WITH DEPARTURES FROM THE NORMAL.

NEW MEXICO SECTION.

July.		August.		September.		October.		November.		December.		Annual.	
Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.	Precipitation.	Departure.
2.20	−0.40	3.46	+0.87	1.33	−0.55	1.26	−0.46	3.03	+1.85	0.40	−0.36	15.34	+0.40
1.75	....	2.19	....	1.72	....	0.67	....	1.95	....	1.47	....	13.90	....
1.99	−0.73	1.72	−0.72	0.95	−0.79	1.17	+0.04	3.40	+2.35	1.95	+0.81	14.16	+0.48
2.20	−0.89	3.28	−0.03	1.18	−0.79	0.34	−0.80	2.95	+2.17	1.15	+0.32	15.67	+0.55
0.43	−1.37	0.38	−1.23	1.70	+0.62	0.30	−0.48	3.89	+3.30	0.42	−0.26	11.69	−0.26
1.58	−0.80	1.69	−1.19	2.10	+0.30	1.09	−0.24	2.36	+1.17	1.58	+0.34	15.02	−0.60
0.81	....	1.26	....	1.23	....	0.36	....	3.02	....	1.01	....	12.07	....
2.24	....	1.76	....	1.09	....	0.55	....	3.55	....	1.73	....	16.78	....

ARIZONA SECTION.

2.66	....	4.32	....	3.65	....	2.89	....	1.35	....	1.08	....	18.31	....
1.39	....	4.87	....	2.10	....	1.15	....	2.28	....	1.15	....	17.31	....
0.34	−2.40	1.03	−1.75	0.72	−0.46	T.	−0.66	2.41	+1.78	0.62	−0.45	8.15	−5.56
3.63	+1.62	3.57	−1.24	0.62	−0.94	0.10	−0.98	2.12	+1.56	1.38	+0.32	15.31	−0.46
0.49	−2.50	1.43	−1.92	0.60	−1.00	0.64	−0.84	1.13	+0.02	1.34	−0.08	8.69	−0.58
3.35	−0.71	1.84	−0.77	0.90	−0.65	0.41	−0.92	1.73	+0.54	1.50	−0.20	14.72	−3.37
0.85	−0.12	0.35	−1.27	0.90	+0.14	0.00	−0.41	1.75	+1.41	1.10	+0.54	....	....
3.48	+0.98	2.48	+0.48	1.10	+0.16	0.36	−0.39	1.33	+0.41	1.25	+0.21	12.83	+1.47

YEAR 1914, WITH DEPARTURES FROM THE NORMAL.

NEW MEXICO SECTION.

3.33	+0.69	3.47	+0.82	0.42	−1.37	3.77	+1.92	1.89	+0.67	3.43	+2.51	20.00	+4.48
4.75	....	2.42	....	0.52	....	2.55	....	0.70	....	2.36	....	16.86	....
7.40	+4.22	3.54	+0.29	1.02	−0.93	3.40	+2.21	1.05	+0.27	4.57	+3.65	24.40	+9.15
6.72	+4.02	3.94	+0.98	0.86	−0.88	2.76	+1.33	0.98	−0.19	3.04	+1.68	20.27	+4.43
4.34	+1.48	2.27	−0.14	0.36	−0.48	2.83	+1.96	0.65	−0.43	3.12	+1.85	16.70	+3.35
2.63	+0.80	4.06	+2.37	1.00	−0.07	2.81	+1.97	0.69	+0.09	4.46	+3.67	19.70	+10.39

ARIZONA SECTION.

7.48	....	5.29	....	1.56	....	3.98	....	1.08	....	2.24	....	25.98	....
7.65	....	4.82	....	0.94	....	3.20	....	1.51	....	4.50	....	24.80	....
4.72	+2.04	2.82	−0.04	1.02	−0.13	2.81	+2.17	1.29	+0.68	3.45	+2.44	21.83	+8.63
5.78	+3.70	2.99	+0.56	2.20	+0.68	2.99	+2.00	0.71	−0.39	1.96	+0.49	9.63	−7.[illegible]8
3.10	+0.17	1.46	−2.04	0.04	−1.56	0.88	−0.34	1.40	−0.09	5.59	+3.99	23.47	+7.24
4.90	+2.45	3.17	+0.73	0.47	−0.96	3.24	+1.90	0.71	+0.29	3.34	+2.84	....	....
4.00	+3.14	4.9[illegible]	+3.3[illegible]	....	....	....	....	0.78	−0.13	3.02	+2.22	12.38	+2.31
1.52	−0.44	2.[illegible]	+1.1[illegible]	0.22	−0.75	1.94	+1.24	1.67	+1.02	3.61	+2.55	19.96	+6.28

YEAR 1915, WITH DEPARTURES FROM THE NORMAL.

NEW MEXICO SECTION.

5.27	+2.48	1.71	−0.88	1.83	+0.04	0.37	−1.39	0.85	−0.35	1.65	+0.69	17.81	+2.16
4.13	+1.56	1.15	−1.31	0.80	−0.48	0.30	−0.98	0.75	−0.43	2.08	+0.66	14.42	−0.75
3.88	+0.68	3.62	+0.37	3.08	+1.11	0.09	−1.08	0.16	−0.61	2.00	+1.06	20.37	+4.95
2.93	+1.07	1.60	−0.08	0.24	−0.81	0.00	−0.81	0.00	−0.58	1.64	+0.82	10.91	+1.55
4.43	+1.62	1.39	−1.46	1.19	−0.51	T.	−1.33	0.92	−0.24	2.30	+0.88	17.59	+1.65
6.02	+2.88	1.29	−1.02	0.72	−0.11	0.09	−0.71	0.52	−0.51	1.02	−0.23	15.40	+1.85

ARIZONA SECTION.

1.56	....	0.54	....	0.58	....	0.00	....	1.32	....	4.18	....	....	....
7.44	....	2.33	....	3.14	....	0.11	....	1.18	....	1.94	....	25.29	....
3.26	+0.53	1.06	−1.80	0.47	−0.68	0.25	−0.44	1.40	+0.73	1.44	+0.32	12.74	−1.00
3.73	+1.49	1.95	−0.50	1.63	+0.08	0.00	−1.07	0.84	+0.21	2.02	+0.91	15.24	+1.69
4.08	+1.14	2.08	−1.37	1.36	−0.20	0.14	−1.08	0.83	−0.27	1.89	+0.48	18.74	+0.87
2.70	+0.16	3.33	+0.83	0.57	−0.79	0.12	−1.35	1.52	+0.03	2.61	+0.70	22.40	+5.69
0.82	−0.19	1.05	−1.69	0.04	−0.60	T.	−0.37	0.65	−0.22	1.09	+0.46	6.13	−1.68
1.22	−0.70	1.59	−0.25	1.49	+0.56	0.04	−0.74	0.52	−0.38	0.83	−0.10	10.14	−0.09

RUN-OFF.

The estimates for run-off at San Carlos or of flood run-off at any junction point of a tributary with the main stream, or with any larger lateral are only approximate, for there are no continuous cylinder records for the Gila River flow during any considerable period, or any other continuous records which do not require interpolations and insertions to complete. This fact when the general inferences are plain is not so unfortunate as might be thought for even accurate flood measurements may not be significant of the status of the area in so far as giving notice of need for stream correction. For instance, the San Simon is critical, and there is at stake an empire of arable fertile land, and yet the maximum flood-flow figures per square mile appear negligible. The run-off data is valuable, but must not be overemphasized when considered in parallel with accurate observations of run-off effects in the stream channels themselves, or in the lower valleys.

SAN FRANCISCO RIVER.

The total drainage area of the San Francisco amounts to 2,895 square miles. There are 381,700 acres covered with timber in the watershed, and it is believed that originally the conditions of run-off were good. They are now bad, and rapidly becoming worse. The San Francisco is the largest tributary and the strongest flood feeder to the Gila of any in the watershed. It drops from over 9,000 feet at the crest line which separates the San Francisco from the Little Colorado on the north and Salt River on the west, to an elevation 3,257 feet at the junction with the Gila, 163 miles down the stream, or a drop of 352 feet a mile. The average annual rainfall over this area of 2,895 square miles is 16.98 inches, and if it all ran off it would amount to 2,620,000 acre-feet, or a continuous flow for the year of 3,618 cubic feet per second.

Using the same percentage of run-off for the San Francisco drainage area as the measurements show for the Gila watershed above San Carlos (though this of course will not necessarily be true), the annual run-off can be, in lieu of better data, taken at 4.3 per cent, or 112,660 acre-feet, or an average annual flow of 155 cubic feet per second.

The rainfall of the storm of January, 1916, which produced the most disastrous flood ever known in the lower Gila, is estimated to have averaged 3.61 inches over the San Francisco watershed, amounting 558,000 acre-feet, The average rainfall of the storm of October, 1916, estimated in the same way, amounted to 5.10 inches, or 788,000 acre-feet. The crest discharge due to the latter storm amounted 60,200 cubic feet per second at the mouth of the river. At Clifton, 10 miles above the mouth, a flood crest flow of 107,870 cubic feet per second was measured. The difference between these measurements is attributed to the subsidence of the crest due to its retardation by the irregularities of channel cross section and alignment. That such irregularities do cause a reduction in flood crest heights is a matter of common observation, and is accounted for by the theory that any influence which tends to delay the crest holds the crest back upon the ebbing portion of the flood wave, and thus reduces the crest's altitude. Unless continuously augmented, therefore, the crest of a flood will subside in the course of its progress through any ordinary river channel.

The highest flood in the San Francisco at Clifton of which there is any authentic record occurred December 3, 1906. The floor of the roundhouse of the Arizona & New Mexico Railroad was covered with 3 feet of silt. Chase Creek, which enters the San Francisco a few hundred feet above the point where the flood sections were measured, was also then the highest it has ever been known to be and is estimated to have discharged, when at its maximum height, 17,660 cubic feet per second. Although the discharge of Chase Creek on this occasion was augmented by the failure of a dam at Morenci, the effect of the additional waters thus brought down could not have increased the discharge of the river below by any material percentage. As shown by well-established high-water marks in the Central Hotel, the flood of December, 1906, was 1.9 feet higher than the flood of October, 1916, and had a crest discharge at this point of 143,450 cubic feet per second. According to Mr. George A. Wagstaff, an interested observer, then engaged in the construction of the Clifton & Coronado Railroad, this flood fluctuated in crests for 12 hours, from midnight, December 2, till noon, December 3. The crest of the October flood was sustained for only three hours, from 4 a. m. to 7 a. m. on the 13th, and was the result of the combination of the greatest flood ever known in Blue River with a flood of moderate proportions from the lower tributaries of the San Francisco. The crest of the flood in Blue River passed the base line ranger station at 10.30 p. m. Friday, October 13, and arrived at Clifton, together with the flood water of the other lower tributaries of the San Francisco, at 4 a. m., Saturday. In this interval of 5½ hours the flood crest traveled 35 miles, or at the rate of 6.36 miles an hour, or 9.33 feet per second. Assuming the mean velocity of the water to have been 23.8 feet per second, the average of the mean velocities in Blue River at its mouth and 48 miles

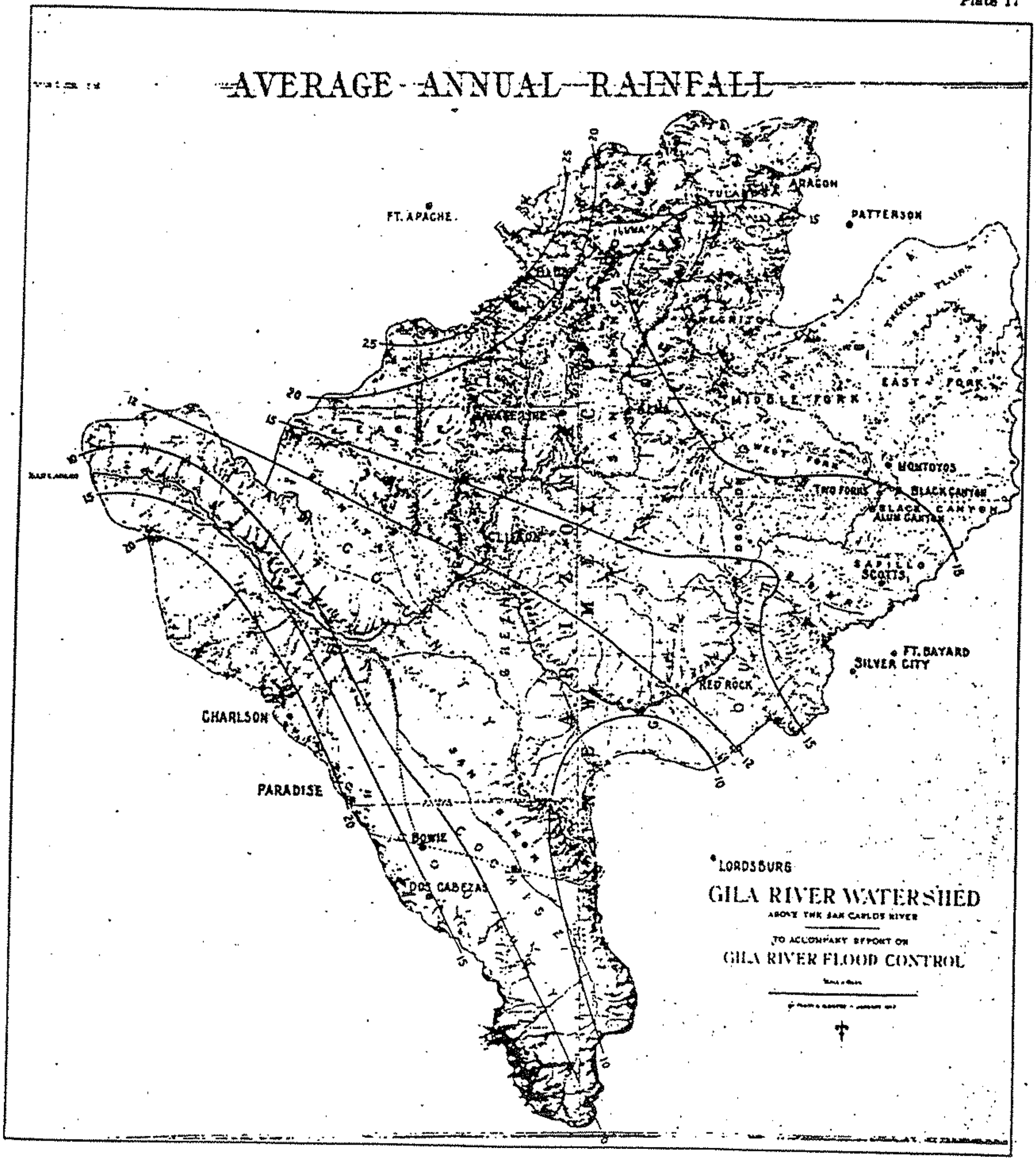

AVERAGE ANNUAL RAINFALL
FT. APACHE
ARAGON
TULAROSA
PATTERSON
LUNA
NEGRITO
EAST FORK
MIDDLE FORK
WEST FORK
MONTOYOS
TWO FORKS
BLACK CANYON
ALUM CANYON
SAPILLO
SCOTTS
CLIFTON
FT. BAYARD
SILVER CITY
RED ROCK
CHARLSON
PARADISE
BOWIE
DOS CABEZAS
LORDSBURG
GILA RIVER WATERSHED
ABOVE THE SAN CARLOS RIVER
TO ACCOMPANY REPORT ON
GILA RIVER FLOOD CONTROL

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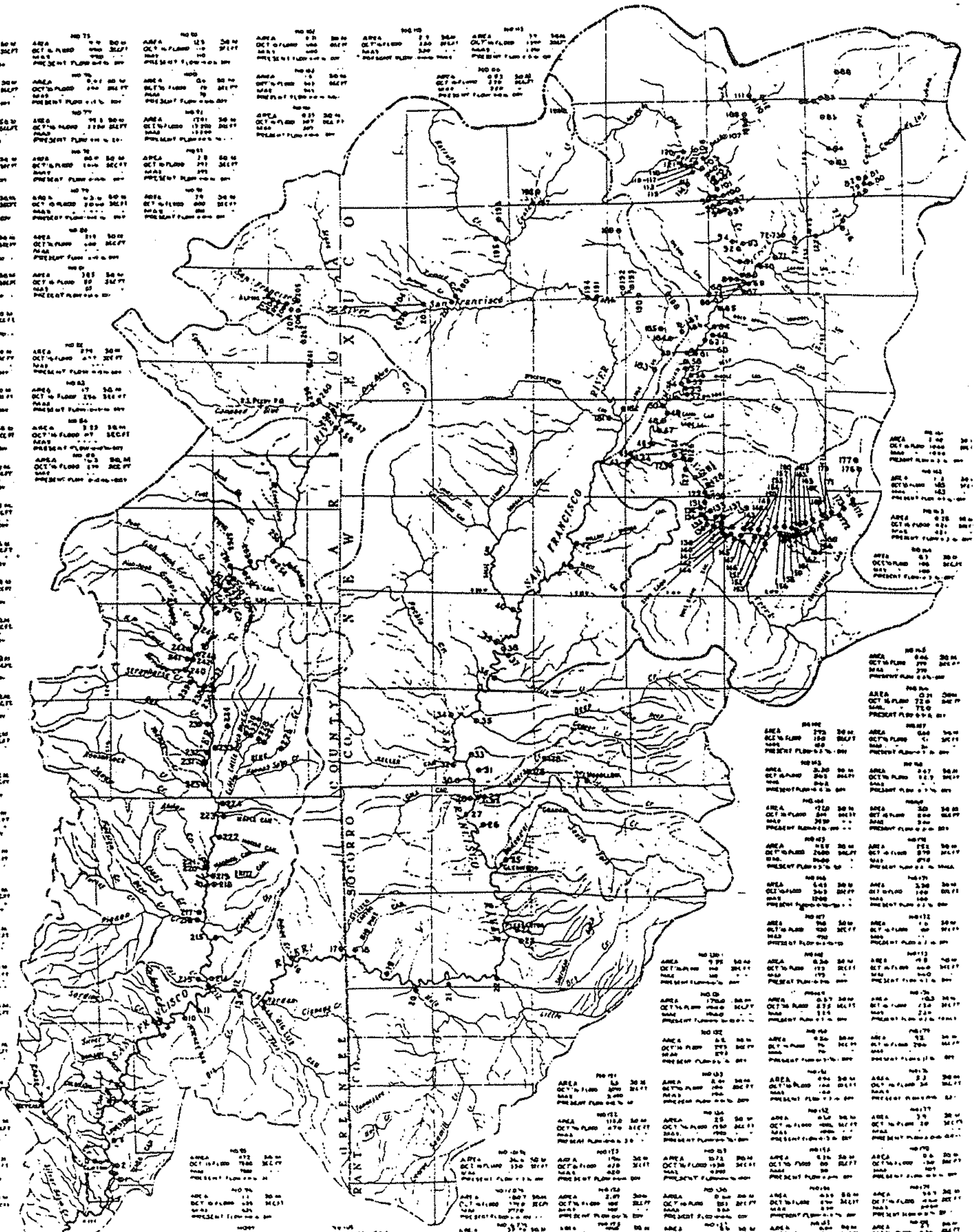
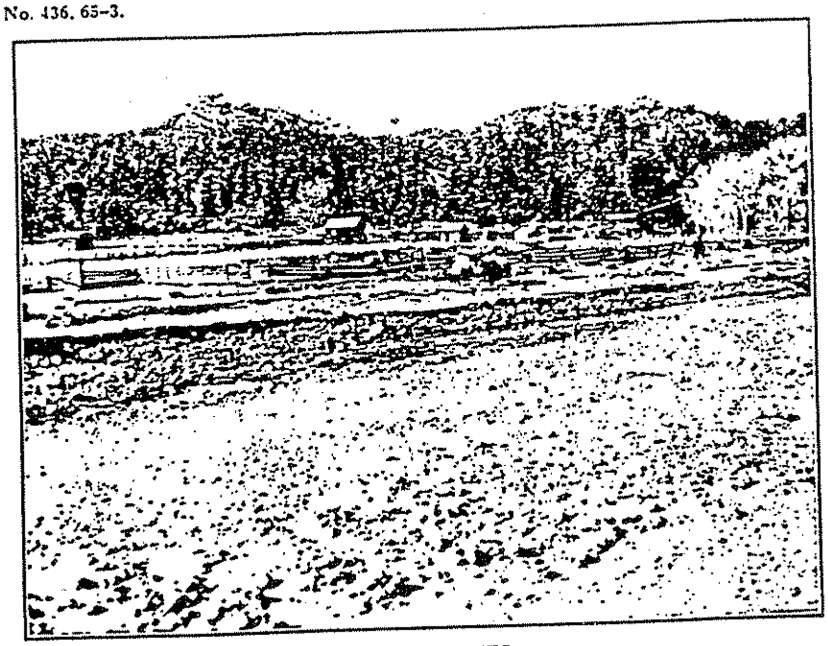
Plate 18.

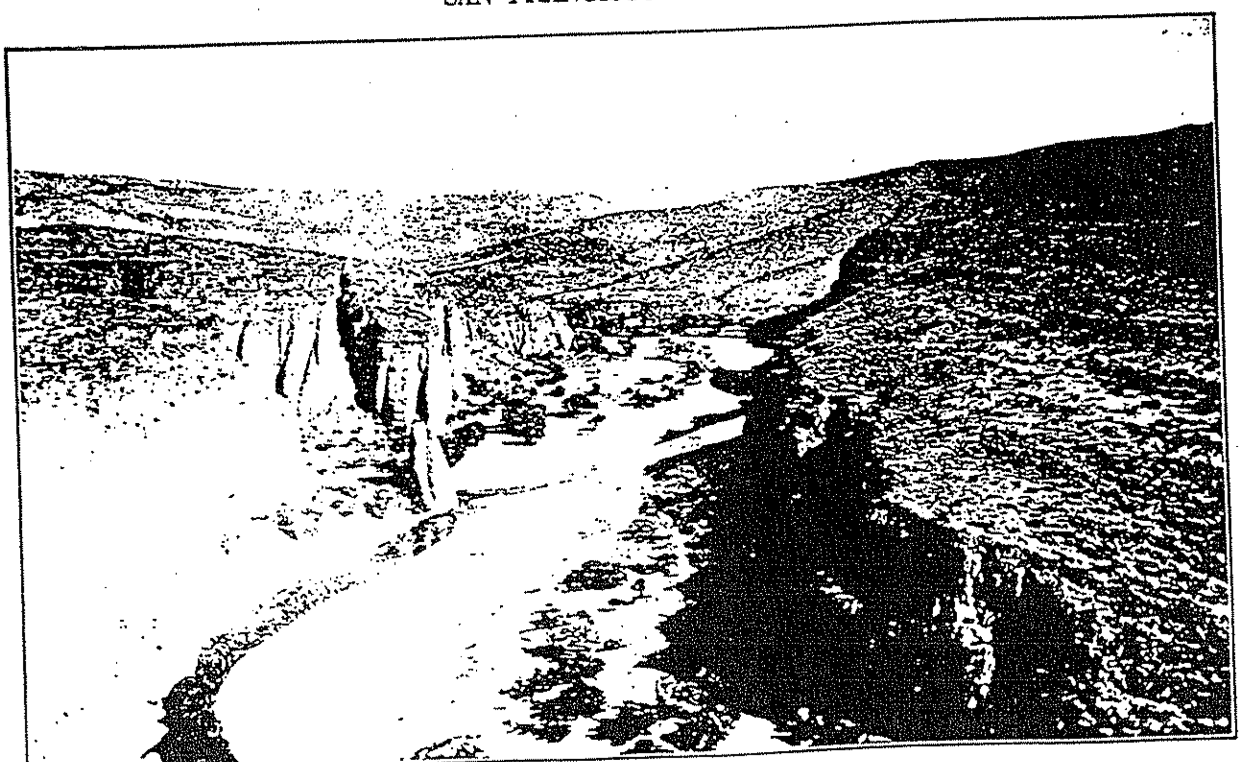


SAN FRANCISCO DRAINAGE



UPPER REACHES.

SAN FRANCISCO RIVER.



AT JUNCTION WITH GILA.

above and in the San Francisco at just above the mouth of the Blue and at Clifton, this flood crest traveled at a velocity equal to about 37 per cent of that of the water itself.

The rainfall of the October storm was greatest about Alpine in the region of the headwaters of both the Blue and the San Francisco, the area of heaviest precipitation extending to the east entirely across the upper portion of the San Francisco Basin and causing the highest water ever known in the upper San Francisco and in Tularosa Creek. The failure of an earth dam at Alpine storing about 750 acre-feet of water contributed probably 4,000 cubic feet per second to the flood crest of 10,680 cubic feet per second measured a short distance above Luna. The crests of the Tularosa Creek flood and that of the upper San Francisco appear to have met and caused an unprecedented flood in the river for 10 or 12 miles below, sweeping away most of the few benches of bottom land that had escaped former floods. The flood crested here, as nearly as could be ascertained, about 4 o'clock Saturday morning or at the same time the crest of the Blue River flood reached Clifton. The crest of the upper river flood was not maintained by the lesser discharges of the central tributaries, and this crest was largely dissipated by the time of its arrival at the mouth of Blue River which had then run down.

According to local observers the flood crests of Blue River are from 3 to 12 hours ahead of those of the San Francisco, and the flood crests of the San Francisco are about 18 hours ahead of those of the Gila. Mr. Wagstaff describes the flood of December, 1906, as an uninterrupted succession of crests extending over a period of 12 hours.

The second largest flood on the San Francisco of which we have any record was in 1891 when the wooden depot at Clifton was washed away and a heavy iron safe carried down the stream and never recovered. In 1905 there were three large floods, January 10, February 17, and November 27, the intensities of which we do not know.

Within the historical period there have been pronounced changes in many of the valleys and drainage lines in the upper watershed of the San Francisco, and undoubtedly the character and size of the flood flows have changed for the worse. Mr. Harry L. Lawson, forest examiner southern division Apache National Forest, says:

> The intrusion of large herds of goats upon the steep slopes of the rough broken country to the south of the northerly boundary of the Apache Forest in the years 1900–1905 (resulting in great damage to the range and protecting cover, and as commonly believed the consequent destructive floods along the Gila and San Francisco Rivers) led, on December ..., 1905, to the withdrawal for settlement and entry of the entire area lying south of the base line to within a few miles of the town of Clifton.

The upper San Francisco is extremely rough and broken. The valleys are generally very narrow and oftentimes true box canyons. The upper headwaters rise in a finely forested country, and there should be in connection with this timber crop considerable business, but as a fact the roads are annually ruined by floods and so are not available for use, and the river flow is too violent during floods and too limited at other times to furnish transportation by water for the logs, the consequence being that the timber year after year decays and is a debit to the Nation rather than a credit.

The entire agricultural area of these mountain streams has been swept away during the last 10 years.

Erosion goes on at a terrific and ever accelerating rate and the forest growth itself so will soon be affected by the drying up of moist drainage lines and cienagas through the rapid run-off in deeply eroded gully lines.

The Blue in many places narrows to a box canyon with cliffs from 20 to 50 feet high on each side, and with a network of deep narrow tributary canyons drawing into it.

The San Francisco River itself rises on the east slope of the Datil Mountains a few miles northwest of the village of Alpine, Ariz., Flowing in a southeasterly direction through the Alpine Valley and then easterly down the Luna Valley, it breaks through the San Francisco Mountains in a narrow gorge a mile long, and taking a southerly course unites with the Tularosa a few miles above the reserve. After passing through 3 miles of valley it enters a canyon having an average width of perhaps 300 feet. Emerging from this canyon about 8 miles above Alma it continues south in a shifting channel through the Alma Valley, again entering a canyon a mile below Alma. In this canyon is the Alma dam site. At Glenwood the river emerges from the canyon, and winding southerly through the Pleasanton Valley, is again confined in a canyon about 2 miles below Pleasanton.

Excepting a few small benches, upon the principal one of which, 2 miles above the mouth of Blue River, the Sliger ranch is located, there is no arable land within this canyon which, broken only by the entering side canyons continues as far as Clifton. In its upper reaches it has an average width of about 500 feet but narrows in places to a width of 300 feet. In its lower portions it sometimes attains a width of 800 or 900 feet.

There is a dam site just below Dix Creek near Sliger's ranch, one in the northwest quarter of section 26, township 12 south, range 20 west, a mile and a half above the mouth of Dry

Creek, the Alma dam site, previously referred to, and a dam site a short distance below the mouth of Devil Creek in the San Francisco Mountains. Because the storage of the reservoirs above these dam sites is small in proportion to the height of dam, owing to the steep gradient of the stream and the narrowness of the canyon or valley, and because of the great quantity of silt which this stream carries, it is not thought advisable to attempt the use of any of them as a measure of flood control.

WARD CANYON, CHASE CREEK, LIMESTONE GULCH, COLORADO GULCH, DORSEY GULCH, SARDINE CREEK, OREJANA CANYON, AND HICKEY CANYON.

The mountain slopes on both sides of the San Francisco River between Clifton and Blue River are steep and rugged and support only a desert growth of juniper, scrub oak, mesquite, greasewood, cacti, ocatillo, and bear grass. The rock in the lower portion of this district is limestone, and in the upper portion hard sandstone, with frequent intrusions of volcanic rock in both. The short, steep water courses have a uniformly high rate of flood discharge. The only treatment practicable is by check dams. Chase Creek has a bad record because of destruction repeatedly wrought by it in the last mile of its course, in which it passes through a portion of the town of Clifton. Its flood discharge per mile of drainage area is not greater, however, than that of other streams in the district. For check dams in the water courses tributary to the San Francisco between Clifton and Blue River a total of $157,470 is recommended, distributed as shown in the appended list of retardation works.

DIX CREEK.

This is the first important stream which enters the San Francisco above Blue River. It drains the western part of the north slope of Big Lue Mountain, and with a drainage area of 35.9 square miles, one-fifth of which has a light cover of juniper, oak, and pine, had a flood discharge in the October storm of 6,060 cubic feet per second, or 169 cubic feet per second per square mile, and shows a maximum discharge of 10,260 cubic feet per second, or 285 cubic feet per second per square mile. Flood conditions in this watershed have grown worse in recent years as the result of overgrazing in Pleasant Valley and on Lightening Mesa, Dix Mesa, Burntstump Mesa, and the upper mountain slopes, which formerly were well sodded. In the lower portion of the stream 25 years ago a considerable area of bottom land was farmed where now is only a bowlder wash. A thorough treatment by check dams is recommended for this stream. The cost is estimated at $66,010.

BIG LUE CANYON.

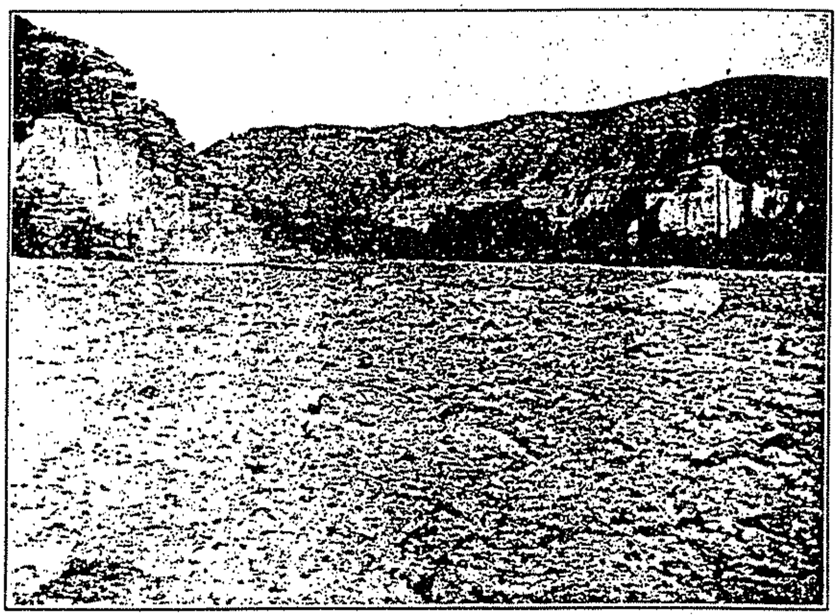
The west slopes of Table Top Mesa and Grassy Mountain and the north slopes of Big Lue Mountain drain into this canyon. The area of the watershed is 28.5 square miles, about 60 per cent of which has a forest cover, principally of oak, juniper, and pine. The flood discharge of the October storm was 4,440 cubic feet per second, or 156 cubic feet per second per square mile of drainage area. Higher flood marks than those on which this estimate is based could not be found. An expenditure of $17,940 is recommended for check dams for the upper portions of the canyon and in the tributary watercourses.

HARDEN CIENEGA CREEK.

This stream drains an open country. Only about 10 per cent of its watershed, or 33.6 square miles, is timbered. Notwithstanding the low percentage of forest cover the October flood discharge was but 2,130 cubic feet per second, or 63 cubic feet per second per square mile. No evidence of a greater discharge could be found. Because of its relatively low flood flow no expenditure upon this stream seems necessary.

INDIAN CREEK, BIG PINE CANYON, CITIZEN CANYON.

Of the streams entering the San Francisco from the north between the Blue River and Mule Creek the following have been selected for treatment: Indian Creek, area 8.1 square miles, 20 per cent timbered, with a maximum discharge of 5,400 cubic feet per second, or 255 cubic feet per second per square mile; Citizen Canyon, area 23.3 square miles, 10 per cent timbered, with a maximum discharge of 5,960 cubic feet per second, or 255 cubic feet per second per square mile; Big Pine Canyon, area 8.4 square miles, 10 per cent timbered, with a maximum discharge of 2,790 cubic feet per second, or 322 cubic feet per second per square mile; and the stream designated as No. 19 on the San Francisco drainage area, having a watershed of 2.6 square miles and a maximum discharge 1,290 cubic feet per second per square mile. A total of $70,495 distributed as shown on the appended list of retardation works, is recommended for the treatment of these watercourses.



BLUE, 2,000 FEET ABOVE MOUTH.

MULE CREEK.

The area of the drainage basin of this stream is 86.6 square miles. About half of it is forested. The mountain divide which forms its southern boundary has an altitude of about 7,000 feet. The central portion of the basin is a mesa having an altitude of about 5,300 feet, and in the last 5 miles of its course the stream descends to the river through a deep canyon offering favorable conditions for rock fill dams. On November 22, 1916, the flow was 7 cubic feet per second. The crest discharge in the October storm was 8,900 cubic feet per second, or 103 cubic feet per second per square mile. No evidence of any greater former flow could be found. The estimated cost of treating this watershed is $57,500.

BLUE RIVER.

There are no good reservoir sites on Blue River although there are several good dam sites. The grade of the stream is too great and the canyon in general too narrow to afford any considerable storage. The best dam site is half a mile above the H. U. Bar ranch in section 24, township 10 south, range 30 east. The river here has cut through a trap-rock dike. The width between walls at the low-water level is 46 feet and at 102 feet above this level the walls are 119 feet apart. Above this elevation the distance between them increases rapidly.

Probably the next best dam site on Blue River is that about 6½ miles above its mouth and one-fourth mile below the mouth of Clear Creek. This site is in a sandstone trough, the lower side of which rises to a height of 90 feet above the present bed of the stream. The width between sides at the bottom is 133 feet and at 90 feet above the bottom they are 261 feet apart. A structure this high would store 11,400 acre-feet.

A third dam site was noted a short distance below the mouth of K. P. Creek about 27 miles above the mouth of Blue River. It is in a tarp-rock canyon having at this point a bottom width of 124 feet and a width of 223 feet at 83 feet above the bottom. An 80-foot dam would store 3,000 acre-feet.

This stream rises on the east slope of the Datil Mountains and immediately south of the headwaters of the San Francisco River. Flowing in a general southerly course, at 66 miles from the source of its longest tributary, the Campbell Blue, it enters the San Francisco at a point 19 miles above Clifton, 29 miles above the mouth of the San Francisco and 110 miles, by river, from San Carlos.

From an elevation of 9,000 feet in Datil Mountains, which form the divide between the Gila Basin and that of the Little Colorado, the Blue River descends to an elevation of 3,850 feet at its mouth, a fall of 5,170 feet, or an average of 78 feet to the mile. Its drainage basin is roughly rectangular, being about 14 miles wide and 43 miles long, and having an area of 605 square miles, or 387,200 acres

The predominant country rock is a hard red or white sandstone, usually containing older rock in the form of pebbles, cobbles, and angular fragments. The matrix is as hard as the embedded stones, and where exposed to erosion all wear down together, presenting a smooth surface made of many different rocks. The dip of the sandstone seldom exceeds 10°-and is, for the most part, much less. Many buttes and cliffs occur in this nearly level formation as a result of erosion beneath covering strata having a weather-resisting capacity greater than that of the rock below. In this formation the watercourses usually have troughlike sections with occasional vertical falls. Rock for construction purposes would generally have to be loosened by blasting. At many of the dam sites most of the rocks required can be blasted directly into place from cliffs above.

There are also numerous intrusions and extensive flows of volcanic rock. The eruptive rock is principally trap and because of its great weight and the ease with which it can be separated into blocks of suitable size it is well adapted for use in check dams. The canyons in this formation are usually narrow and deep, having steeply stepped walls, from the higher elevations of which material for damming the canyons below may readily be stripped.

About 400 square miles, or 66 per cent, of the watershed is timbered, the density of vegetation being greater about the headwaters and rapidly decreasing toward the mouth of the river where large areas have only a desert growth. The yellow pine, pinon, juniper, oak, and cottonwood of the upper portions of the watershed give place in the lower to mesquite, yucca, greasewood, bear grass, and cacti.

The slopes of the Blue River have but little sod. Upon the mesas and mountain slopes well back from the river a fair sod still exists, but the entire watershed has suffered greatly from overgrazing, though in recent years under the stricter supervision of the Forest Service less than formerly.

White gramma grass, an excellent forage plant, attaining a height of 30 inches, once grew luxuriantly over all the open country, and pine grass covered the woodlands. These grasses defied the encroachment of weeds, but since the sod has been injured and sometimes destroyed by overgrazing and the evils that attend and follow after it, weeds of many kinds have obtained a foothold and taken the place of the native grasses. Among these weeds are the sunflower, horehound, snake weed, and rabbit grass. An inferior but very prolific grass, known as six weeks grass, has appeared in recent years and spread over the country. It follows the summer rains, is short lived, and has little value as forage.

Thirty years ago the Blue River flowed through a sodded or cultivated bottom land and in the channel lined with tall pines and cottonwoods. The valley, which had an average width of 700 feet, was well settled and nearly all under cultivation. To-day the bottom is a wide wash. Portions of a few of the ranches lying below projecting dikes or in coves have escaped the general destruction of the flood of recent years, but they do not aggregate 200 acres in all and represent less than 8 per cent of the original arable area.

The average annual precipitation of the Blue River Basin, as estimated from rainfall records extending over the period from 1895 to 1915, inclusive, is 19.15 inches, or 618,000 acre-feet.

During the storm of October, 1916, which produced the greatest flood that has ever occurred in the Blue River, the average precipitation for the whole watershed was 5.4 inches, or 174,300 acre-feet. As the examination of this stream was made within six weeks after the occurrence of the flood and as most of the contributing streams were also at their highest during this storm, it is thought that the flood crest discharges of the streams of this basin fairly represent the run-off conditions of their respective watersheds. In drawing conclusions from such evidence, however, it must be borne in mind that, other conditions remaining the same, the flood crest discharge rapidly decreases as the area of the drainage basin increases.

In marked contrast with the San Francisco, the Blue River is normally clear and free from silt. Its water may be distinguished from that of the San Francisco for some distance below their confluence. In general, the streams of the Blue River Basin flow in beds of gravel and bowlders or in solid rock troughs, into which very little silt is washed except in times of considerable floods.

The estimated flood crest discharge of Blue River near its mouth in the October flood was 31,900 cubic feet per second, or 53 cubic feet per second per square mile of drainage area. According to Mr. William R. Warner, of the base line ranger station, the crest was maintained for six hours and was about 10 inches higher than that of the flood of January, 1916, which, up to that time, had been regarded as the maximum. A discharge of 31,900 cubic feet per second would amount to 15,830 acre-feet during the six-hour crest period, or 9.1 per cent of the rainfall of the entire storm.

Unless retarding works were constructed to reduce the velocity of the water that would enter these reservoirs and cause the deposition before reaching them of most of the solid matter carried by it, they would in time be filled with detritus. They can, therefore, only be regarded as a part of the general scheme of flood control and not as offering a complete solution of the problem even for this tributary.

Pat Creek, entering Blue River from the west near its mouth, drains the barren south slope of Pat Mountain, the south half of Pat Mesa, and the north of Sunflower Mesa. Its drainage area is 5.5 square miles, and its maximum flood-crest discharge is 4,280 cubic feet per second, or 780 cubic feet per second per square mile. It is a narrow trough in sandstone, and can be cheaply and effectively treated.

Cienega Creek has a drainage area of 6.1 square miles and a maximum flood-crest discharge of 4,230 cubic feet per second, or 694 cubic feet per second per square mile. The upper portion of this watershed is scantily covered with brush. Near its mouth the canyon is narrow and can be cheaply dammed. It is susceptible for sufficient treatment to greatly reduce its abnormal flood discharge.

Pigeon Creek, with its tributaries, Bear Creek, Turkey Creek, and Cow Canyon, drains an area of 66.8 square miles, and had in the flood of October, 1916, a maximum crest discharge of 10,600 cubic feet per second, or 166 cubic feet per second per square mile. The country rock is sandstone, but there are numerous intrusions of volcanic rock. About one-third of the area of this watershed has a scanty growth of pinon, juniper, and scrub oak. Gramma grass grows upon the upper mountain slopes and on the high mesas, but the sod is generally inadequate for the proper protection of the soil.

Pigeon Creek passes through numerous deep and narrow boxes, one, about 2½ miles below the Slaughter ranch, affording an opportunity for considerable storage. Another site of the same kind exists on Turkey Creek, a quarter of a mile below the Chitty ranch. The canyon at the former site has a bottom width of 20 feet, and is 75 feet wide at 75 feet above the bottom. A rock-fill dam at this point would cost about $5,900, and store about 1,850 acre-feet of water.

The box on Turkey Creek, near Chitty ranch, has a bottom width of 10 feet, and is 20 feet wide 75 feet feet above the bottom. A rock-fill dam at this site would cost about $2,200.

Conditions over the entire Pigeon Creek Basin are generally favorable for greatly reducing the present high flood discharge by constructing check dams of moderate cost. In some localities the cost of loosening the rock by blasting may be prohibitive, but there are many places where rock in large masses can be blasted directly into position in the dam at small expense. Much can be accomplished in bettering conditions by taking advantage of the many exceptionally favorable opportunities for cheap and effective construction.

Mud Springs Canyon, Wild Bunch Canyon, Fritz Canyon, Horse Canyon, and Maple Canyon drain the rugged western slopes of Maple Peak. The lower portions of the canyons are in sandstone, but the trap rock of the ridge, which is intrusive, extends well down the mountain sides, so that the upper portions of these watercourses are entirely in the harder rock. There is a scanty growth of juniper, oak, and pine in the stream bottoms and over the upper portions of their watershed, but little grass or other vegetation. The flood-crest discharge of these streams averaged about 500 cubic feet per second per square mile of drainage area. This high run-off is due in large measure to the steepness of the mountain slopes. The streams in their short courses from the ridge to the river have a fall of about 3,000 feet. Material for the cheap construction of check dams is readily available, and the channels of the watercourses, especially near their mouths where they break into the river through parallel reaches, present many narrows and gorges that can be filled with rock at small expense.

Excepting the lightly timbered areas along their banks, Clear Creek and Alder Creek drain an open country almost destitute of sod. A month after the storm of October, 1916, they were flowing, respectively, one-quarter and one-half cubic feet per second. The Clear Creek Basin has an area of 17.8 square miles and a maximum flood discharge of 6,680 cubic feet per second, or 376 cubic feet per second per square mile. It passes through a narrow box near its mouth and through a wider box about 2 miles above its mouth. It is not well adapted to check dam treatment throughout its length, but its flood discharge can be greatly modified by treatment of those portions in which check dams can be built cheaply and by a similar treatment of its tributary.

The drainage area of Alder Creek is 5.3 square miles, and its maximum discharge is 13,200 cubic feet per second, or 2,500 cubic feet per second per square mile. The flood marks attesting this enormous run-off are unmistakable and were verified by eyewitnesses of the flood who were present when they were made. Alder Creek passes through numerous narrow boxes and is susceptible of check-dam treatment sufficient to reduce its flood discharge to very moderate proportions.

Little Blue Creek with its tributary, Dutch Blue Creek, drains an area largely of sandstone. To the south of the Little Blue Creek and Hanah Springs Creek much of the rock is trap. Excepting a barren area of about 7 square miles extending some 4 miles up Little Blue Creek and about 3 miles up Dutch Blue Creek, the watershed is covered with a scattering growth of juniper, pinon, scrub oak, bear grass, and yucca. In the trap-rock area the ground is covered with stones. Gramma grass once grew in great abundance over most of the area, and in the stony places it still has a firm hold, but the sod generally is poor and considerable erosion is taking place. The area of the Little Blue Creek basin is 24.9 square miles and the maximum discharge at its mouth during the October flood was 8,060 cubic feet per second, or 324 cubic feet per second per square mile. The flow on November 20, 1916, five weeks after the storm, was 2 cubic feet per second.

Measurement of the flood flows of the two forks of Dutch Blue Creek at the Alma Trail just above their confluence shows a maximum discharge of 1,750 cubic feet per second, or 211 cubic feet per second per square mile for the west fork and 1,623 cubic feet per second, or 270 cubic feet per second per square mile of drainage area for the east fork. Measurement of Little Blue Creek at the trail shows a flood discharge of 2,490 cubic feet per second, or 157 cubic feet per second per square mile of drainage area. The higher discharge per square mile at its mouth is attributed to the rapid run-off from the barren slopes below the point at which these upper measurements were taken.

Little Blue Creek flows through an almost continuous canyon which in some places is not over 10 feet wide at the bottom. At 1,000 feet above the mouth of Hanah Springs Canyon it is 6 feet wide at the bottom and 16 feet wide at 50 feet above the bottom. Favorable conditions for check dams exist also on most parts of the other streams of this watershed. Small trees grow in considerable number along the watercourses.

In the October flood Squaw Creek had a discharge of 12,200 cubic feet per second from its drainage area of 37.3 square miles, or 327 cubic feet per second per square mile. On November 20, five weeks after the storm, its flow was 3 cubic feet per second. In its lower portion it passes through numerous boxes of an average width of 30 feet, but above the

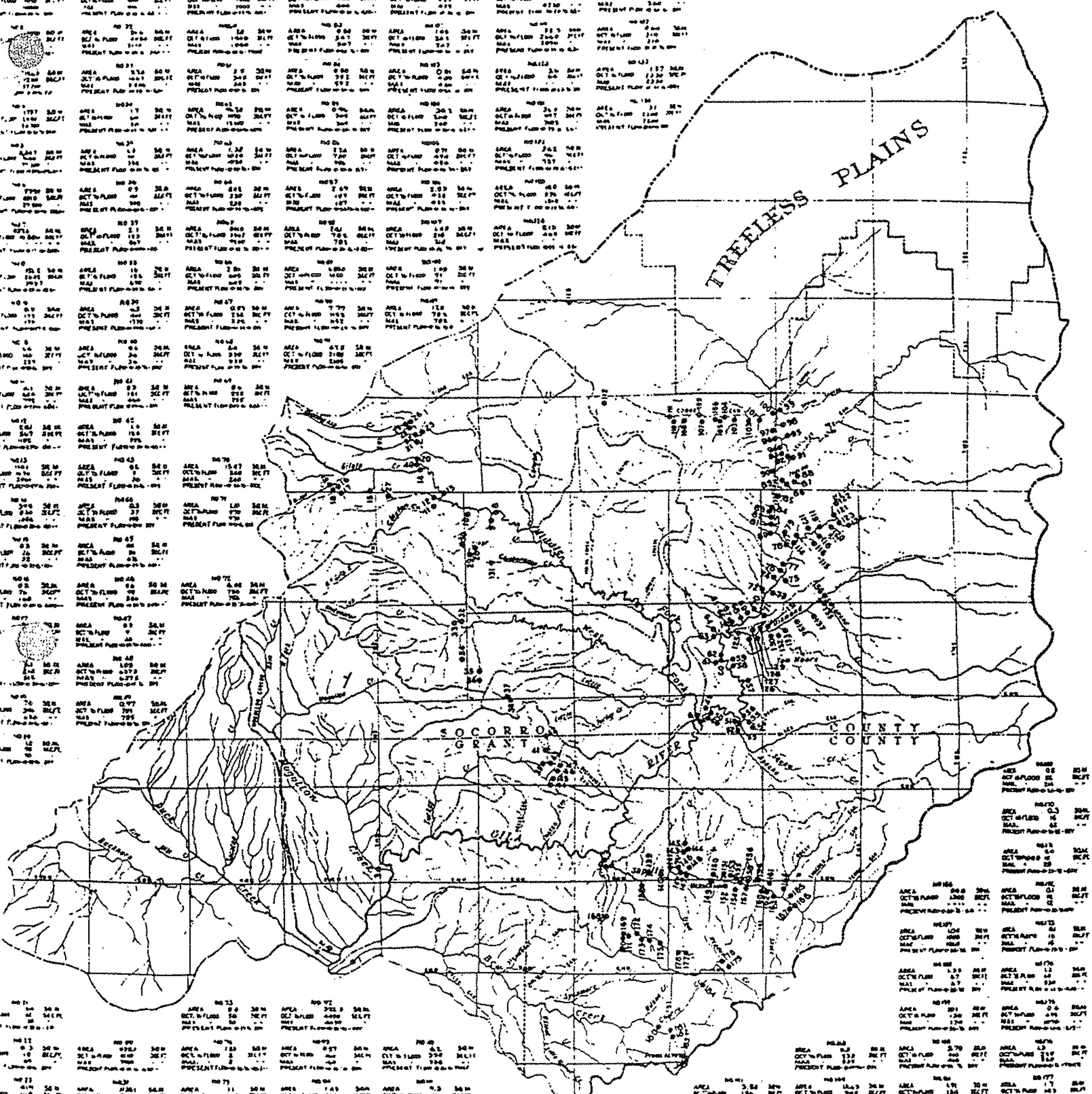
A. B. Bar ranch it flows through an open country. Its largest tributary, Rousensock Creek, passes through boxes of an average width of 25 feet. Thomas Creek, its second longest tributary, near its mouth also passes through a narrow box a mile long. The need of an effective treatment of these streams is further emphasized by the high flood discharges of the neighboring streams on the north up to and including Oak Creek, which show, taken together, an average flood flow of 1,010 cubic feet per second per square mile of drainage area. In striking contrast with this figure is the low flood discharge of Stray Horse Creek, the next stream north, amounting to only 966 cubic feet per second, or 35 cubic feet per second per square mile of drainage area, indicating a condition of comparative excellence over its watershed and in the stream itself that removes it from consideration as a flood feeder.

The short streams entering Blue River from the east between the H. U. Bar ranch and Dry Blue Creek, excepting Johnson Creek, have large flood discharges but not discharges so excessive as those of the streams to the south. A denser forest cover and a heavier growth of brush and grass tend rapidly to reduce the run-off, notwithstanding the increase in rainfall. Johnson Creek, with an area of only 6.3 square miles, has a relatively low flood run-off of 41 cubic feet per second per square mile.

Of the streams entering Blue River from the west above Stray Horse Creek, K. P. Creek is most in need of treatment, having a flood of 15,000 cubic feet per second from a drainage of but 7.6 square miles. Grant Creek comes next with a discharge of 7,600 cubic feet per second from an area of 16.4 square miles. Both of these streams pass through boxes which afford good sites for check dams, and in general the stream channels of this portion of the watershed are adapted to receive sufficient treatment to reduce their flood discharges to moderate proportions.

San Francisco system.

Portion.	Type C structures.		Type D structures.		Type B structures.		Total.	
	Vertical height (total).	Cost.	Vertical height (total).	Cost.	Vertical height (total).	Cost.	Vertical height (total).	Cost.
	Feet.		*Feet.*		*Feet.*		*Feet.*	
Frisco above Luna	60,500	$75,600	960	$23,800			61,460	$104,400
Trout Creek	15,360	19,200	120	2,400			15,480	21,600
Dillman Creek	10,240	12,800	144	2,880			10,384	15,680
Center Fire Creek	49,600	62,000	1,890	42,000			51,490	104,000
Devil Creek	4,800	6,000					4,800	6,000
Largo Creek	35,840	44,800	240	16,000			36,080	60,800
Stockweather Creek	36,350	45,440	480	16,000			36,860	61,440
West Fork Apache Creek	15,440	19,300					15,440	19,300
Middle Fork	24,000	30,000	190	3,800			24,190	33,800
East Fork Apache Creek	20,320	25,400	600	12,000			20,920	37,400
Apache between forks and mouth	59,440	74,300	324	12,000			59,764	86,300
Canon del Buey	4,540	5,675	120	2,400			4,660	8,075
Tularosa above Apache Creek	20,920	26,150	600	23,840			21,520	49,990
Tularosa between Apache and Negrito	19,323	24,160	150	15,000			19,478	39,160
Sign Camp Canyon, Negrito Creek	52,736	65,920	120	3,200			52,856	69,120
Saliz Creek	58,000	72,500	240	16,000			58,240	88,500
Devils Creek	12,000	15,000					12,000	15,000
Pueblo Creek	36,000	45,000					36,000	45,000
Keller Canyon	40,000	50,000					40,000	50,000
Mineral Creek	30,000	37,500	420	12,500			30,420	50,000
Gila Canyon	40,000	50,000					40,000	50,000
Whitewater Creek	15,000	18,750	210	6,250			15,210	25,000
Dry Creek	36,000	45,000					36,000	45,000
Mule Creek	40,000	50,000					40,000	50,000
Big Pine Canyon	6,720	8,400					6,720	8,400
Citizen Canyon	29,840	37,300					29,840	37,300
Indian Creek	10,400	13,000					10,400	13,000
Big Lue Canyon	12,470	15,600					12,470	15,600
Dix Creek	45,900	57,400					45,900	57,400
Campbell Blue	34,960	43,700	60	5,000	270	$4,500	35,200	53,200
Turkey Creek	9,600	12,000	24	750	75	1,250	9,699	14,000
Dry Blue	24,000	30,000	168	6,850	225	3,750	24,393	40,600
West Center Fire	7,200	9,000			60	1,000	7,260	10,000
Johnson Creek	3,200	4,000	24	500	30	500	3,254	5,000
Tutt Creek	7,200	9,000			60	1,000	7,260	10,000
Cow Creek	3,600	4,500	36	700	30	500	3,666	5,700
Twin Springs Canyon	1,800	2,250	24	500	15	250	1,839	3,000
South Canyon	2,850	3,600			30	500	2,910	4,100
Lamphier Creek	3,600	4,500			30	500	3,630	5,000
Largo Canyon	400	500					400	500
Foote Creek	15,038	18,800			120	2,000	15,158	20,800
Fish Hook Creek	10,800	13,500			90	1,500	10,890	15,000
Grant Creek	14,600	18,250			105	1,750	14,705	20,000
Steeple Creek	6,280	7,850			45	750	6,325	8,600
Bear Creek	2,800	3,500			30	500	2,830	4,000
K. P. Creek	10,960	13,700			90	1,500	11,050	15,200
Tornado Creek	2,360	2,950			15	250	2,375	3,200
Stray Horse Canyon	3,600	4,500			30	500	3,630	5,000
Oak Creek	7,160	8,950			75	1,250	7,235	10,200
Squaw Creek	25,600	32,000			135	2,250	25,735	34,250
Little Blue Creek	25,600	32,000			180	3,000	25,780	35,000
Maple Canyon	6,400	8,000			60	1,000	6,400	9,000
Horse Canyon	8,400	10,500			90	1,500	8,490	12,000



UPPER GILA RIVER

San Francisco system.—Continued.

Portion.	Type C structures.		Type D structures.		Type B structures.		Total.	
	Vertical height (total).	Cost.	Vertical height (total).	Cost.	Vertical height (total).	Cost.	Vertical height (total).	Cost.
	Feet.		*Feet.*		*Feet.*		*Feet.*	
Alder Creek	3,840	$4,800			45	$750	3,885	$5,550
Manning Creek	3,600	4,500			30	500	3,630	5,000
Fritz Canyon	4,200	5,250			45	750	4,245	6,000
Clear Creek	12,800	16,000			45	750	12,845	16,750
Pigeon Creek	18,440	23,050			300	5,000	18,740	28,050
Cienega Creek	4,100	5,120			45	750	4,145	5,870
Pat Creek	6,400	8,000			45	750	6,445	8,750
Hickey Canyon	5,880	7,350					5,880	7,350
Orejana Creek	5,880	7,350					5,880	7,350
Sardine Creek	19,090	23,850					19,090	23,850
Dorsey Gulch	3,120	3,900					3,120	3,900
Colorado Gulch	4,050	5,100					4,080	5,100
Limestone Gulch	13,824	17,280					13,824	17,280
Chase Creek	35,850	44,800					35,850	44,800
Ward Creek	15,600	19,500					15,600	19,500
Miscellaneous	89,400	111,800	1,428	$100,000	6,000	100,000	96,828	311,800
Total	1,325,916	1,657,395	8,572	329,370	8,445	140,750	1,342,933	2,127,515
Contingencies, engineering, overhead, 15 per cent								319,127
Grand total								2,446,642

EAST FORK OF THE GILA RIVER.

The East Fork of the Gila River, which heads in the Black Range of the Continental Divide, the Elk Mountain Divide, and the Tucson Mountains, has an extreme length of 59 miles from its mouth to the head of its longest feeder, Beaver Creek. In this distance it rises from an elevation of 5,540 feet to 9,750 feet. This is an average grade of 1.35 per cent. The area of this watershed is 1,137.6 square miles, and the average annual rainfall is 15 inches, or 910,080 acre-feet. The maximum rate of discharge from this area as obtained by flood marks is 16,800 cubic feet per second, or 14.8 cubic feet per second per square mile.

The small unit flow would indicate that the East Fork of the Gila River is not in any sense of the word a bad flood feeder. Large flood crests from out of this branch in the past have undoubtedly been due to extraordinary rainfall, rather than to any physical trouble in the watershed, but like all of these streams it has its bad portions. The greater part of the flood flow of the East Fork is discharged from those feeders which head on Black Mountain and Indian Creek. Erosion is progressing very rapidly in those areas, and it is believed that this can be overcome by the application of the check-dam idea. It is thought advisable to reduce the grade in the main East Fork above its junction with Diamond Creek and in the Beaver Canyon up to its junction with Indian Creek. In addition, it is proposed to construct two rock fill dams in the East Fork above its junction with Beaver Creek. This will constitute the proposed works on the East Fork of the Gila River.

The following are notes pertaining to feeders of the East Fork of the Gila River:

EAST FORK OF GILA, ABOVE JUNCTION WITH BEAVER CREEK.

In the Gila River immediately above the junction with Beaver Creek there is a rock fill dam site in which probably a 50-foot structure might be built. It is a short mile above the forks, at an elevation of 6,350 feet. The rock is a metamorphosed conglomerate and would probably fall in large units. This structure would probably contain approximately 2,500 cubic yards of material, which would probably cost $1,250. This structure would back up the water in a flat, wide portion of the canyon, known as Sayre's ranch, and would afford considerable storage. A scant mile farther up is another rock fill dam site, where it is possible to construct a 50-foot dam. This site is at elevation 6,390 feet, and would contain 5,500 cubic yards of material, and would cost $2,750. The rock is the same as in the first site, but would have a greater distance to fall. This dam would back the water into the large flat caused by the junction of Gila River and Hoyt Creek. The Gila in this reach is in the main a broad gravel wash and shows considerable erosion. Checking in the main stream is not practicable outside of the two rock fill dams mentioned.

HOYT CREEK.

Hoyt Creek is an exceedingly wide flat valley, which does not appear to have had excessive flood flows. The channel proper is a gravel and bowlder wash, and the fact that the flood waters are so well spread out probably accounts for the proportionately high normal discharge at its mouth. There is undoubtedly opportunity for further conservation in this and other canyons of its nature.

COX CANYON.

Cox Canyon is much the same as Hoyt Canyon, on a smaller scale. The flood flows have been small and the normal flow comparatively large. Checking is possible in this canyon above a point 2 miles from the mouth.

WHITEWATER CANYON.

Whitewater Canyon is the main feeder of the upper East Fork of the Gila and is more or less of a gorge throughout its entire length. Great walls of volcanic rock flank both sides of the canyon, which, however, is too wide to permit of successful rock filling, although it may be that the relatively small amounts of flood water would not wash out small structures blasted into the canyon. Feeders drain a high mesa country; are short and very steep. It is not thought that this canyon needs a great deal of attention.

WHITETAIL CANYON.

This canyon is a narrow gorge, having rock bottom in many places and high velocity of flood flow. Small rock fill dams are possible almost anywhere, and the main canyon is so narrow that ordinary check dams can be constructed throughout its length.

EAST FORK OF GILA RIVER, BETWEEN DIAMOND CREEK AND BEAVER CREEK.

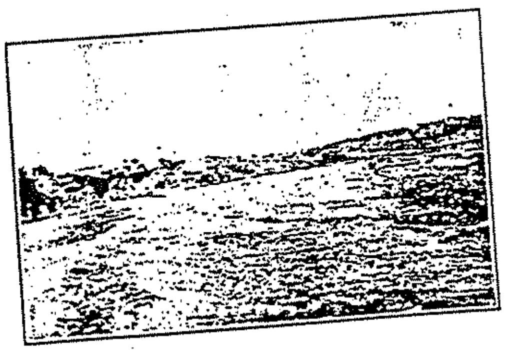
This reach of the Gila River is fed by numerous tributaries—on the west from the Black Mountain slopes, on the east from a high bench land. These streams throw large crests and great quantities of detritus into the Gila, and may be considered as bad streams. This is due to the great number of cattle belonging to the D. D. Bar ranch which graze on this area. The majority of these streams have been eroded clear to their source, and each year sees an increased quantity of solid matter poured into the Gila. These streams can all be easily checked with timber, but the rock is not of the best.

BEAVER CREEK.

The Beaver Canyon at its mouth is a comparatively flat valley about 100 feet in width. The flood waters have covered the entire valley with a deposit of sand and silt. This condition exists for a mile or more up this stream where its character changes and becomes more in the nature of a gorge. The tributaries entering this gorge show evidence of carrying great quantities of detritus, mostly volcanic rock. Above this gorge as far up as the mouth of Indian Creek there has been very heavy erosion in the canyon proper. What was formerly a great silt deposit suitable for agricultural purposes has been almost completely wiped out. Beaver Creek above the junction with Indian Creek has no stream way where the tenderest grasses and weeds are not growing. This despite the fact that the high water, October, 1916, covered the entire floor of the canyon. This reach of the Beaver is flanked on both sides by columnar cliffs of igneous formation, which have spalled great quantities of rock down into the canyon. These spallings, together with the detrital cones of the several small tributaries and watercourses have caused obstructions with correspondingly flatter grade. The great mass of loose rock and sands which has filled the canyon bottom has thus been allowed to absorb the flood waters at a maximum rate, and undoubtedly this is partially responsible for the zone of springs at the mouth of the Beaver. This condition exists for about 4 miles, and then the canyon opens out into a broad flat into which empty Corduroy Creek and upper Beaver. Above this flat Beaver Creek runs in a continually narrowing valley as far as the mouth of Cooney Canyon. In this reach there is considerable erosion and signs of flood water. This shows that the flat above referred to is a great equalizing influence on the flow of Beaver Creek. The last two storms have caused small gullies to start in Corduroy Flat and unless these are checked the waters will run through unrestricted. Immediately above the mouth of Cooney Canyon there is a body of water known as the V+T Lakes which covers the entire floor of Beaver Canyon for a distance of about three-fourths of a mile. This water is impounded by a small dam formed partially by the detrital cone of Kennedy Canyon and artificial work done by the V+T Ranch Co. There is no evidence that any flood crest has ever passed over this dam, and for a mile or so below the canyon is bursting with springs. A scant mile above these lakes Beaver Canyon branches; O-O

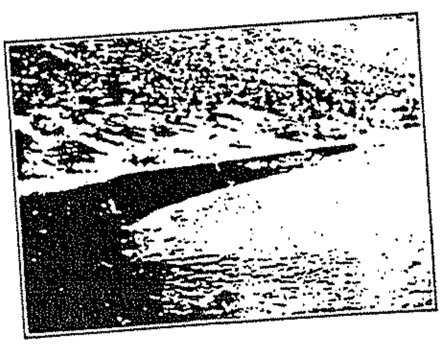
Rock Fill Dam Site, Sayre Ranch.

West Fork.



East Fork at D D Bar Ranch.

UPPER GILA RIVER.



Straight Cutting Down, East Fork.

Junction of Whitetail and Whitewater Creeks.

Canyon running northwest and Bear Canyon running northeast. There is no evidence that any surface water has been discharged by either of these feeders within recent times, and the same condition exists nearly to their heads. The feeders to the O–O Canyon discharge no water into that drainage line until Elk Mountain and the Tucson Mountains are reached. Some erosion was noted at these points, but the canyon floor succeeded in absorbing these discharges.

INDIAN CREEK.

Indian Creek is quite a flood feeder and carries considerable amounts of detritus even in low water. The canyon is alternatively narrow and broad for a distance of 3 miles above its mouth, when it becomes more in the nature of a valley. Gullying in the upper reaches is in quite an advanced stage and is being extended during each storm. This probably accounts for the bad condition of this stream. The small feeders are short and quite steep, contain great quantities of rock suitable for building check dams, and timber is quite plentiful throughout their length. These feeders can be easily checked and should not cost more than $750 per mile of their length. In the main Indian Creek the narrow portions can be checked with rock dams and the broader portions perhaps with timber and earth embankments, with spillways of timber at the ends. There are no opportunities for rock fill dam, although in many places large units of rock can be blasted down to serve as bases for check dams. Pine, oak, and cottonwood are very plentiful in the main canyon. Grass is plentiful except in the immediate neighborhood of the permanent water.

COONEY CANYON.

Cooney Canyon might be more appropriately called Cooney Valley. Of its average bottom width of 100 feet only about 20 feet is taken up as a water course, the remaining 80 feet being covered with grass and pine trees. The restricted channel has in many places vertical sides and the scars all appear to be new. I believe that it is only within the last few years that Cooney Canyon has become a flood feeder of any consequence. It would seem that dikes or embankments such as formed the V+T Lakes might be used to advantage in correcting this stream. Six miles or more from its mouth Cooney Canyon is joined by Houghton Canyon, which has its head on the Elk Mountain divide. This canyon is in good shape, is heavily timbered, well grassed, and needs no correction. On the other hand, Cooney Canyon above the mouth of Houghton Canyon, which drains a portion of the Black Mountain mesa, has had considerable erosion and will sometime need treatment.

CORDUROY CANYON.

Corduroy Canyon is not a bad flood feeder of the Beaver Canyon but, due to gullying, its flood peaks are delivered much too rapidly into the flats. This is tending to continue the gullying through the flats and must be stopped if the Beaver remain in its present good state. This drainage line is like a valley near its mouth but frequently a boxed canyon above. The feeders are short, steep, and easily checked.

KENNEDY CANYON.

Kennedy Canyon and its main tributary, Spring Canyon, drain high mesas by means of numerous short tributaries in which there has been considerable gullying and which can be readily checked. There are many places where the main canyons themselves can be and should be treated as any considerable flood crest from this drainage would menace the dam which confines the V+T Lakes.

DIAMOND CREEK.

This stream runs in a wide valleylike canyon, full of pine and sycamore. It has only had moderate flood flows during the past few years. In 1909, however, a great flood swept out of its east branch and almost inundated the whole valley throughout its length (C. Montoya). The valley is filled with timber, cottonwood and pine, and this offered so much obstruction to the great flood of 1909 that the erosion in the middle and lower reaches was slight.

SOUTH FORK.

This branch has not had a bad flood in recent times. It is a wide valley (850 feet), well grassed and having a large stand of pine. This valley carries no normal surface flow, but numerous springs burst out of the ground at its mouth.

EAST FORK.

This has much the same nature as the South Fork but is in far worse shape from erosion, and has far worse flood flows.

NORTH STAR CANYON.

This canyon drains high pine-clad mesas and is flanked on both sides by low, rocky bluffs. This drainage is well grassed but the numerous cattle grazing on these mesas have caused gullying to start in its upper reaches.

The cost of the proposed work is as follows:

Cost of flood-prevention works, East Fork Gila River.

Portion.	Type B.		Type C.		Type D.		Total.	
	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.
	Feet.		*Feet.*		*Feet.*		*Feet.*	
Tributaries to East Fork between Diamond Creek and Beaver Creek			67,684	$84,490	240	$8,000	67,924	$92.480
Tributaries to Beaver from East Fork of Gila to Indian Creek			22,528	28,160	240	8,000	22,768	36,160
East Fork Gila above junction with Beaver Creek	100	$4,000					100	4,000
Beaver Creek above Indian Creek					30	2,000	30	2,000
Tributaries of Cooney Canyon					120	4,000	120	4,000
Main Cooney Canyon					66	4,400	166	4,400
Main Gila between Diamond and Beaver Creeks					93	6,200	93	6,200
Main Beaver from mouth to Indian Creek					51	3,400	51	3,400
Beaver above Indian					30	2,000	30	2,000
Indian Creek			22,528	28,160	24	800	22,552	28,960
Total	100	4,000	112,740	140,800	894	38,800	113,834	183,600
Engineering, contingencies, and overhead, 15 per cent								27,540
Grand total								211,140

SAPILLO CREEK.

This stream has an area of contributing watershed of 173.7 square miles and may be considered as one of the worst feeders of the upper Gila River, with a unit maximum discharge estimated from flood marks of 200 cubic feet per second per square mile of area. It has its heading on that portion of the Continental Divide known as Black Range at elevations ranging between 7,000 and 8,000 feet. There is an average rainfall over the area of 15 inches, or 138,950 acre-feet.

This stream in its middle reaches winds through a broad, flat valley in which there used to be considerable farming. Constant encroachments of the stream has taken some and threatens to take the entire area that might be adapted to this pursuit. The principal tributaries in this middle reach enter through gullies or barrancas in easily erodible material, and each year are being cut deeper with corresponding shorter periods for delivery of flood waters.

The upper reaches are all badly gullied and are carrying ever-increasing amounts of detritus.

The lower one-third of the area is of a very precipitous and rocky nature, and contains several sites suitable for loose-rock dams (type B). An outline of the cost of the flood prevention works proposed follows:

Sapillo Creek.

Name.	Type B.		Type C.		Type D.		Total.	
	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.
	Feet.		*Feet.*		*Feet.*		*Feet.*	
Skate Creek	13,200	$16,500	90	$1,800			13,290	$18,300
Lincoln Creek and tributaries	29,120	36,400	133	4,000			29,253	40,400
Rocky Canyon	29,120	36,400	200	4,000			29,320	40,400
Meadow Creek	5,600	7,000	168	3,400			5,768	10,400
Jay Bird Canyon	4,000	5,000	168	3,400			4,168	8,400
Trout Creek	4,000	5,000	168	3,400			4,168	8,400
Main Sapillo and minor tributaries	28,000	35,000	495	9,900	425	$8,750	28,920	53,650
Total	113,040	141,300	1,422	29,900	425	8,750	114,887	179,950
Engineering, contingencies, and overhead, 15 per cent								26,992
Grand total								206,942

WEST FORK OF GILA RIVER.

The West Fork of the Gila has an area of watershed of 539 square miles. The maximum length of this stream, from its mouth to the head of its longest tributary, is 50 miles, and in this distance there is a rise in elevation from 5,540 to 10,982 feet, with an average grade for this reach of 2.06 per cent.

The average annual rainfall over this area is 15 inches, or 431,000 acre-feet, and the maximum rate of run-off as determined by flood marks is 27,500 cubic feet per second, or 51 cubic feet per second per square mile of area.

Check dam treatment is proposed for the tributaries entering the West Fork from the south, including Little Creek and Whitewater Creek. Also for Indian Creek, Jordan Canyon, Clear Creek, Clayton Canyon, Chicken Coop Canyon, and the small tributaries to the Middle Fork between Clear Creek and Clayton Canyon.

Log cross structures (type D) are proposed for the main Middle Fork from the mouth of Jordan Canyon to the mouth of Clayton Canyon, and in the lower 1 mile of the main feeders in that reach. Log cross structures of the same type to be installed in the main West Fork between the ranger station and the mouth of Whitewater Creek, and in the lower 1 mile of the principal feeders in that distance. An outline of the cost of the flood-prevention works proposed follows:

West Fork of Gila River.

Name.	Type C structures.		Type D structures.		Total.	
	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.
	Feet.		*Feet.*		*Feet.*	
Willow Creek	4,000	$5,000	51	$1,000	4,051	$6,000
Little Turkey Creek	4,000	5,000			4,000	5,000
Gilita Creek exclusive of Willow and Little Turkey Creeks	16,000	20,000	201	4,000	16,201	24,000
Quaking Asp	4,000	5,000			4,000	5,000
Snow Creek	8,000	10,000	126	2,500	8,126	12,500
T. Bar Creek	6,400	8,000	99	2,000	6,499	10,000
Iron Creek	8,000	10,000	126	2,500	8,126	12,500
Clayton Creek	4,000	5,000			4,000	5,000
Canyon Creek	16,000	20,000	252	5,000	16,252	25,000
Clear Creek	4,000	5,000			4,000	5,000
Chickencoop Creek	4,000	5,000			4,000	5,000
Indian Creek	13,200	16,500	174	3,500	13,374	20,000
Jordan Canyon	10,000	12,500	126	2,500	10,126	15,000
Main Middle Fork and minor tributaries	20,000	25,000	186	37,320	20,186	62,320
Whitewater Creek and tributaries	20,000	25,000	252	5,000	20,252	30,000
West Fork above junction with Whitewater and tributaries	40,000	50,000	756	15,000	40,756	65,000
Little Creek and tributaries	13,200	16,500	174	3,500	13,374	20,000
Main West Fork and minor tributaries	20,000	25,000	1,260	25,000	21,260	50,000
Total	214,800	268,500	3,783	108,820	218,583	377,320
Engineering, contingencies, and overhead, 15 per cent						56,598
Grand total						433,918

MOGOLLON CREEK.

The watershed of this creek has an area of 126.3 square miles, of which 74 square miles is woodland. The mouth of Mogollon Creek is 179 miles above the San Carlos by river channel, and has an elevation of 4,600 feet, and its sources are among the precipitous eastern side slopes of the Mogollon Mountains, which attain in places an elevation of over 10,000 feet.

Haystack Mountain, Lookout Mountain, and Seventy-four Mountain are the prominent features of the mid reach of Mogollon Creek. The general character of the drainage is extremely rough. The Diablo Range of mountains, with Granite Peak and White Pinnacle, running northwest and southeast, define the drainage flow of the Mogollon and West Fork of the Gila. There was at one time a fairly good wagon road up Mogollon Creek, but it is now washed out and impassable.

The October 16 flood had a crest of 1,200 cubic feet per second with a previous maximum of 37,200 feet. Two hundred and ninety-five cubic feet per second crest flow per square mile indicates that in all probability retardation works are needed, though it is impossible to explain the low October 16 flood erosion. The opportunities are ample for providing building materials and the lateral canyons can be economically checked. An allowance is made for treating a zone reaching nearly to the crest line and running in a circle from the Diablo Range through to Black Mountain and including all the left-hand tributaries that furnish the larger part of the flood waters. It is estimated that this would call for 190,000 vertical feet of structure covering an area to be treated of 38,400 acres, and that the cost would be $190,000 (type C); for engineering, contingencies, and overhead, 15 per cent, $28,500; total, $218,500.

DUCK CREEK.

This stream which heads in the Mogollon Mountains has an extreme length of 25½ miles from its mouth to the head of its longest feeder, Sacaton Creek.

The area of the watershed is 289 square miles, which receives an annual average precipitation of 15 inches, or 231,200 acre-feet. The valleys feeding this stream are all very badly eroded, and it is imperative that this condition be remedied or the floods at the mouth will continue to increase in size. There follows an estimate of the cost of the work proposed:

	Type C structures.		Type D structures.		Total.	
	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.
	Feet.		*Feet.*		*Feet.*	
Buckhorn Creek	24,000	$30,000	372	$11,220	24,372	$41,220
Duck Creek above Buckhorn	20,000	25,000	280	8,460	20,280	33,460
Sacaton Creek	41,600	52,000	300	9,900	41,900	61,900
Main Duck Creek and minor tributaries	20,512	25,640	228	9,360	20,740	35,000
Total	106,112	132,640	1,180	38,940	107,292	171,580
Contingencies, engineering, and overhead, 15 per cent						25,737
Grand total						197,317

BEAR CREEK.

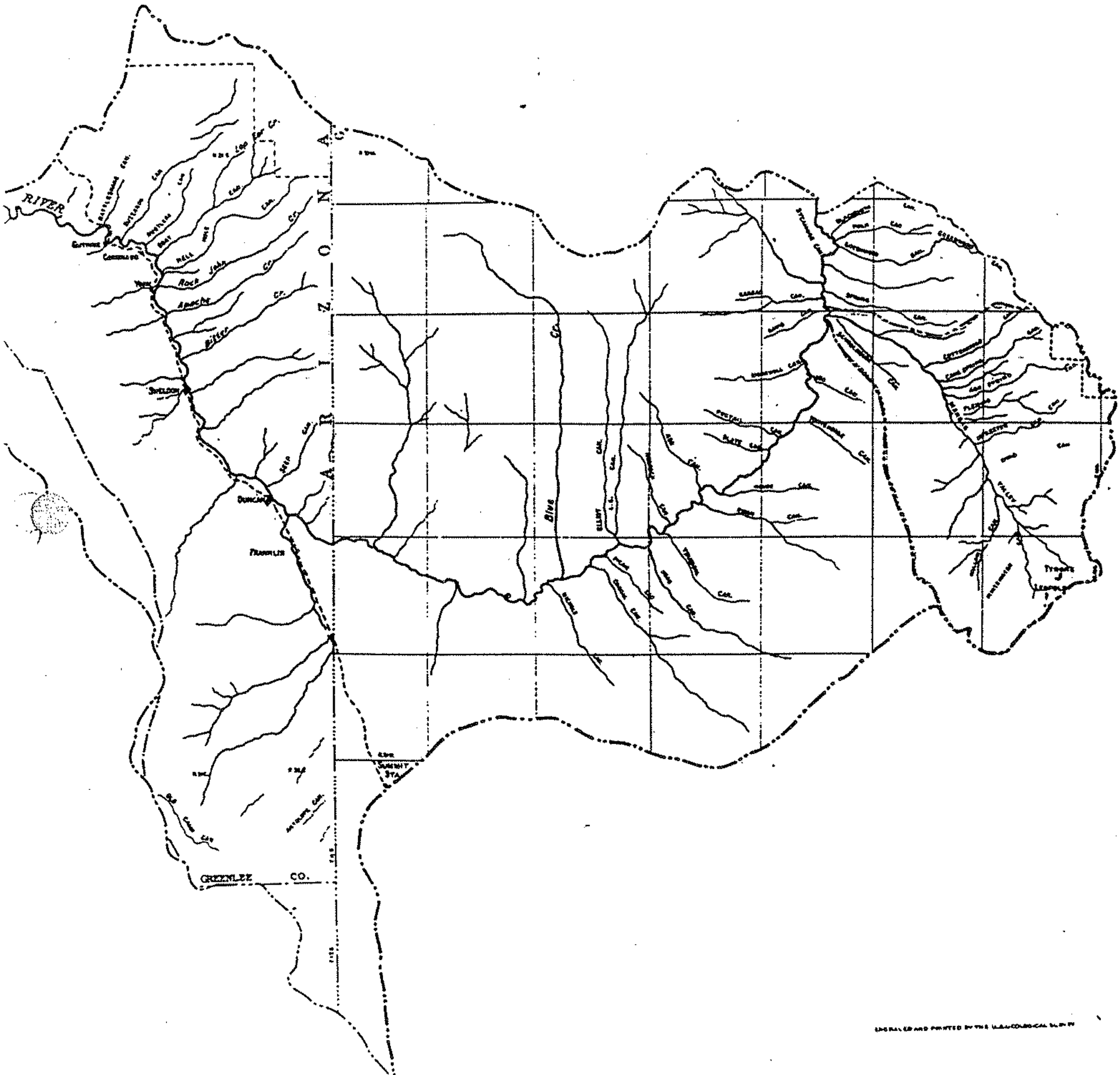
Area of watershed is 159.7 square miles. About 15 per cent timbered. Practically denuded of sod protection and badly eroded. Evidence of terrific floods from head to mouth. Worst flood of record occurred September 5, 1897, when logs in great numbers were swept down into the Gila from the headwaters, many being stranded along the sides of the valley about Gila where they still remain. From this unquestionable evidence of the height of the crest the maximum discharge is estimated at 110,000 cubic feet per second, giving a discharge of 690 cubic feet per second per square mile, which is the highest noted in any part of the Gila watershed for any drainage area comparable in size and easily ranks Bear Creek watershed as the worst. In the lower 5 or 6 miles of its course it passes through a cultivated valley half a mile wide in a shifting channel from 400 to 800 feet wide, having banks from 4 to 12 feet high, but above this the channel narrows and is susceptible of treatment. Estimated cost of proposed work as follows:

	Type C structures.		Type D structures.		Total.	
	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.
	Feet.		*Feet.*		*Feet.*	
Bear Creek above Wilson Creek	5,960	$7,450	66	$1,990	6,026	$9,440
Wilson Creek	5,600	7,000	72	1,480	5,672	8,480
Sycamore Creek	16,000	20,000	246	7,350	16,246	27,350
Walnut Creek	36,000	45,000	666	20,000	36,666	65,000
Holman Creek	4,000	5,000	36	760	4,036	5,760
Stream Boat Canyon	12,000	15,000	192	5,800	12,192	20,800
Welty Canyon	12,000	15,000	147	4,400	12,147	19,400
Main Bear Creek and minor tributaries	32,000	40,000	438	29,280	32,438	69,280
Total	123,560	154,450	1,863	71,060	125,423	225,510
Engineering, contingencies, and overhead, 15 per cent						33,826
Grand total						259,336

MANGAS RIVER VALLEY.

This drainage, consisting of a flat rolling country, has an area of 200 square miles and a maximum unit rate of discharge as determined by flood marks—for the upper 164.6 square miles of its drainage basin—of 181 cubic feet per second per square mile. The average annual rainfall within this area is 15 inches, or 160,000 acre-feet.

This stream is badly eroded in practically all of its reaches and for that reason is a flashy flood stream having an intermittent normal flow.



Senate Doc. No. 436, 65th Cong., 3d Sess.

Name.	Type C structures.		Type D structures.		Total.	
	Vertical height.	Cost.	Vertical height.	Cost.	Vertical height.	Cost.
	Feet.		*Feet.*		*Feet.*	
Mangas, above Whitewater	3,750	$7,500	72	$4,320	3,822	$11,820
Whitewater	12,500	25,000	168	5,040	12,668	30,040
Willow Creek	7,500	15,000	144	4,320	7,644	19,320
Wind Canyon	12,500	25,000	144	4,320	12,644	29,320
McKeefer Canyon	3,750	7,500	96	2,880	3,846	10,380
Fleming Canyon	7,500	15,000	120	3,600	7,620	18,600
Ash Canyon	5,000	10,000	120	3,600	5,120	13,600
Cane Spring Canyon	6,250	12,500	120	3,600	6,370	16,100
Cottonwood Canyon	5,000	10,000	120	3,600	5,120	13,600
Schoolhouse Canyon	5,000	10,000	72	2,160	5,072	12,160
Main Mangas and minor tributaries	25,000	50,000	166	10,000	25,166	60,000
Total	93,750	187,500	1,342	47,440	95,092	234,940
Engineering, contingencies, and overhead, 15 per cent						35,241
Grand total						270,181

EAGLE CREEK.

Eagle Creek has a mountain watershed area of 639 square miles, with a forested area of 57 square miles. The flood marks show a crest flow at some period in the past of 36,000 cubic feet per second, probably in the January, 1916, storm. Eagle Creek rises in the Blue Mountains in both New Mexico and Arizona. There are two irrigated areas on Eagle Creek, the upper one from the Honeymoon ranger station down Eagle Creek, and the lower one scattered in small units along the creek in its lower reaches.

Many years ago there were over 100 Indian farmers with an appreciable area under cultivation on Eagle Creek, but the flood waters proved so disheartening that all abandoned their holdings.

The pump station of domestic water supply for Morenci and Clifton is on Eagle Creek due west of Clifton. This plant delivers 2,000,000 gallons every 24 hours, one-half of which is drawn directly from the surface waters of Eagle Creek, the balance from wells.

The watershed has been badly torn up for the past 10 years, largely on account of changes in the ground cover conditions, due to extensive mining operations. There was once a wagon road from Morenci to Eagle Creek, but this washed out in January, 1916, and the October flood of the same year finished it. After this last-mentioned flood there were many freight wagons marooned in the Eagle Creek bottom which have never been able to return to Morenci.

The lateral flood feeders of Eagle Creek usually carry detrital cones at their mouths and the canyons themselves are well suited for constructing retarding dams.

The need in the future of maintaining and increasing the water supply for the rich cities of Clifton and Morenci will emphasize the direct economic importance of preventing flood waste in so far as conserving the Eagle Creek flow to tide over the dry seasons.

The following construction is proposed for improving the conditions in the Eagle Creek watershed, all the work to be located above the mouth of Sheep Canyon east of Eagle Creek:

Type D, for constructing log cross structures	$8,000
Type C, small check dams	205,000
Total	213,000
For engineering, contingencies, and overhead, 15 per cent	31,950
Grand total	244,950

BONITA CREEK.

The Bonita Creek basin lies to the north of the Safford-Solomonville Valley and has an area of 366 square miles. Its average elevation is approximately 4,000 feet and it is doubtful if any of the mountain peaks within the basin attain an elevation of 6,000 feet. With the exception of its west side this watershed area is sharply defined by the summit line of the mountain ranges on either side. The west fork of Bonita Creek terminates in a wide and flat mesa area locally known as Ash Flat, and much of the run-off from this flat flows toward the west into Ash Creek and thence into the San Carlos River. Part of the Ash Flat area, probably one-fourth, drains into Bonita Creek, and the line dividing these two drainage areas is not well defined.

Practically the entire watershed of Bonita is made up of high mesa lands which extend from the river itself to the base of comparatively low mountain ranges. On the south side the mesa is fairly flat and is from 1 to 3 miles wide, while on the north side the slopes of the mesa are greater and it probably averages a mile in width.

As far up the Bonita as the Ferrel ranch, or for a distance of 9½ miles above its mouth, the river is confined within the wall of what may be called a box canyon. The bottom of this gorge is from 100 to 200 feet in width and the walls of the canyon rise usually about 200 feet vertically and these slope steeply to the mesa edge, the latter having an elevation of from 500 to 1,000 feet above the river bottom. Above the Ferrel ranch, while the slope to the mesa is very steep and vertical in some places, yet the river canyon is accessible and in many places much wider.

Observation in the canyon would indicate that these mesa lands, like those of the Safford-Solomonville Valley, are composed of a cemented conglomerate formation which has been intruded by horizontal sheets of igneous material. These igneous sheets resist erosion longer than the inclosing conglomerates, and are thus largely responsible for the sheer bluffs which form the walls of the river canyon and many of the contributing washes.

The Gila range which flanks the Bonita watershed on the south is made up of the underlying limestones, then porphyry, schists, and a capping of flow "malapi" follow on top of the porphyry. The formation of the range flanking the Bonita watershed to the north is not readily discernible as the lava capping covers nearly all of it. Throughout the Bonita watershed much rock is encountered. In the main ranges, especially on south slopes, the bedrock is everywhere exposed. On the mesa lands many of the rounded conglomerate rocks or fragments from the lava capping are everywhere visible These rocks vary in size from 3 or 4 inches in diameter to as large as a cracker box.

The watershed areas of Bonita are not very abundantly clothed with vegetation. The mesa lands have the usual grease bush and in their upper portions some chapparal. Bunch grass grows quite abundantly on these mesa lands and affords pasturage for many herds of cattle. As we approach the summit of the main ranges, scrub pine, oak, juniper, and cedar are sparingly found, while mesquite and chapparal are more abundant. Brush and bunch grass are to be found quite generally.

This comparatively scant vegetation, together with the steep slopes, conduces to rapid run-off and not a large percentage of the rainfall is retarded. Floods in Bonita Creek are quite common and are torrential in character. Mr. Charles Boggs, a cattleman of Safford, states that on one occasion he observed that Bonita Creek rose to a height of 5 feet in 15 minutes and in four hours' time it had returned to its normal flow. Mr. Ferrel, the owner of the ranch at the head of the box canyon and who has been on Bonita Creek for the past 21 years, advises that the floods usually reach their crest within an hour's time and that they are back to normal within eight hours after the crest has been reached. During winter months of heavy precipitation Bonita Creek will remain in a swollen condition for two or three weeks but never for any great length of time.

The maximum run-off as determined by flood marks at its mouth was 16,640 second-feet. This flood, according to both Mr. Boggs and Mr. Ferrel, occurred in August, 1915, and was the result of extensive thundershowers throughout the basin. According to Mr. Ferrel, Bonita Creek was not in an unusual flood condition during the time of the great flood on the Gila in January, 1916. No marks of this January flood were obtained on Bonita but it was understood to be at no time greater than the last October flood, which was estimated to have a maximum flow of 8,960 second-feet.

Owing to the absence of any great amount of soil or built-up silt lands within the Bonita basin the flood waters of this stream do not contain a large silt content. The contributing washes bring down considerable amounts of detrital matter and this is carried along by the Bonita. A large detrital cone consisting of heavy gravel has been built up at the confluence with the Gila.

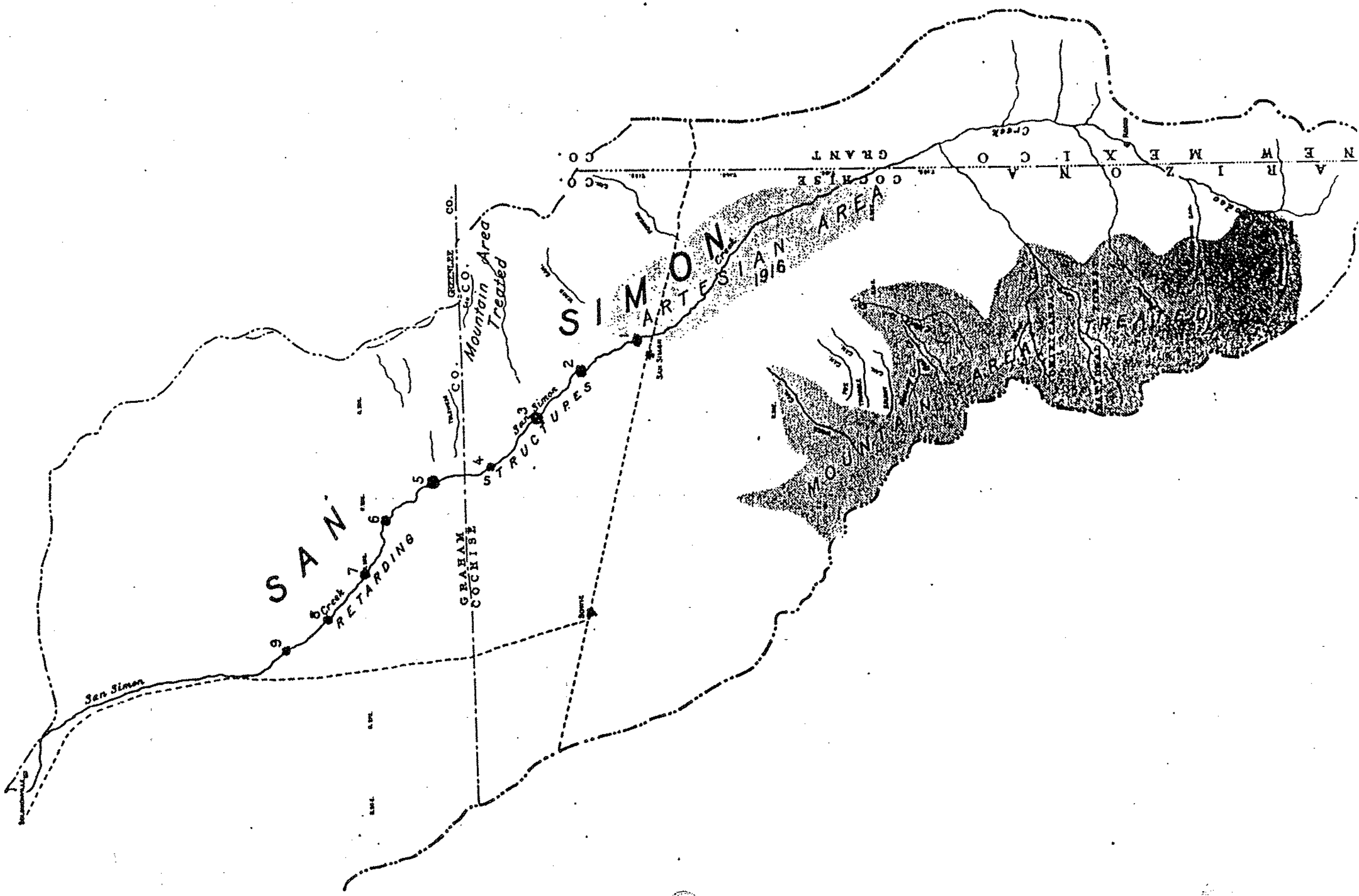
Inasmuch as gravel and rock river bed of the Bonita occupies nearly all of the canyon floor, very little opportunities for farming are to be had. All told, not more than 30 acres are actually under cultivation on Bonita Creek. In the middle of November this year the Bonita was flowing about 30 cubic feet per second, and according to Mr. Ferrel this was its ordinary flow throughout the year. This flow is not always visible as it rises and sinks at a few different places along the stream bed. Large size trees are to be found along the river bottom, mostly cottonwood, although sycamores and black walnut are in evidence.

The opportunities for retardation dams and other works of that nature throughout the Bonita watershed are very good with plenty of rock available, but on account of the relation of the Bonita to the general Gila River system and because the Bonita is not a silt bearer no construction is recommended. Near the mouths of the several washes and in the Bonita itself are many places where retarding dams could be constructed economically by simply blasting down the vertical side walls, if they were demanded.

No reservoir basins of large enough capacity are to be found on Bonita Creek. Mention has been made of a possible reservoir site at the Ferrel ranch basin, but even here the storage area is many times too small to justify any sort of an impounding dam.

SAN SIMON.

At Bowie, on the Southern Pacific Railroad, transcontinental passengers look over the wide horizon of a far-extended plain and usually call it the Arizona Desert. As a fact the soil is fertile and the elevation (3,760 feet) such that under the Arizona sun there would be infinite



SAN SIMON
San Simon
Creek
RETARDING STRUCTURES
9
8
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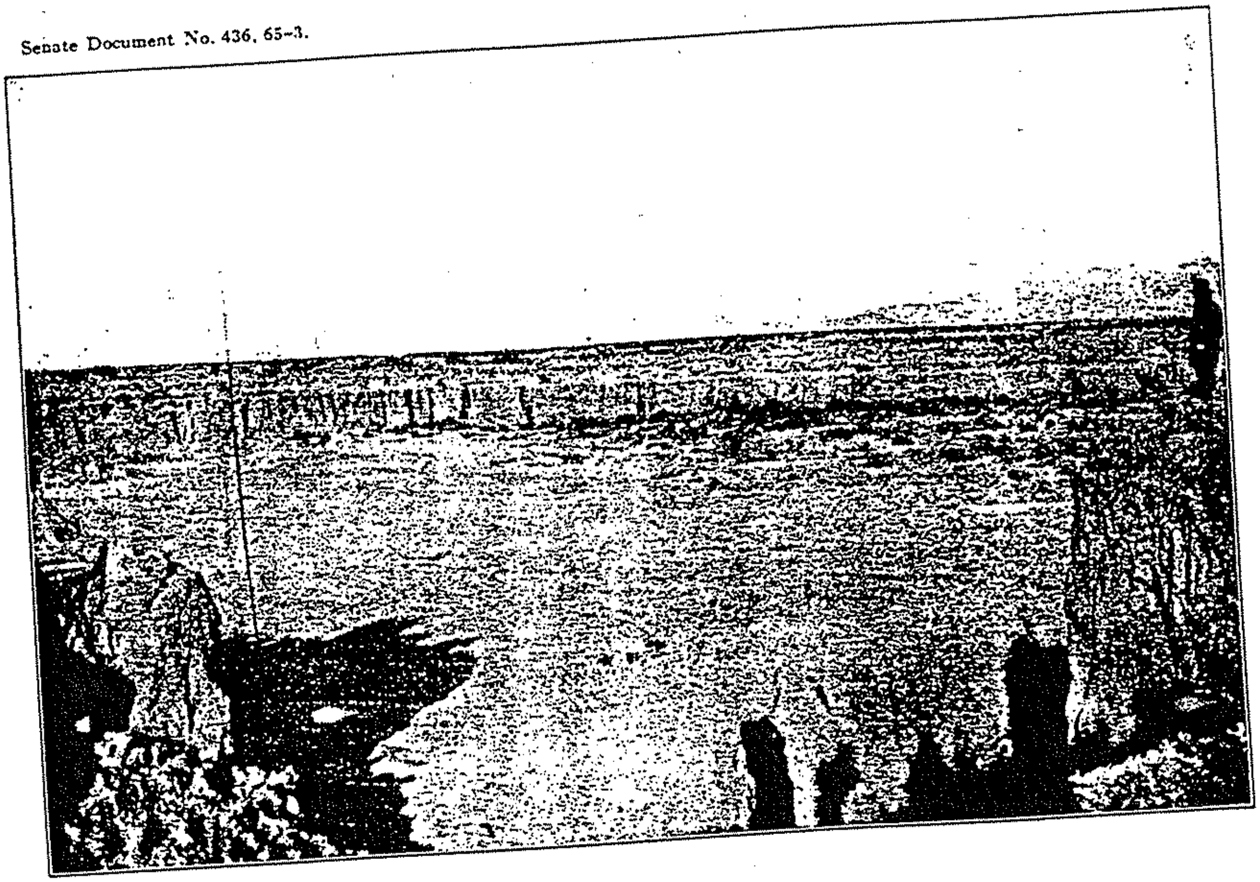
San Simon
ARTESIAN AREA 1916
Mountain Area Treated
MOUNTAIN AREA TREATED
GRAHAM CO.
COCHISE CO.
GREENLEE CO.
GRANT CO.
COCHISE
ARIZONA
NEW MEXICO
Creek



agricultural possibilities if only there were water. Bowie is located in the San Simon Valley near its western rim, and approximately midway between the elevated mountains where the creek of the same name takes its rise to where it debauches into the Safford Valley near Solomonville. The area of the watershed is 1,957 square miles, or 1,250,000 acres, a veritable empire of arable land, with an average rainfall of 11.24 inches, or 1,174,000 acre-feet, and 21,300 acres of fine mountain timber in the upper end of the watershed.

Most of this light precipitation formerly sank directly through the valley floor and furnished the artesian well supply in and near the station of San Simon on the Southern Pacific Railroad. About 1883 there was an unbroken flat or meadow over 100 miles along from Rodeo, near the mouth of Jackwood Canyon, at the head of the valley, to Solomonville, but at that time certain settlers near Solomonville whose lands were along this drainage line were annoyed at finding occasionally after heavy rains that sand and detritus had been washed down on them from the San Simon. They accordingly excavated a small channel, about 4 feet deep and 20 feet wide, for a short distance so that the floods could be discharged in concentrated flow into the Gila. They also built funneling levees so that there would be no question of the water reaching this artificial trough.

It worked, and to-day there is a chasm, in many places 600 to 800 feet wide and from 10 feet to 30 feet deep, for 60 miles, as the indirect result of their effective work to protect their lands from overflow. "Oh, Liberty, how many crimes are committed in thy name!"

In inspecting so pronounced an illustration of what a half dozen unthinking men can do to create waste, why does it seem so difficult to believe that a nation, if aroused to a proper sense of proportion, can reverse this process and gradually recover at least a portion of the lost ground?

The mountain area long the western rim of the San Simon watershed, as well as at the far southern end of the valley, has a considerable elevation and an annual rainfall of from 16 to 18 inches. This precipitation is now largely wasted, for instead of spreading out in its run-off for over a width of 2,000 feet or more and moving slowly down the floor of the valley, recharging the artesian supply and carrying moisture and blessing within the scope of its influence, it now rushes out of the canyons and runs rapidly down its deeply eroded bed into the Gila, carrying immense quantities of fine silt soil along with it. In less intense rainfalls the flow sinks in the sandy bed of this gorge and fails to furnish the surface moisture to the upper slopes of the valley which it formerly supplied. It is believed that the conditions in the mountain region have also deteriorated to a pronounced extent within the last 30 years. The minor drainage areas which supply the greater part of the flood flows of the San Simon are as follows: Emigrant, Wood, East Whitetail (including Indian Creek), Cave Creek (including Silver Creek), Sulphur Creek, Horseshoe Creek, and Jackwood Creek, all being drainage lines in the Chiricahua Mountains, and in addition Tule Wells Canyon on the western slope of the Pelincillo Range.

There has been a flood flow at the mouth of the San Simon wash of 11,960 cubic feet per second, or 6.1 cubic feet per second per square mile of drainage area. The October, 1916, flood, which was a bad one over this district, as measured by Mr. C. H. Southworth, reached 7,548 cubic feet per second, or 3.76 cubic feet per second per square mile of drainage area. These figures are so modest that it seems a paradox to say that the run-off conditions are probably worse in the San Simon Valley than in any other tributary of the Gila River above San Carlos, but from a certain viewpoint this statement is true.

The opportunities for improving the situation in the San Simon are fairly good, and if improved will carry in their train immense benefits to the generations which will follow us. The mouth of the San Simon is at mile 57.7 above San Carlos. The outline for the works is as follows:

Chiricahua Range:		
Emigrant Canyon: Drainage area, 14.6 square miles; length of main artery, 8 miles; average grade, 5.8 per cent; 25,000 vertical feet of retarding structures (type C)		$31,150
Wood Canyon: Drainage area, 14.5 square miles; length of main artery, 6.3 miles; average grade, 9.6 per cent; 24,720 vertical feet of retarding structures (type C)		30,900
East Whitetail: Mountain drainage area, 12 square miles; length of main artery, 6 miles; average grade, 7.3 per cent; 20,500 vertical feet of retarding structures (type C)		25,600
Cave Creek Canyon (including Silver Creek): Mountain drainage area, 62 square miles; length of main artery, 24 miles; average grade, 2.6 per cent; 120,200 vertical feet of retarding structures (type C)		150,300
Sulphur Creek: Mountain drainage area, 22.2 square miles; length of main artery, 11 miles; average grade, 3 per cent; 37,800 vertical feet of retarding structures (type C)		47,360
Horseshoe and Jackwood Canyons: Mountain drainage areas combined, 35 square miles; length of main artery, 16 miles; average grade, 2.3 per cent; 30,000 vertical feet of retarding structures (type C)		37,330
Total expenditures proposed for retarding work in the Chiricahua Range (type C)		322,640
Pelincillo Range:		
Tule Wells Canyon: Mountain drainage area, 11.3 square miles; length of main artery, 9.2 miles; average grade, 3.9 per cent; 19,250 vertical feet of retarding structures (type C)	24,100	
Total expenditure proposed for retarding work in the Pelincillo Range		24,100
Total expenditure proposed for the San Simon Valley for mountain retardation		346,740

For improving the main San Simon wash it is proposed to construct nine silt weirs, or cross structures (location as shown on the plan), to be built of piles. These silt weirs are designed to retard the flood waters and to fill up back of them to the original floor line of the valley if possible, and to prevent scouring below by reducing grades and by permitting the flood waters to drop vertically over this weir onto a log floor; the weir to be strongly anchored into the adjoining banks some 30 feet above the axial line of the structure. It is estimated that the total average length of these nine structures will be 5,400 feet, including an allowance for abutments. The estimate is based on the ability to deliver logs from the upper Gila watershed, where they are plentiful. These it is proposed to have floated down the stream from the upper Gila River to the mouth of San Simon. The estimate for this work is $15 a running foot, to include abutment expenditures, making $81,000 for this item. This is the limit proposed for controlling the San Simon flood situation and restoring, so far as practicable, the original conditions.

Silt weirs	$81,000
Checks	346,740
	427,740
$427,740 plus 15 per cent engineering contingencies, etc	491,901

Stream names.	Reference No.	Watershed area (square miles).	Per cent forested area.	Maximum flood flow per square mile (cubic seconds).	Stream flow.	
					Date.	Cubic seconds.
SAN SIMON RIVER.						
CHIRICAHUA RANGE.						
Emigrant Creek		14.6				
Wood Canyon		14.5				
East Whitetail Canyon		12.0				
Cave Creek Canyon		62.0	5.0			
Sulphur Creek		22.2				
Horseshoe and Jackwood Canyons		35.0	5.0			
FELINCILLO RANGE.						
Tule Wells Canyon		11.3				
San Simon at mouth		1,957.0		6.1		
SAFFORD VALLEY WASHES.						
Sand wash	24	128.0	5.0	26.0		
Safford wash	26	38.2	22.0	52.0		
Thatcher wash	28	25.5	20.0	49.0		
Central wash	30	20.3	16.0	24.0		
Cliff ranch wash	32	39.0	12.0	26.0		
Cottonwood	34	71.0	5.0	33.0		
Bear Springs wash	36	84.0		49.0		
Tripp and Underwood Creeks	38	49.0		23.0		
Black Rock wash	40	78.0		28.0		
Camp Goodwin wash	46	64.0		101.0		
Geronimo wash	48	20.4		50.0		
	70	20.0		325.0		
EAST FORK GILA RIVER.						
Cooney Creek	100	33.8	60.0	25.8	Oct. 26, 1916	Dry.
Kennedy Canyon	99	16.5	75.0	19.6	do	0.50
Corduroy Canyon	91	67.5	100.0	33.4	do	Dry.
Indian Creek	86	27.4	100.0	36.0	Oct. 24, 1916	.70
Beaver above Indian	89	688.4	25.0	2.0	do	Dry.
Whitewater Creek	121	36.0	100.0	86.4	Oct. 23, 1916	1.60
Whitetail Creek	123	10.8	100.0	139.5	do	.60
Cox Canyon	120	3.6	100.0	17.7	do	Dry.
Hoyt Creek	118	38.3	100.0	112.9	do	6.50
East Fork above junction with Beaver Creek	114	88.7	100.0	116.7	Oct. 22, 1916	22.00
East Fork above junction with Diamond Creek	65	841.0	35.0	109.3	do	50.00
Diamond Creek	125	122.0	60.0	19.2	Oct. 21, 1916	12.00
Tom Moore Creek	57	21.2	35.0	73.8	Nov. 24, 1916	Dry.
Corral Canyon	54–55	4.5	5.0	1,2[illegible]9.0	do	.06
Black Canyon	52	126.9	80.0	21.0	do	7.00
East Fork at mouth	7	1,137.6	49.5	14.8	Oct. 17, 1916	210.00
WEST FORK GILA RIVER.						
Willow Creek	19	7.4	100.0	84.2	Oct. 30, 1916	9.00
Little Turkey	18	4.1	100.0	124.7	do	2.00
Gilita Creek at mouth	14	35.5	75.0	40.9	Oct. 23, 1916	18.00
Quaking Asp Creek	25	6.8		58.3	do	.60
Snow Creek	26	8.8		393.5	do	.08
T. Bar Canyon	23	41.9		25.0	do	13.00
School Canyon	21	6.4		24.7	do	1.00
Middle Fork below Gilita Creek	13	114.1	50.0	18.1	Oct. 27, 1916	35.00
Iron Creek	12	20.1	95.0	59.1	do	13.00
Clayton Creek	11	4.1	100.0	193.0	do	.84
Middle above Canyon Creek	8	151.2	50.0	26.0	do	45.00
Whitewater at mouth	33	27.4	100.0	82.0	Oct. 25, 1916	5.50
West Fork Whitewater and up	32	31.6	100.0	96.3	Oct. 26, 1916	30.00
West Fork at mouth	6	539.0	49.5	51.1	Oct. 20, 1916	395.00

Stream names.	Reference No.	Watershed area (square miles).	Per cent forested area.	Maximum flood flow per square mile (cubic seconds).	Stream flow.	
					Date.	Cubic seconds.
SAPILLO CREEK.						
Skate Creek	167	13.6	90.0	340.5	Nov. 28, 1916	Dry.
Lincoln Canyon above Skate Creek	166	40.0	60.0	71.0	do	Dry.
Rocky Canyon	164	22.9	5.0	339.5	do	Dry.
Meadow Creek	149	13.6	90.0	38.1	do	T.
Jay Bird Canyon	147	4.2	35.0	1,080.0	Nov. 27, 1915	Dry.
Copperas Creek	142	14.4	50.0	74.2	do	.10
Trout Creek	138	12.7	95.0	60.0	do	1.50
Sapillo above mouth of Trout Creek	139	141.7	60.0	107.3	do	14.00
Sapillo at mouth	4	173.7	65.0	200.0	Oct. 23, 1916	28.00
MOGOLLON CREEK.						
Mogollon Creek		126.3		295.0		
DUCK CREEK.						
Duck Creek		289.0		145.0	Oct. 14, 1916	4.00
BEAR CREEK.						
Bear Creek above Little Cherry Creek		5.0		283.0	Oct. 20, 1916	T.
Little Cherry Creek		4.8		62.5	do	.60
Big Cherry Creek		8.3		43.4	do	.80
Wilson Creek		5.3				
Sycamore Creek		17.1				
Walnut Creek		40.6				
Holman Canyon		3.6				
Steamboat Canyon		13.0				
Welty Canyon		12.2				
Bear Creek at mouth		159.7		689.0	Nov. 29, 1916	Dry.
MANGAS VALLEY CREEK.						
Mangas 2 miles above mouth		200.0		131.0	do	4.00
EAGLE CREEK.						
Eagle Creek		639.0	9.0	56.3	Nov. 22, 1916	45.50
BONITA CREEK.						
Bonita Creek		366.0		45.5	Nov. 23, 1916	16.60
GILA RIVER AT SOLOMONVILLE.						
Gila River at Solomonville		8,586.0	29.5	10.5		

DRY CREEK.

Dry Creek drains the timbered west slopes of the Mogollon Mountain between Grouse Mountain, Black Mountain, and West Baldy, which rise to an altitude of about 10,000 feet. Troffer Canyon, a tributary from the south, drains Cactus Flat and the mesa north of Mule Mountain, both of which have been deeply gullied as the result of overgrazing. Of this watershed of 84.5 square miles about 35 per cent is timbered. The flow of Dry Creek on November 22, 1916, was 2.4 cubic feet per second. Its October flood flow was 3,280 cubic feet per second, or 39 cubic feet per second per square mile. Fifty-one thousand seven hundred and fifty dollars has been allowed for check dams in this watershed.

WHITEWATER CREEK.

This stream heads upon the high, timbered western slopes of the Mogollon Mountains, whose peaks rise to an altitude of 10,000 feet. Eighty-five per cent of the watershed, which has an area of 53.8 square miles, is covered with timber. Yellow pine, fir, spruce, and quaking asp, with a heavy underbrush, cover the upper mountain slopes, which are thickly strewn with loose lava rock. The water supply of this stream is very dependable and is made use of in a power plant 3 miles below Graham and again below for irrigation. Its flow at Glenwood November 23, 1916, was 15 cubic feet per second, and in the October storm it discharged 3,760 cubic feet per second, or 70 cubic feet per second per square mile. The flood marks of this stream are said by old residents of Glenwood to be as high as any known. Notwithstanding the relatively low flood flow, considerable damage has been done by the shifting and spreading out of the channel in the lower valley. The estimate of $28,750 includes $7,187 for log cross structures, the balance being for check dams in the upper portion of the stream and its tributaries.

GILA CANYON (OR VIGIL CANYON).

This canyon drains the mesa west of Alma and the east slope of Maple Peak, which rises to an elevation of 8,300 feet. The bottom of the canyon generally is wide, and treatment will need to be confined to the narrower upper reaches of the watercourse and to its tributaries. Mr. Anderson, of the Anderson ranch, describes the result of the construction of a dam 13 feet high, 12 feet wide on the bottom, and 30 feet wide on top, in a normally dry portion of Buzzard Canyon above his ranch, in 1910. The first storm completely filled it with sand, gravel, and bowlders, but below the dam there has been ever since in the driest seasons sufficient water for several head of stock.

About 20 per cent of the watershed, which has an area of 70.1 square miles, is covered with a light growth of juniper, pinon, oak, and cottonwood. The mesas and slopes are deeply gullied. The flood discharge of the October storm was 7,950 cubic feet per second, or 113 cubic feet per second per square mile. No positive evidence of a higher discharge could be found. The flow of November 19, 1916, was 0.25 second-foot. An estimate of $57,500 is made for check dams in this watershed.

MINERAL CREEK.

This stream with its principal tributary, Silver Creek, drains the high wooded western slopes of the Mogollon Mountain between Willow Peak and Bear Wallow Peak. About 75 per cent of the entire watershed has a covering of juniper, pinon, and oak, with yellow pine, fir, spruce, and quaking asp on the high mountain slopes, which in most places have a heavy undergrowth and are covered with malpais. About Mogollon the slopes have long been barren of trees, the smaller wood, after the removal of the saw timber, being cut and carried down the mountain side on burros. The denudation of the area immediately surrounding the town and the cutting of innumerable trails, which quickly became gullies, has resulted in a number of disastrous floods in the town, from which places farther up the stream beyond the gullied area are exempt. Such a flood swept down the main street 2 feet deep in August, 1914. Its flow is estimated to have been 3,560 cubic feet per second, or 636 cubic feet per second per square mile of drainage area. On October 31, 1916, it was flowing 1 cubic foot per second, having had a discharge of 636 cubic feet per second in the storm of that month, or 111 cubic feet per second per square mile of drainage area. Mineral Creek, 2 miles below Cooney, was flowing 5 cubic feet per second on the same day. Above Cooney its watershed is well protected with heavy underbrush. Its flood discharge in October was 464 cubic feet per second, or 14 cubic feet per second per square mile of drainage area, and its maximum flood discharge is 3,050 cubic feet per second, or 93 cubic feet per second per square mile of area. In the lower portion of its course, and especially below the mouth of Silver Creek, it has proved difficult of control and has washed away much valuable bottom land. The discharge of Mineral Creek at its mouth at Alma in the October storm is estimated to have been 1,152 cubic feet per second, or 23 cubic feet per second per square mile, and its maximum discharge is estimated at 5,740 cubic feet per second, or 113 cubic feet per secoud per square mile. Forty-three thousand one hundred and twenty-five dollars is the estimated cost of check dams for the upper streams, and $14,375 is allowed for log cross structures in the lower reaches of the stream.

KELLER CANYON.

Keller Canyon drains an open country extending west from the San Francisco River to and including the Alma Mesa. The entire area of 65.1 square miles, excepting about 10 per cent having a forest cover, originally supported a heavy growth of white gramma grass, which stood about 30 inches high. Great numbers of sheep and goats were pastured in this watershed and worked destruction. A large part of the area is covered with malpais, which to some extent protects the grass from extermination. Conditions are said to have improved in recent years since a limit has been set to the number of animals allowed pasturage. Much gullying of the soil has resulted from the destruction of the sod. The canyon a mile above its mouth was dry on November 18, 1916, but had water at intervals in its upper portion. Its flood in the October storm was 4,800 cubic feet per second, or 74 cubic feet per second per square mile of drainage area. No positive evidence of a higher flood could be obtained. Fifty-seven thousand five hundred dollars is the estimated cost of treatment by check dams.

PUEBLO CREEK.

The estimated flood flow of this stream, which has a watershed of 45 square miles, is 7,000 cubic feet per second, or 156 cubic feet per second per square mile. About 45 per cent of its area is timbered. An estimate of $51,750 is made for check dams.

DEEP CREEK.

The area of the Deep Creek watershed is 49 square miles, 80 per cent of which has forest cover. Its maximum discharge is estimated at 4,000 cubic feet per second, or 82 cubic feet per second per square mile. On November 1, 1916, it had a flow of 3 cubic feet per second. An estimate of $17,250 is made for check dams in this watershed.

DEVILS CREEK.

Having a flow of 4 cubic feet per second November 1, 1916, and a flood discharge of only 46 cubic feet per second per square mile of drainage area, no treatment of this watershed seems necessary.

SALIZ CANYON.

This watershed has an area of 64.3 square miles, 45 per cent of which has forest cover. The upper portion of the basin includes two flats, one having an elevation of 6,500 feet and the other, Bull Basin, having an elevation of about 7,600 feet. Both are timbered and covered with malpais, which has afforded the sod some protection. Bull Basin has begun to wash, but the lower flat, which has a clay soil and is heavily timbered, has not been deeply cut. The flow of Saliz Canyon at its mouth on November 2, 1916, was 1.8 cubic feet per second. Its discharge in the October storm was 4,720 cubic feet per second, or 73 cubic feet per second per square mile of drainage area. Its maximum flood flow is 9,830 cubic feet per second, or 153 cubic feet per second per square mile. An estimate of $83,375 is made for check dams for this watershed, and $18,400 is allowed for log cross structures in its lower portions.

NEGRITO CREEK.

The watershed drained by this stream has an area of 197 square miles, 65 per cent of which is timbered. The mountain slopes are rough and brushy and the snow on the northern slopes melts slowly. The Negrito has a perennial flow. On November 6, 1916, it measured 14 cubic feet per second at its mouth. The North Fork two days before was flowing 1.5 cubic feet per second and the Negrito above the North Fork 7 cubic feet per second, while Sign Camp Canyon showed but a trace of water. Sign Camp Canyon contributed the bulk of the Negrito flow in the October storm, having a flood discharge of 53 cubic feet per second per square mile, as compared with 18 for the North Fork and 19 for the Negrito above the North Fork. The flood discharge of the Negrito at its mouth was 12 cubic feet per second per square mile. In Sheep Basin and Bull Basin, which drain into Sign Camp Canyon, deep cutting has begun.

Sign Camp Canyon and its tributaries are the only streams which require treatment in the Negrito watershed. The cost is estimated at $75,808 for check dams and $3,680 for log cross structures, making a total of $79,488.

TULAROSA CREEK.

For a distance of 15 miles, from its mouth to the Tularosa ranger station, this stream is confined in a narrow canyon from which nearly all the bottom lands have been washed by the floods of recent years. From the Tularosa ranger station to a point a mile beyond Aragon its course lies through a cultivated valley, half a mile wide, having a firm clay soil, into which the stream is cutting deeper every year. A mile above Aragon it is again confined for a few miles in a canyon beyond which it and its tributaries, the Canyon del Buey and the Canyon del los Indios are spread out over a flat, sandy region. The Tularosa is the muddiest tributary of the San Francisco. The area of its drainage basin is 663 square miles, 60 per cent of which has forest cover consisting principally of juniper, pinon, oak, cottonwood, and yellow pine. It had a flow of 35 cubic feet per second at its mouth on November 6, 1916. In the October storm, when it was at the highest stage ever known, it had a crest discharge at its mouth of 13,480 cubic feet per second, or 20 cubic feet per second per square mile of drainage area. For the treatment of this stream and its watershed, exclusive of the Canyon del Buey, the following estimate is made: Between Negrito Creek and Apache Creek, for check dams, $27,784; for log cross structures, $17,250; above Apache Creek, for check dams, $30,073; for log cross structures, $27,416; total, $102,523.

CANYON DEL BUEY.

With a drainage of 27.9 square miles, 25 per cent with forest cover, this stream has a flood discharge of but 17 cubic feet per second per square mile of drainage area. It has three feeders which contributes flood flows, one heading in the Gallo Mountains at an elevation of about

8,500 feet; a second heading in and running through what is known as Sand Flats; and a third which heads on Apache Mountain at an elevation of 8,000 feet. The flows of the former branches are spread out and retarded in their course through Sand Flats and at the present time need no treatment. The third feeder is cresting much too rapidly and the following treatment is proposed: For check dams, $6,526; for log cross structures, $2,760; total, $9,286.

CANYON DE LOS INDIOS.

No treatment whatever is required upon this stream which, with an area of 38.5 square miles, 20 per cent of which is forested, has a flood discharge of but 2 cubic feet per second per square mile.

LANE CANYON, CAMP CANYON, WILSON CANYON (EAST), MIDDLE CANYON, DEEP CANYON, COLD SPRING CANYON, WILSON CANYON (WEST), AND SQUIRREL CANYON.

The principal data concerning these streams are given in the appended list of proposed retardation works. It is considered advisable to leave them untreated in order that the run-off from this portion of the watershed may pass out ahead of that of the headwaters.

O. BLOCK AND WILLOW SPRINGS CANYON.

It is considered advisable to omit treatment of these streams also in order to supply the San Francisco River at their point of entry with immediate run-off water.

APACHE CREEK.

The area drained by this stream is 130.5 square miles, 60 per cent of which is forested. It has a flood discharge of 12,700 cubic feet per second, or 97 cubic feet per second per square mile. On November 10, 1916, its flow was 7 cubic feet per second. The east fork of this stream with an area of 39 square miles, 60 per cent forested, has a maximum flood discharge of 4,102 cubic feet per second, or 105 cubic feet per second per square mile of drainage area and had on November 12, 1916, a flow of 2 cubic feet per second. The middle fork, with an area of 49.4 square miles, 65 per cent of which has forest cover, has a maximum flood discharge of 985 cubic feet per second, or 20 cubic feet per second per square mile of drainage area, and had on November 14, 1916, a flow of 2 cubic feet per second. And the west fork, with an area of 6.5 square miles, 80 per cent of which is timbered, has a maximum flood discharge of 3,090 cubic feet per second, or 475 cubic feet per second per square mile, and had on November 12, 1916, a flow of 1 cubic foot per second. The following estimate is made for the cost of treating the watershed:

Apache Creek below the forks:		
For check dams	$85,445	
For log cross structures	13,800	
		$99,245
East Fork:		
For check dams	29,210	
For log cross structures	13,800	
		43,010
Middle Fork:		
For check dams	34,500	
For log cross structures	4,370	
		38,870
West Fork, for check dams		22,195
Total of Apache watershed		203,320

LARGO CREEK.

Largo Creek with a watershed area of 26.7 square miles, 65 per cent timbered, has a maximum flood discharge of 6,210 cubic feet per second, or 232 cubic feet per second per square mile of drainage area, and had on November 3, 1916, a flow of 1.8 cubic feet per second. For check dams in this watershed an estimate of $51,520 is made, and for log cross structures the estimate is $18,400, a total of $69,920.

DEVIL CANYON.

This stream with a watershed area of 5.4 square miles, 90 per cent forested, has a flood discharge of 1,670 cubic feet per second, or 309 cubic feet per second per square mile. It is in need of treatment, having begun to erode in its upper forested portion. An estimate of $6,900 is made for check dams.

CENTER FIRE CREEK.

This stream, excluding the drainage area of its principal tributary, Karuth Creek, drains an area of 72 square miles, 25 per cent of which is forested. The discharge at its mouth was not measured, but from observation of erosion taking place in the upper Center Fire Valley and in Spur Lake Basin and from measurements made upon its upper tributaries, an expenditure of $50,600 is recommended for check dams and $34,500 for log cross structures, a total of $85,100.

KARUTH CREEK.

The drainage area of this stream is 29.4 square miles and includes the south part of Spur Lake Basin, the whole of which is deeply eroded, many of the gullies having a depth of 20 feet and some a depth of 40 feet. Before the destruction of the original sod no erosion had taken place in either the Spur Lake Basin or in Center Fire Valley, the entire run-off flowing over the sod or in very small grassy channels. Only 35 per cent of the area of this watershed has forest cover. The flow of Karuth Creek November 9, 1916, was 1 cubic foot per second, and its maximum discharge in the October storm was 1,210 cubic feet per second, or 41 cubic feet per second per square mile of drainage area. So far as could be learned it was as high then as it ever gets. The estimate is $20,700 for check dams and $13,800 for log cross structures, a total of $34,500.

DILLMAN CREEK.

This stream drains an area of 10.5 square miles, all forested. On November 10, 1916, it was dry at its mouth. Its maximum flood discharge is 1,090 cubic feet per second, or 104 cubic feet per second per square mile. The cost of check dams for the proper treatment of its watershed is estimated at $14,720 and the cost of log structures at $3,312, a total of $18,032.

TROUT CREEK.

The watershed of Trout Creek has an area of 17.5 square miles, entirely forested. In the October storm it had a maximum flood discharge of 22,460 cubic feet per second, or 140 cubic feet per second per square mile. Its flow November 10, 1916, was 2.5 cubic feet per second. For check dams $22,080 is estimated, and for log cross structures $2,760, a total of $24,840.

SAN FRANCISCO RIVER ABOVE LUNA.

The San Francisco River a mile above Luna has a drainage area of 100 square miles. Its maximum flood flow at this point occurred in the October storm and amounted to 10,680 cubic feet per second, or 107 cubic feet per second per square mile of area. Except for the failure of an earth dam at Alpine it would probably have not exceeded 7,000 cubic feet per second. Erosion of the stream bed in the Alpine Valley has begun and with continued cultivation of the bottom land will undoubtedly increase. The estimate for this drainage area is $86,940 for check dams, and $33,120 for log cross structures, a total of $120,060.

Additional stream data to that shown on diagram.

(186)	
Area	0.14 sq. mi.
October, 1916, flood	48 sec. ft.
Maximum	418 sec. ft.
Flow Nov. 4, 1916	Dry.

(187)	
Area	0.02 sq. mi.
October flood	750 sec. ft.
Maximum	1,500 sec. ft.
Flow Nov. 14, 1916	Dry.

(188)	
Area	1.24 sq. mi.
October flood	757 sec. ft.
Maximum	1,060 sec. ft.
Flow Nov. 4, 1916	Dry.

(189)	
Area	4.3 sq. mi.
October flood	59 sec. ft.
Maximum	59 sec. ft.
Flow Nov. 9, 1916	0.03 sec. ft.

(190)	
Area	0.5 sq. mi.
October flood	17 sec. ft.
Maximum	17 sec. ft.
Flow Nov. 4, 1916	Dry.

(191)	
Area	5.4 sq. mi.
October flood	1,330 sec. ft.
Maximum	1,670 sec. ft.
Flow Nov. 4, 1916	Dry.

(192)	
Area	0.9 sq. mi.
October flood	128 sec. ft.
Maximum	128 sec. ft.
Flow Nov. 4, 1916	0.05 sec. ft.

(193)	
Area	0.2 sq. mi.
October flood	146 sec. ft.
Maximum	146 sec. ft.
Flow Nov. 4, 1916	0.02 sec. ft.

(194)	
Area	293.8 sq. mi.
October flood	17,850 sec. ft.
Maximum	17,850 sec. ft.
Flow Nov. 4, 1916	32 sec. ft.

(195)	
Area	29.4 sq. mi.
October flood	1,210 sec. ft.
Maximum	1,210 sec. ft.
Flow Nov. 9, 1916	1.0 sec. ft.

(196)

Area	1.6 sq. mi.
October flood	209 sec. ft.
Maximum	209 sec. ft.
Flow Nov. 9, 1916	Dry.

(197)

Area	1.7 sq. mi.
October flood	27 sec. ft.
Maximum	74 sec. ft.
Flow Nov. 9, 1916	0.05 sec. ft.

(198)

Area	32.4 sq. mi.
October flood	774 sec. ft.
Maximum	1,450 sec. ft.
Flow Nov. 9, 1916	0.2 sec. ft.

(199)

Area	1.8 sq. mi.
October flood	265 sec. ft.
Maximum	331 sec. ft.
Flow Nov. 9, 1916	0.03 sec. ft.

(200)

Area	17.5 sq. mi.
October flood	2,460 sec. ft.
Maximum	2,460 sec. ft.
Flow Nov. 10, 1916	2.5 sec. ft.

(201)

Area	10.5 sq. mi.
October flood	1,090 sec. ft.
Maximum	1,090 sec. ft.
Flow Nov. 10, 1916	Dry.

(202)

Area	2.7 sq. mi.
October flood	488 sec. ft.
Maximum	488 sec. ft.
Flow Nov. 10, 1916	0.1 sec. ft.

(203)

Area	100.1 sq. mi.
October flood	10,680 sec. ft.
Maximum	10,680 sec. ft.
Flow Nov. 10, 1916	12 sec. ft.

(204)

Area	32.3 sq. mi.
October flood	3,230 sec. ft.
Maximun	3,230 sec. ft.
Flow Nov. 10, 1916	2 sec. ft.

(205)

Area	1.5 sq. mi.
October flood	283 sec. ft.
Maximum	283 sec. ft.
Flow Nov. 12, 1916	0.6 sec. ft.

(206)

Area	0.6 sq. mi.
October flood	143 sec. ft.
Maximum	143 sec. ft.
Flow Nov. 12, 1916	0.06 sec. ft.

(207)

Area	1.3 sq. mi.
October flood	246 sec. ft.
Maximum	246 sec. ft.
Flow Nov. 12, 1916	0.4 sec. ft.

(208)

Area	29.6 sq. mi.
October flood	1,407 sec. ft.
Maximum	1,407 sec. ft.
Flow Nov. 12, 1916	10 sec. ft.

(209)

Area	2.2 sq. mi.
October flood	301 sec. ft.
Maximum	301 sec. ft.
Flow Nov. 13, 1916	Dry.

(210)

Area	0.7 sq. mi.
October flood	109 sec.-ft.
Maximum	109 sec.-ft.
Flow, Nov. 13, 1916	0.04 sec.-ft.

(211)

Area	1.2 sq. mi.
October flood	123 sec.-ft.
Maximum	123 sec.-ft.
Flow, Nov. 13, 1916	0.1 sec.-ft.

(212)

Area	605.2 sq. mi.
October flood	31,900 sec.-ft.
Maximum	31,900 sec.-ft.
Flow, Nov. 21, 1916	25 sec.-ft.

(213)

Area	5.5 sq. mi.
October flood	4,280 sec.-ft.
Maximum	4,280 sec.-ft.
Flow, Nov. 21, 1916	Dry.

(214)

Area	2.4 sq. mi.
October flood	950 sec.-ft.
Maximum	1,720 sec.-ft.
Flow, Nov. 21, 1916	Dry.

(215)

Area	6.1 sq. mi.
October flood	4,230 sec.-ft.
Maximum	4,230 sec.-ft.
Flow, Nov. 20, 1916	Dry.

(216)

Area	63.8 sq. mi.
October flood	10,600 sec.-ft.
Maximum	10,600 sec.-ft.
Flow, Nov. 20, 1916	3 sec.-ft.

(217)

Area	17.8 sq. mi.
October flood	6,680 sec.-ft.
Maximum	6,680 sec.-ft.
Flow, Nov. 20, 1916	0.25 sec.-ft.

(218)

Area	3.7 sq. mi.
October flood	1,860 sec.-ft.
Maximum	1,860 sec.-ft.
Flow, Nov. 20, 1916	0.1 sec.-ft.

(219)

Area	2.3 sq. mi.
October flood	2,540 sec.-ft.
Maximum	2,540 sec.-ft.
Flow, Nov. 20, 1916	0.03 sec.-ft.

(220)

Area	3.2 sq. mi.
October flood	3,930 sec.-ft.
Maximum	3,930 sec.-ft.
Flow, Nov. 20, 1916	Dry.

(221)

Area	5.3 sq. mi.
October flood	13,200 sec.-ft.
Maximum	13,200 sec.-ft.
Flow, Nov. 20, 1916	0.5 sec.-ft.

(222)

Area	7.1 sq. mi.
October flood	4,100 sec.-ft.
Maximum	4,100 sec.-ft.
Flow, Nov. 20, 1916	Dry.

(223)

Area	5.1 sq. mi.
October flood	847 sec.-ft.
Maximum	847 sec.-ft.
Flow, Nov. 20, 1916	Dry.

(224)

Area	62 sq. mi.
October flood	8,060 sec.-ft.
Maximum	8,060 sec.-ft.
Flow, Nov. 20, 1916	2 sec.-ft.

(225)

Area	37.3 sq. mi.
October flood	12,200 sec.-ft.
Maximum	12,200 sec.-ft.
Flow, Nov. 20, 1916	3 sec.-ft.

(226)

Area	15.9 sq. mi.
October flood	2,490 sec.-ft.
Maximum	2,490 sec.-ft.
Flow, Nov. 19, 1916	0.8 sq. ft.

(227)

Area	0.65 sq. mi.
October flood	700 sec.-ft.
Maximum	700 sec.-ft.
Flow, Nov. 17, 1916	Dry.

(228)

Area	0.06 sq. mi.
October flood	210 sec.-ft.
Maximum	210 sec.-ft.
Flow, Nov. 17, 1916	Dry.

(229)

Area	6 sq. mi.
October flood	1,623 sec.-ft.
Maximum	1,623 sec.-ft.
Flow, Nov. 17, 1916	0.2 sec.-ft.

(230)

Area	8.3 sq. mi.
October flood	1,750 sec.-ft.
Maximum	1,750 sec.-ft.
Flow, Nov. 17, 1916	Dry.

(231)

Area	2.8 sq. mi.
October flood	1,420 sec.-ft.
Maximum	1,420 sec.-ft.
Flow, Nov. 20, 1916	Dry.

(232)

Area	2.9 sq. mi.
October flood	5,660 sec.-ft.
Maximum	5,660 sec.-ft.
Flow, Nov. 17, 1916	0.1 sec.-ft.

(233)

Area	2.1 sq. mi.
October flood	1,920 sec.-ft.
Maximum	1,920 sec.-ft.
Flow, Nov. 16, 1916	Dry.

(234)

Area	1.3 sq. mi.
October flood	1,080 sec.-ft.
Maximum	1,080 sec.-ft.
Flow, Nov. 17, 1916	Dry.

(235)

Area	6.4 sq. mi.
October flood	3,670 sec.-ft.
Maximum	3,670 sec.-ft.
Flow, Nov. 16, 1916	Dry.

(236)

Area	2 sq. mi.
October flood	502 sec.-ft.
Maximum	502 sec.-ft.
Flow, Nov. 16, 1916	Dry.

(237)

Area	1.4 sq. mi.
October flood	1,524 sec.-ft.
Maximum	1,524 sec.-ft.
Flow Nov. 16, 1916	Dry.

(238)

Area	1.6 sq. mi.
October flood	930 sec.-ft.
Maximum	930 sec.-ft.
Flow Nov. 16, 1916	Dry.

(239)

Area	27.3 sq. mi.
October flood	966 sec.-ft.
Maximum	966 sec.-ft.
Flow Nov. 16, 1916	2 sec.-ft.

(240)

Area	3.2 sq. mi.
October flood	1,690 sec.-ft.
Maximum	1,690 sec.-ft.
Flow Nov. 16, 1916	1.6 sec.-ft.

(241)

Area	7.6 sq. mi.
October flood	15,000 sec.-ft.
Maximum	15,000 sec.-ft.
Flow Nov. 16, 1916	4 sec.-ft.

(242)

Area	1.2 sq. mi.
October flood	1,400 sec.-ft.
Maximum	1,400 sec.-ft.
Flow Nov. 16, 1916	0.15 sec.-ft.

(243)

Area	4 sq. mi.
October flood	1,096 sec.-ft.
Maximum	1,096 sec.-ft.
Flow Nov. 15, 1916	Dry.

(244)

Area	8.6 sq. mi.
October flood	2,260 sec.-ft.
Maximum	2,260 sec.-ft.
Flow Nov. 15, 1916	Dry.

(245)

Area	16.4 sq. mi.
October flood	7,600 sec.-ft.
Maximum	7,600 sec.-ft.
Flow Nov. 15, 1916	2.8 sec.-ft.

(246)

Area	16.3 sq. mi.
October flood	2,326 sec.-ft.
Maximum	2,326 sec.-ft.
Flow Nov. 15, 1916	0.2 sec.-ft.

(247)

Area	13 sq. mi.
October flood	7,640 sec.-ft.
Maximum	7,640 sec.-ft.
Flow Nov. 15, 1916	2 sec.-ft.

(248)

Area	1.3 sq. mi.
October flood	155 sec.-ft.
Maximum	155 sec.-ft.
Flow Nov. 15, 1916	Dry.

(249)

Area	4.1 sq. mi.
October flood	860 sec.-ft.
Maximum	860 sec.-ft.
Flow Nov. 15, 1916	0.7 sec.-ft.

(250)

Area	4.1 sq. mi.
October flood	504 sec.-ft.
Maximum	504 sec.-ft.
Flow Nov. 15, 1916	0.02 sec.-ft.

(251)

Area	2.7 sq. mi.
October flood	1,355 sec.-ft.
Maximum	1,355 sec.-ft.
Flow Nov. 15, 1916	Dry.

(252)

Area	5.7 sq. mi.
October flood	1,020 sec.-ft.
Maximum	1,020 sec.
Flow Nov. 15, 1916	0.1 sec.-ft.

(253)

Area	11.6 sq. mi.
October flood	644 sec.-ft.
Maximum	644 sec.-ft.
Flow Nov. 15, 1916	0.7 sec.-ft.

(254)

Area	6.2 sq. mi.
October flood	255 sec.-ft.
Maximum	255 sec.-ft.
Flow Nov. 14, 1916	0.1 sec.-ft.

(255)

Area	15.8 sq. mi.
October flood	907 sec.-ft.
Maximum	907 sec.-ft.
Flow Nov. 14, 1916	Dry.

(256)

Area	97.4 sq. mi.
October flood	12,230 sec.-ft.
Maximum	12,230 sec.-ft.
Flow Nov. 14, 1916	10 sec.-ft.

(257)

Area	25.4 sq. mi.
October flood	323 sec.-ft.
Maximum	323 sec.-ft.
Flow Nov. 14, 1916	3.3 sec.-ft.

(258)

Area	2.6 sq. mi.
October flood	125 sec.-ft.
Maximum	125 sec.-ft.
Flow Nov. 14, 1916	Dry.

(259)

Area	53.2 sq. mi.
October flood	8,520 sec.-ft.
Maximum	8,520 sec.-ft.
Flow Nov. 14, 1916	5.5 sec.-ft.

(260)

Area	14 sq. mi.
October flood	3,200 sec.-ft.
Maximum	3,200 sec.-ft.
Flow Nov. 14, 1916	0.6 sec.-ft.

(261)

Area	0.05 sq. mi.
October flood	27 sec.-ft.
Maximum	27 sec.-ft.
Flow Nov. 14, 1916	Dry.

(262)

Area	0.7 sq. mi.
October flood	53 sec.-ft.
Maximum	53 sec.-ft.
Flow Nov. 14, 1916	0.1 sec.-ft.

IMPROVING MAIN GILA CHANNEL ABOVE SAFFORD VALLEY.

From the Solomonville Narrows (mile 66.6) to the mouth of the San Francisco River (mile 81.2), a distance of 14.6 miles, there is need of realigning the low water flow channel.

It is proposed to accomplish this by the building of 15,400 linear feet of rock cylinders (type E construction).

This reach has not received a detail study, but it is estimated that 10 per cent of the distance may need treatment, making this expenditure for—

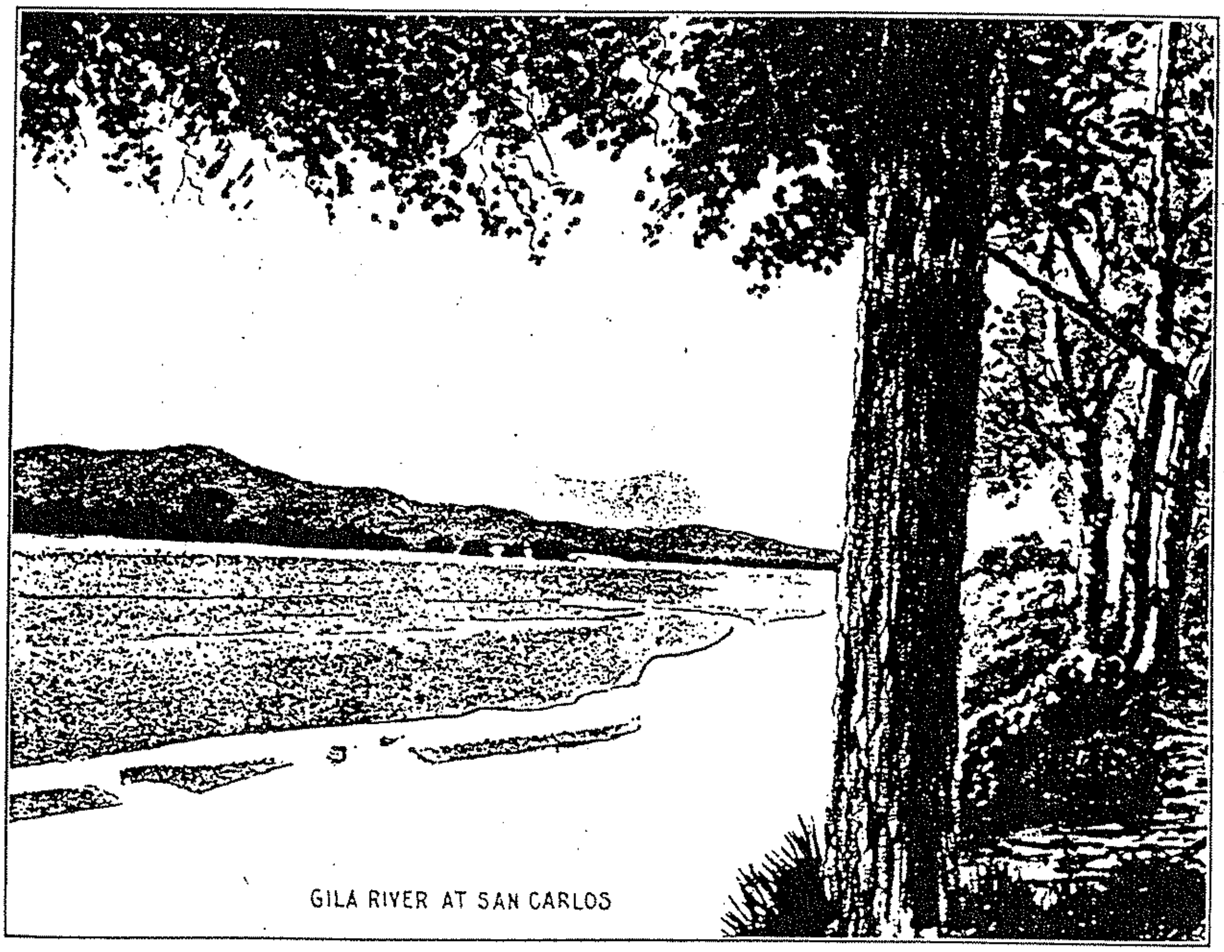
15,400 feet, at $1 per foot	$15,400
For contingencies, engineering, and overhead, 15 per cent	2,310
Total	17,710

Summary.

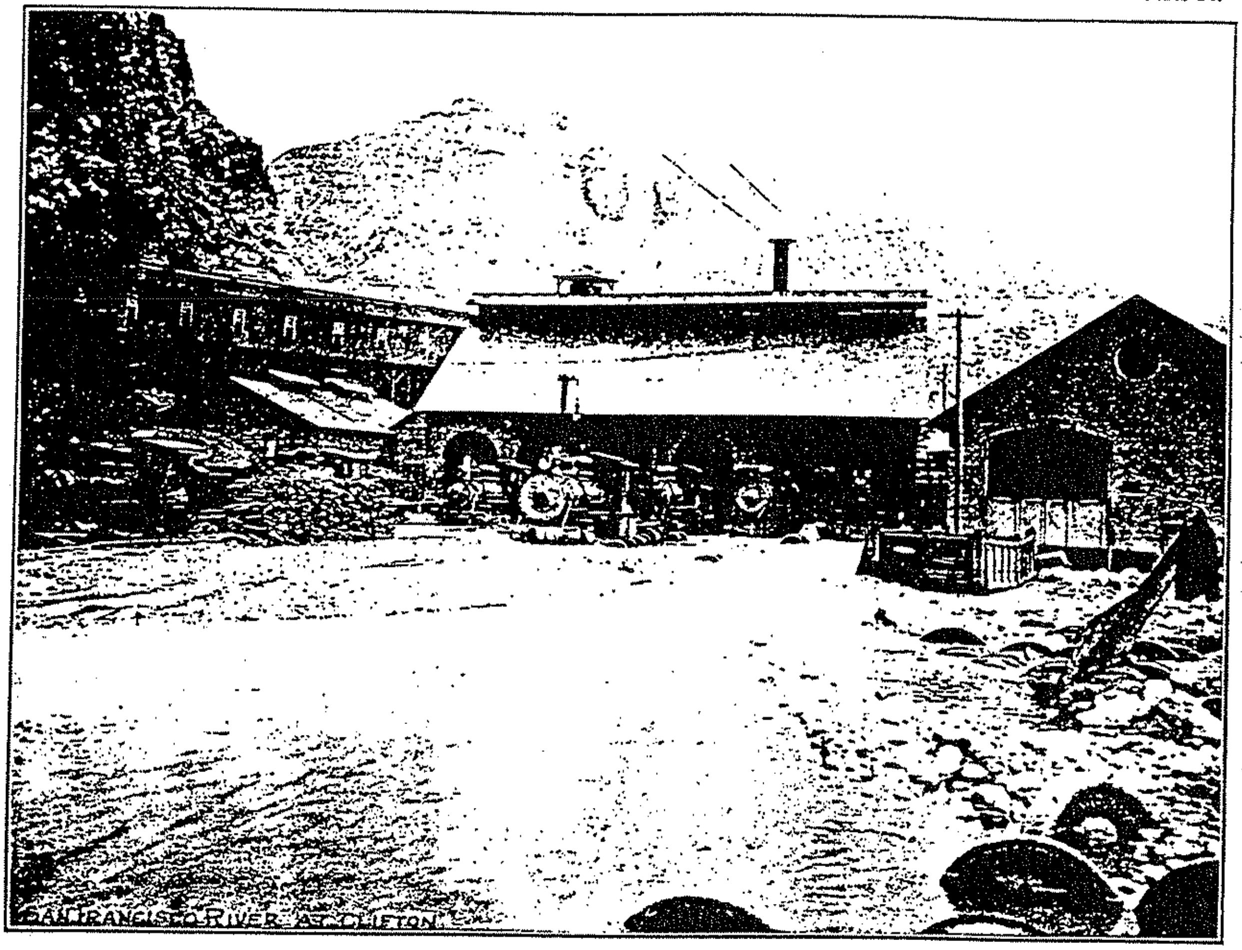
Part 1:		
Gila River bank protection through Safford Valley		$1,109,242
Part 2:		
San Francisco River improvements	$2,446,642	
East Fork of Gila improvements	211,140	
Sapillo Creek improvements	206,942	
West Fork of Gila improvements	433,918	
Mogollon Creek improvements	218,500	
Duck Creek improvements	197,317	
Bear Creek improvements	259,336	
Mangas Valley improvements	270,181	
Eagle Creek improvements	244,950	
Bonita Creek (no improvements)		
San Simon River improvements	491,901	
Safford Valley improvements	293,250	
Main Gila Channel improvements	17,710	
Total expenditure for retardation		5,291,787
Grand total		6,401,029

This total expenditure recommended by the writer for the flood control of the Gila River above San Carlos makes a per acre charge over this area of 83 cents.

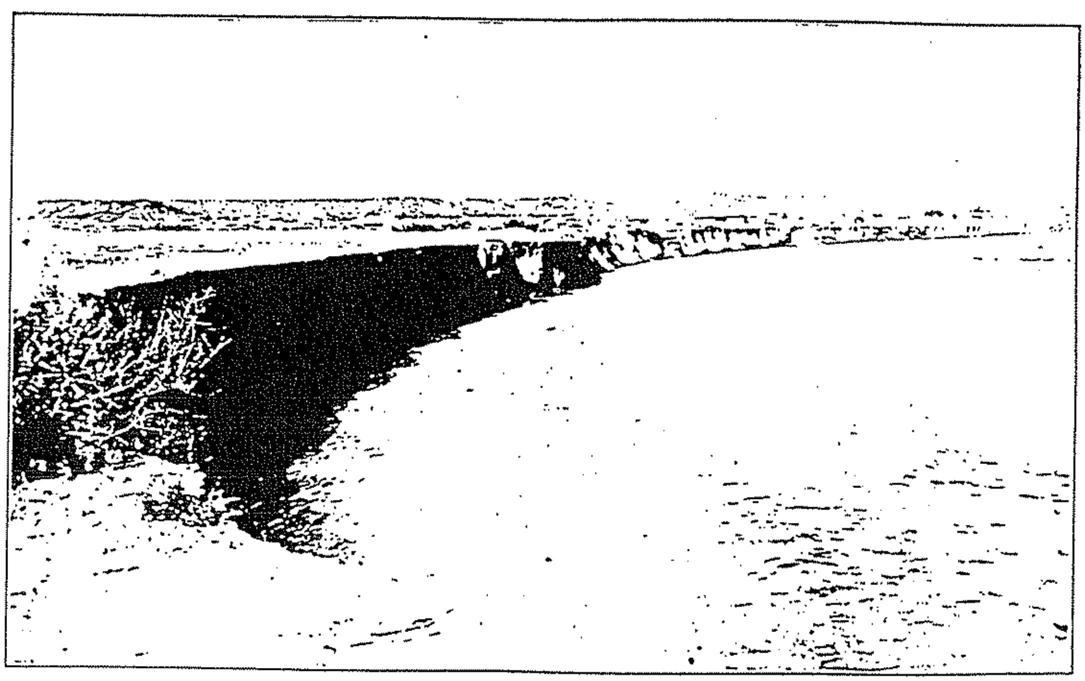
This improvement, if executed, would favorably affect the whole lower Gila and lower Colorado River agricultural sections. In addition to this direct benefit the work would furnish a standard for a new, and it is believed a better, river control system throughout the United States than hitherto has been followed.



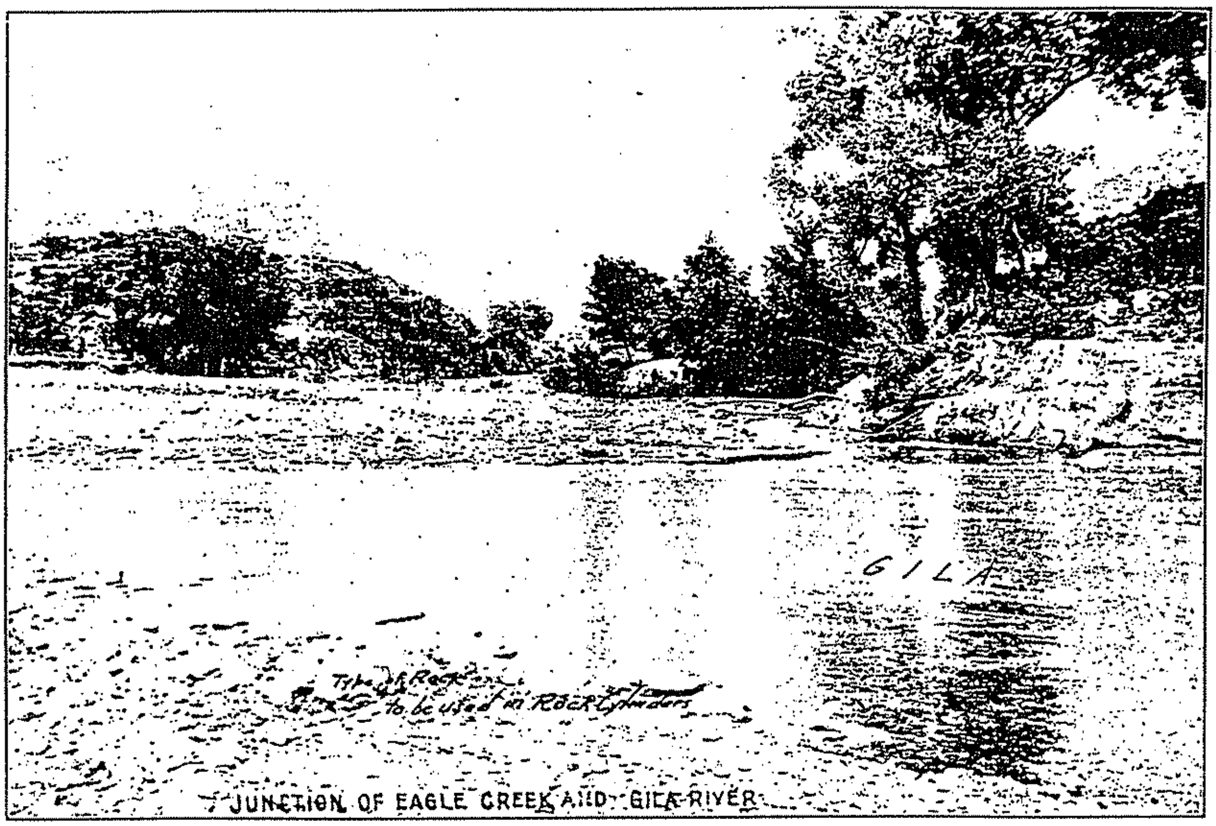
GILA RIVER AT SAN CARLOS



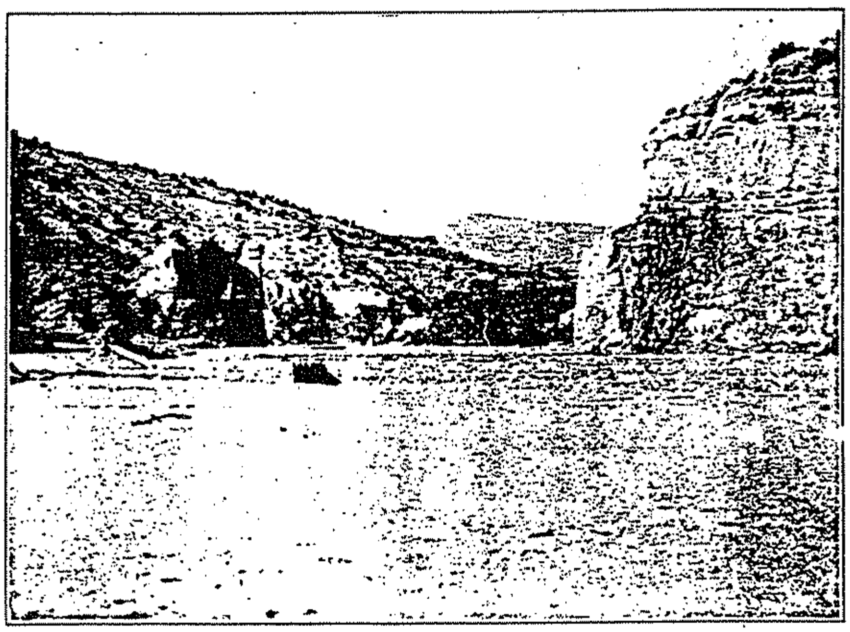
1906 FLOOD.

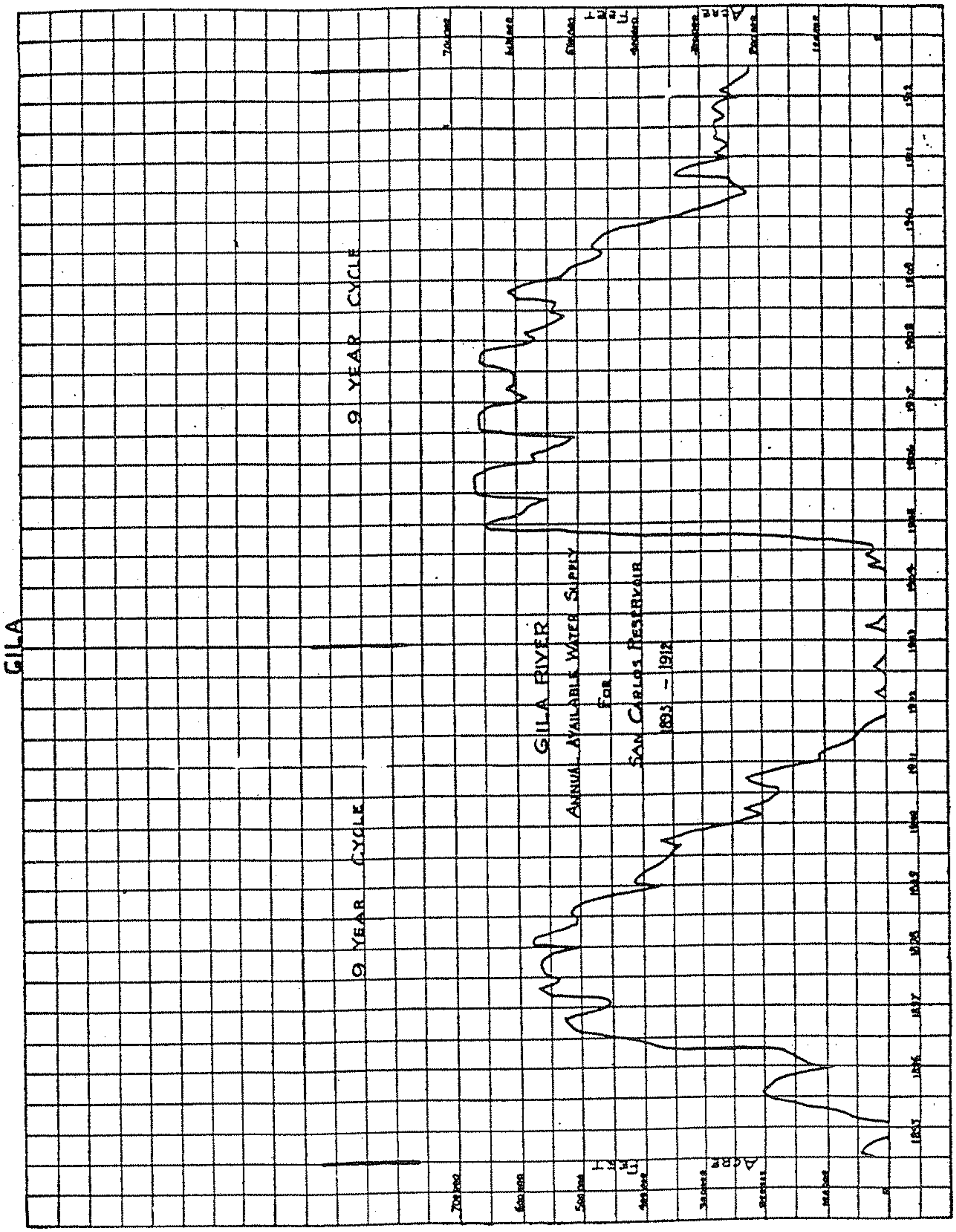


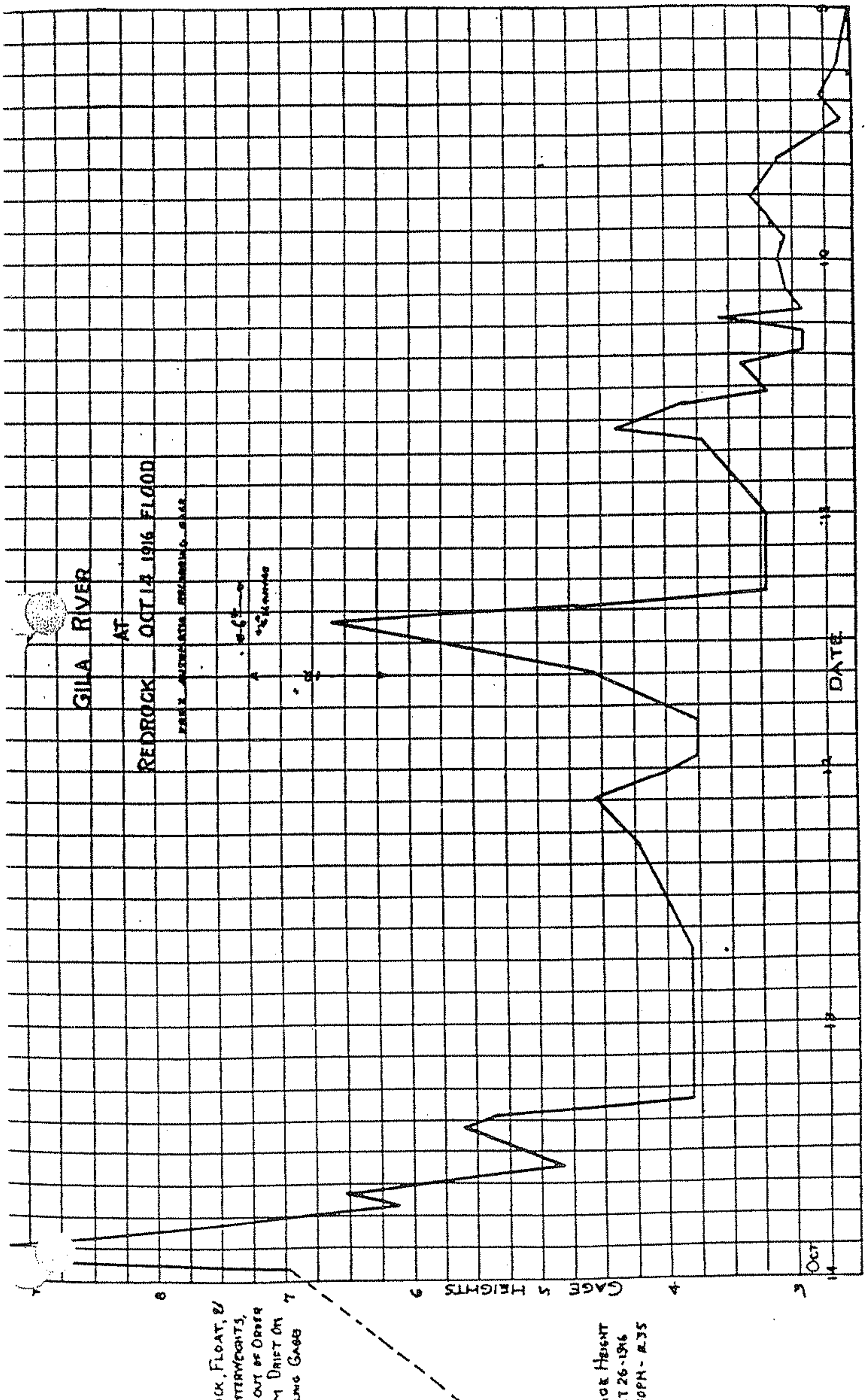
CAVING BANKS.



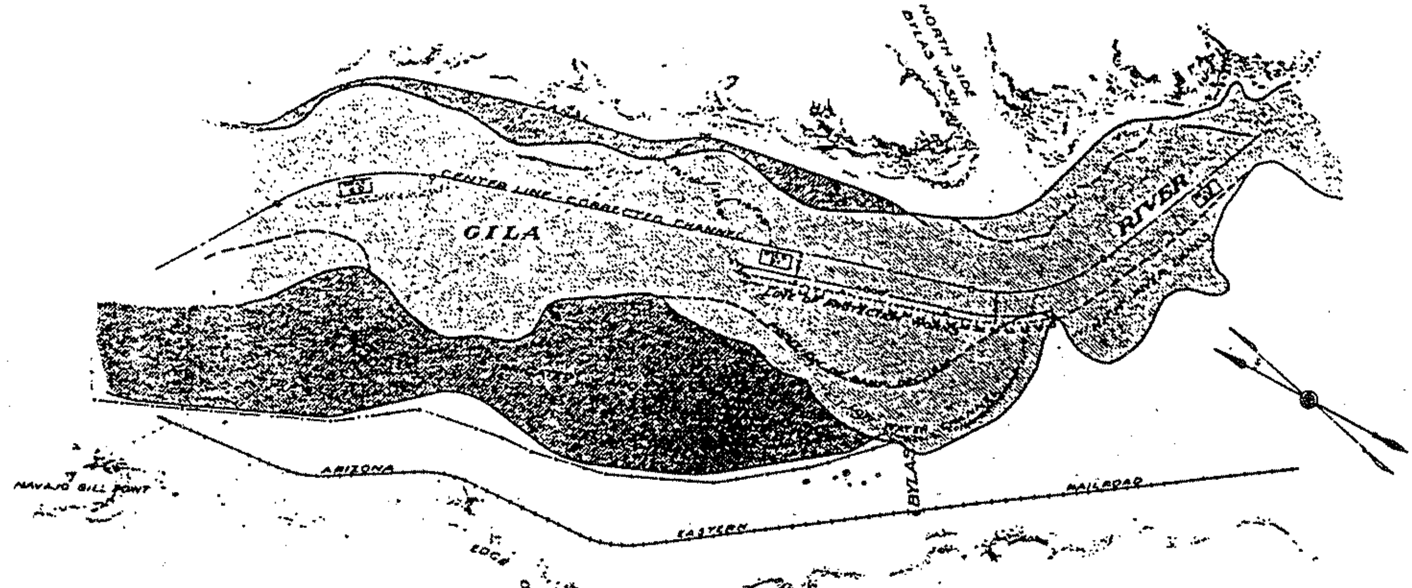
JUNCTION OF EAGLE CREEK AND GILA RIVER




GILA
GILA RIVER
ANNUAL AVAILABLE WATER SUPPLY
FOR
SAN CARLOS RESERVOIR
1895 – 1912
9 YEAR CYCLE
9 YEAR CYCLE
ACRE FEET

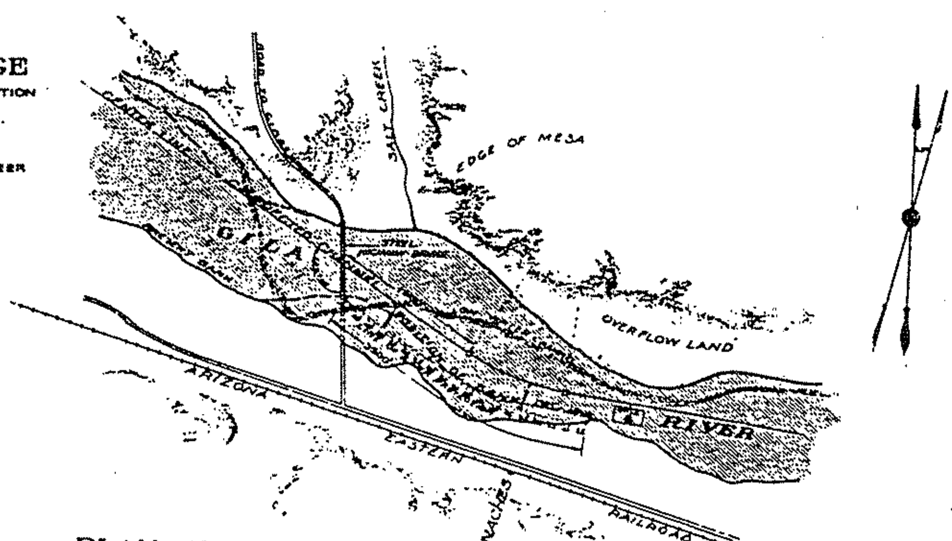

GILA RIVER
AT
REDROCK OCT 14 1916 FLOOD
DATE
GAGE HEIGHTS
Oct 14
13
12
11
10
8
7
6
4
3


TREELESS PLAINS
EAST FORK
BLACK CANYON
WATERSHED
CARLOS RIVER
REPORT ON
CONTROL

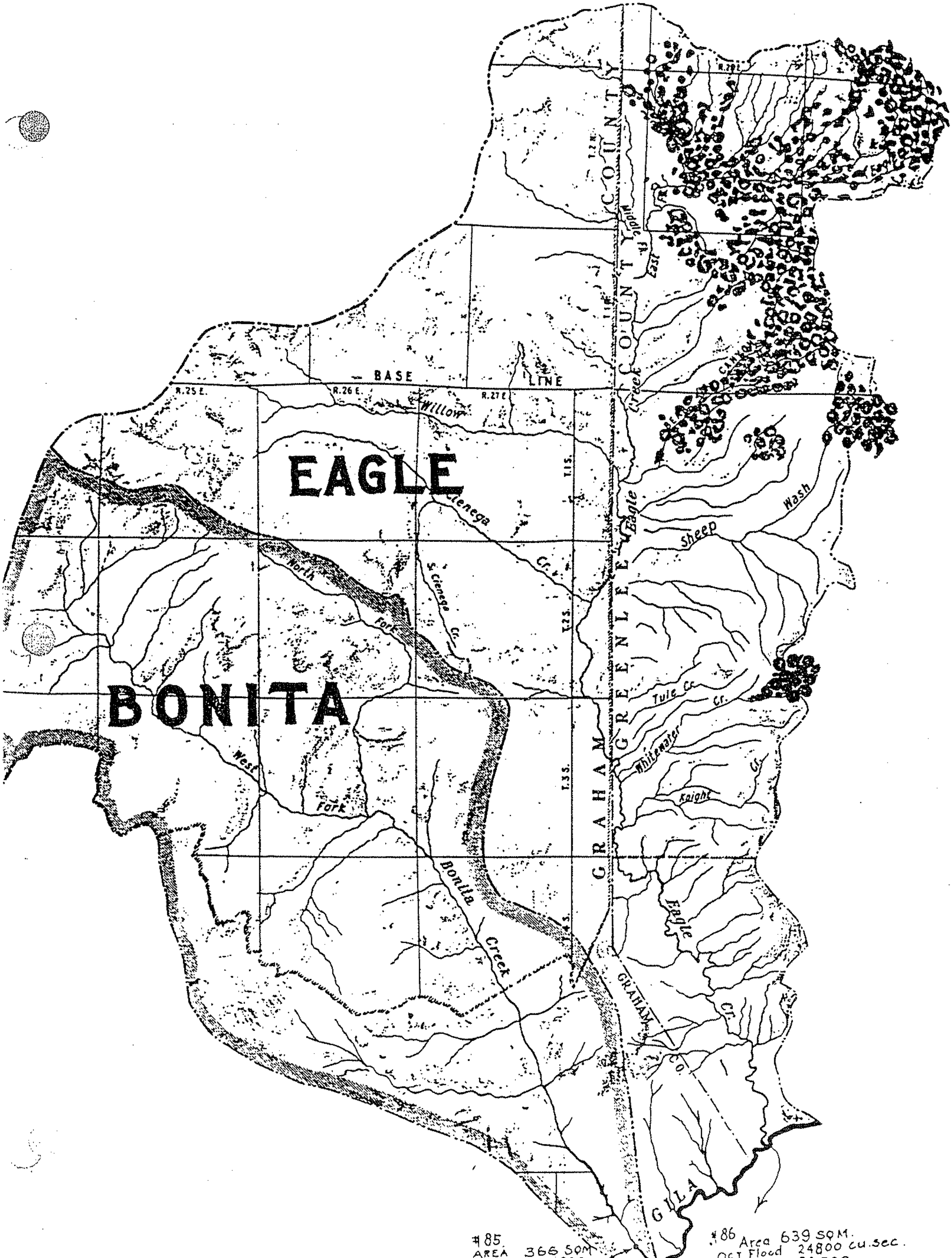


PLAN AT BYLAS

PLAN
OF
PROPOSED
BANK PROTECTION WORKS
AT
BYLAS
AND AT
GILA RIVER BRIDGE
SAN CARLOS INDIAN RESERVATION
GRAHAM COUNTY
ARIZONA
FRANK HOLMSTED ENGINEER
JAN. 1917
SCALE 1 IN.=1000 FT.

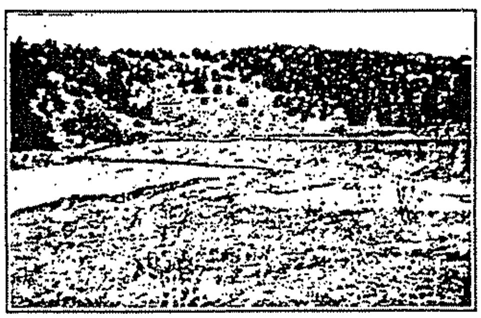


PLAN AT GILA RIVER BRIDGE


EAGLE
BONITA
BASE LINE
R.25 E.
R.26 E.
R.27 E.
R.29 E.
T.1 N.
T.1 S.
T.2 S.
T.3 S.
T.4 S.
GREENLEE COUNTY
GRAHAM
GRAHAM CO.
Willow
Cienega
Cr.
S. Cienega Cr.
North Fork
West Fork
Bonita Creek
Eagle Creek
East
Middle
Sheep Wash
Tule Cr.
Whitewater Cr.
Knight
Eagle Cr.
GILA
#85
AREA 366 SQM
#86 Area 639 SQM.
Oct Flood 24800 cu.sec.

Tularosa Gorge.

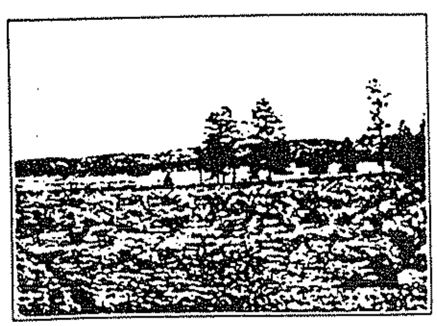
Apache Cliffs.



Straight Cutting Down, Tularosa.

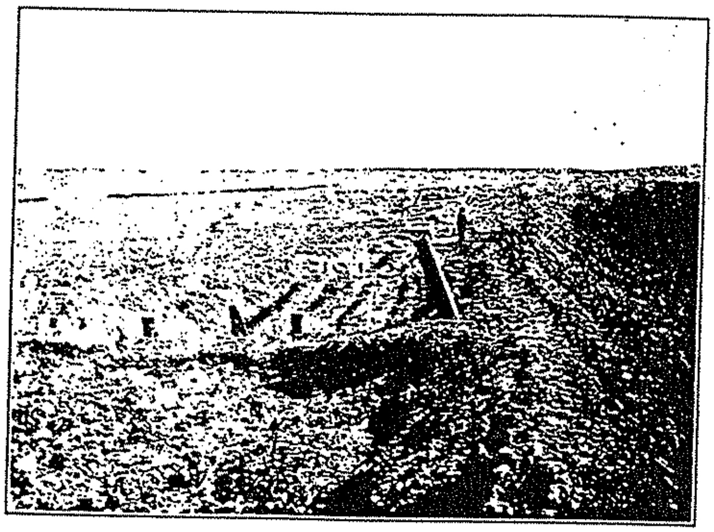
Deep Gullying, Apache.

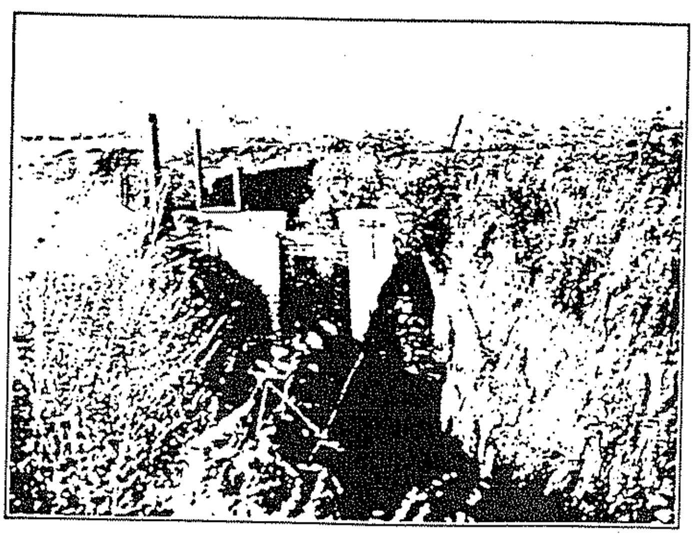
Lateral Back Cutting, Apache.



Upper Tularosa Drainage.

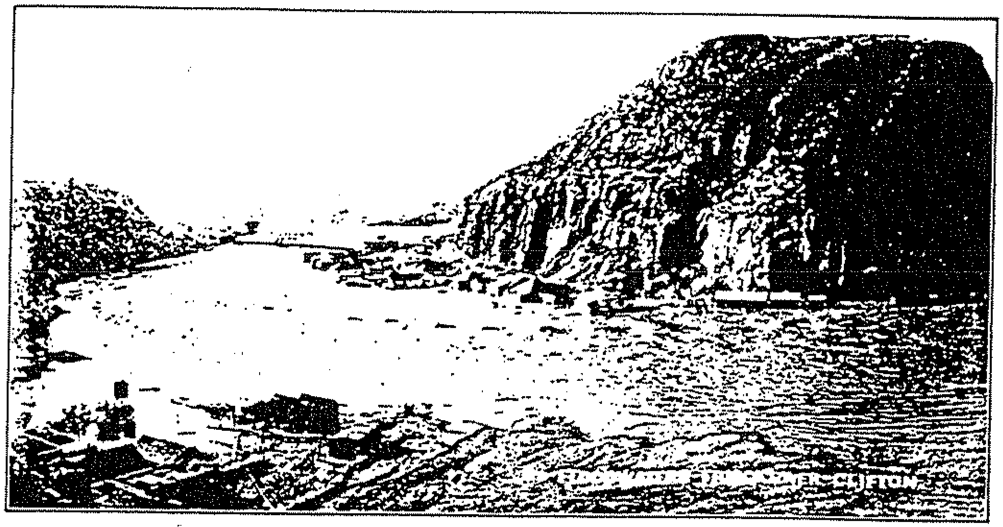
APACHE AND TULAROSA CREEKS.

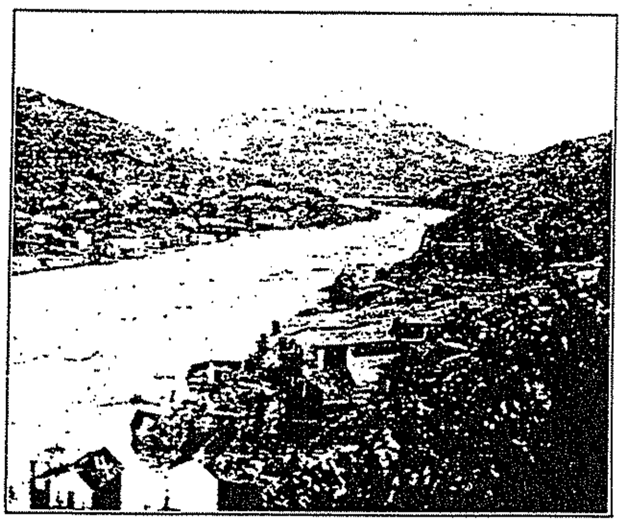


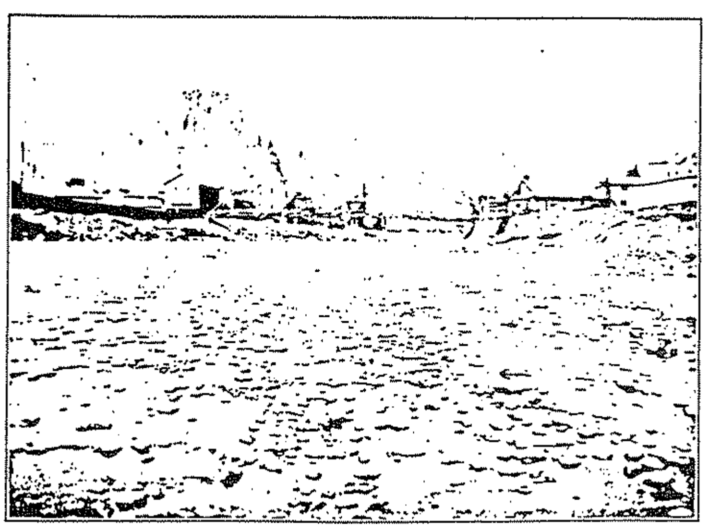


RELIEF FROM EROSION OBTAINED BY USE OF RETARDING STRUCTURES OR CHECK DAMS.

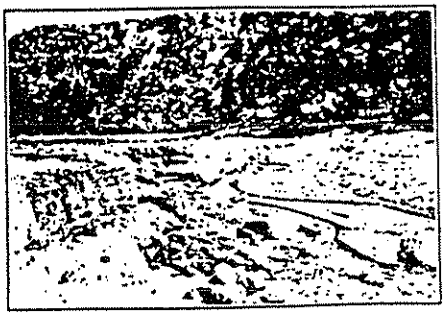
VENTURA COUNTY, CALIF.



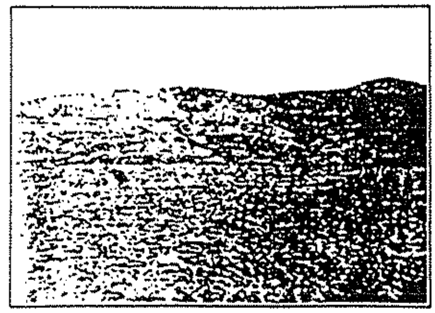




SCENES ON SAN FRANCISCO RIVER AT CLIFTON, ARIZ.



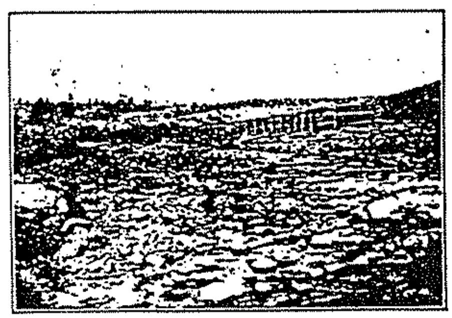
Below Indian Creek.



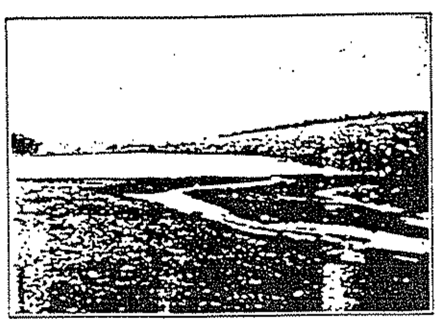
Mouth of Cooney Canyon.

Above Indian Creek.

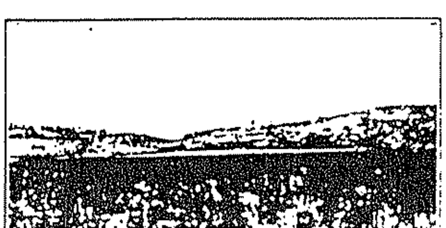
Corduroy Flat.

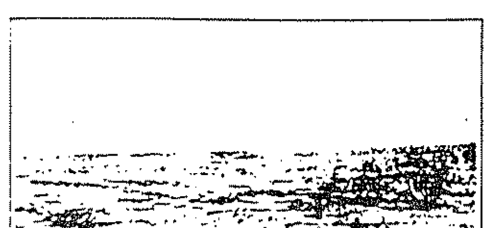


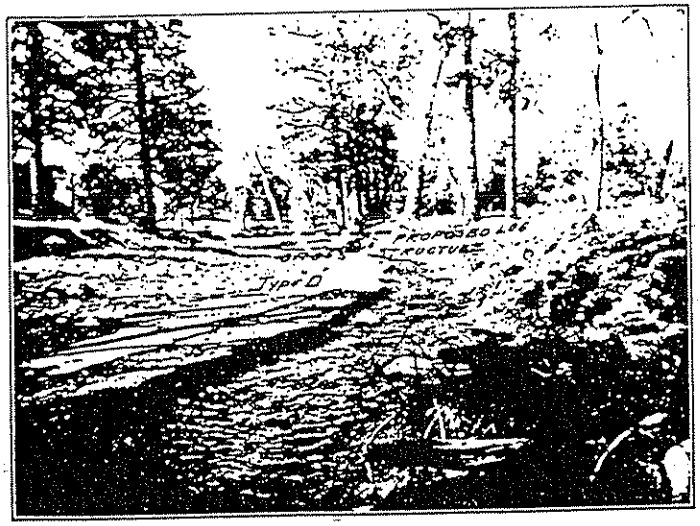
Above Corduroy Flat.



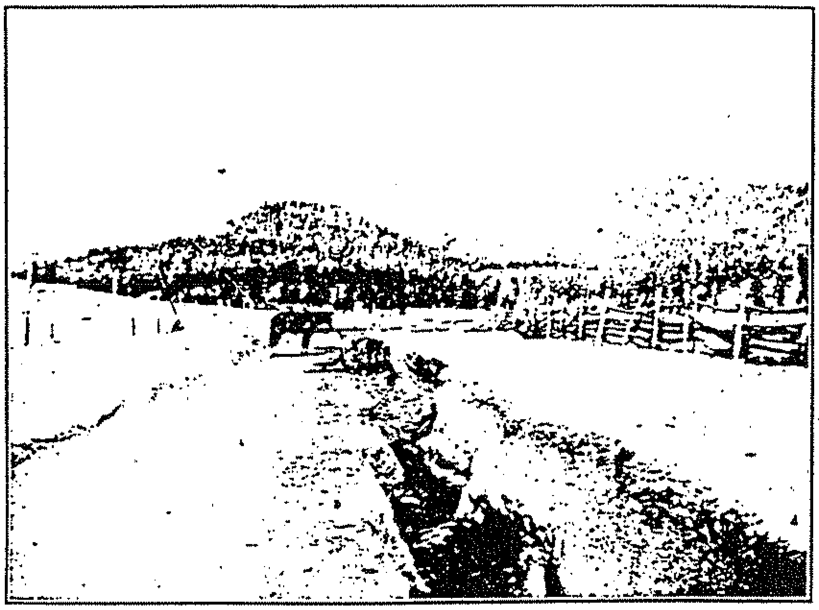
Cooney Tank.



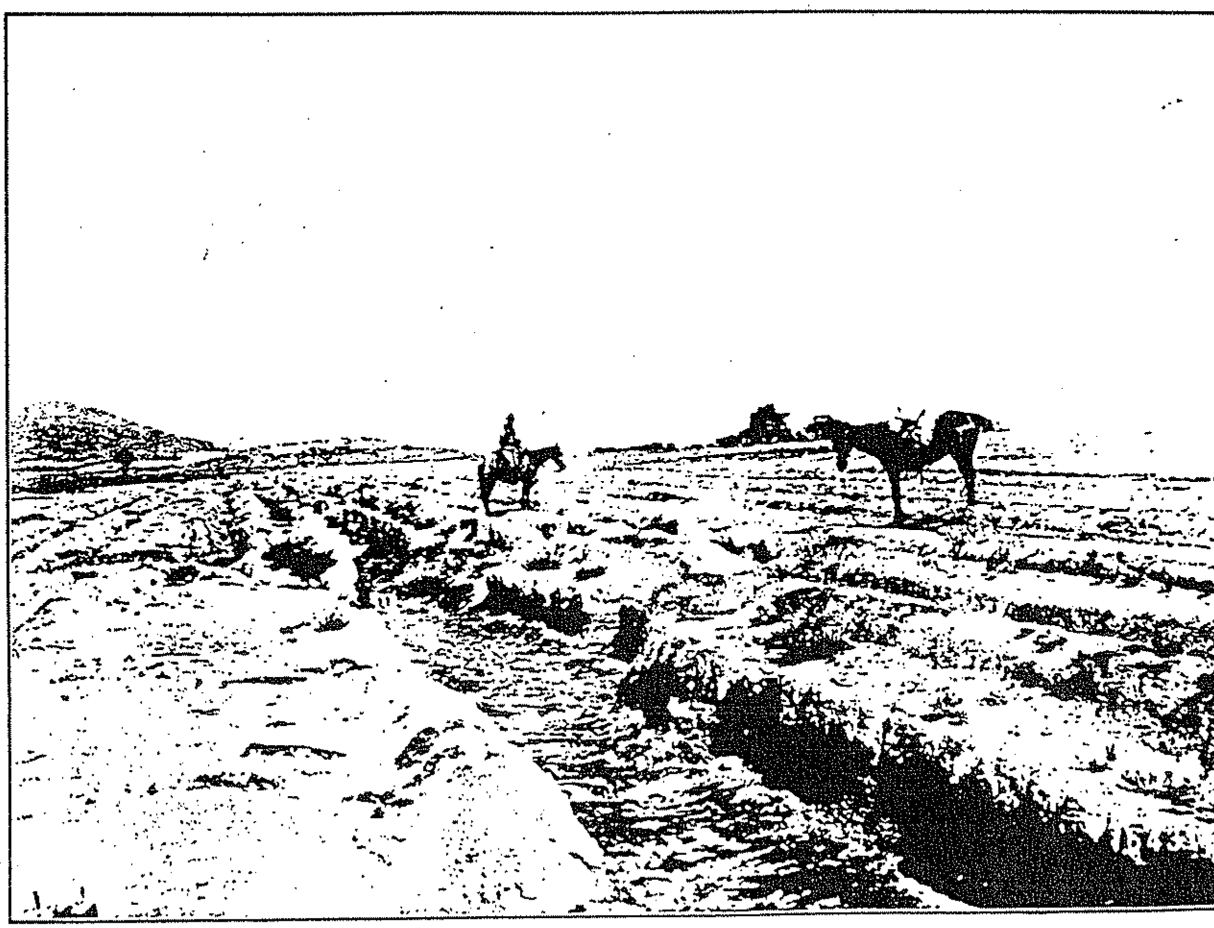


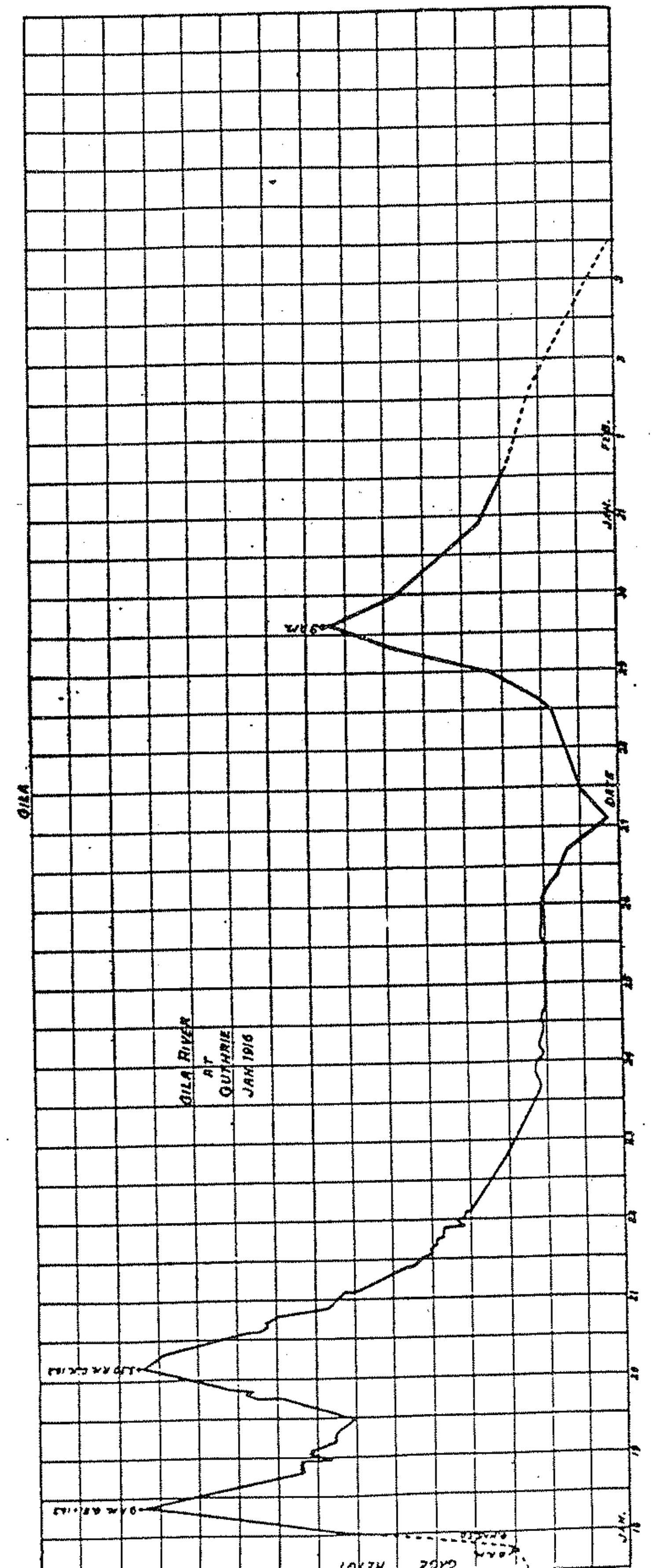


TYPICAL EROSION BY STRAIGHT CUTTING DOWN.



WHEEL-RUT EROSION.




GILA
GILA RIVER
AT
GUTHRIE
JAN 1916
DAYS
JAN.
FEB.

IN THE DISTRICT COURT OF THE UNITED STATES, IN AND FOR THE DISTRICT OF ARIZONA

IN EQUITY

NO. E-59-GLOBE

UNITED STATES OF AMERICA

Plaintiff,

V.

D. E. Adams; D. T. Adams; L. A. Adams; J. L. Aker; Albert Canal Company; H. Albert; Joseph Alder; Mrs. Eliza Alexander; H. L. Alexander; Ephriam J. Allen; J. A. Allen; John W. Allen; Le Allen; S. E. Allen; A. A. Allred; Della Allred; Edith M. Allred; Elden Allred; E. M. Allred; J. N. Allred; Mrs. Maude Allred; M. M. Allred; Myron J. Allred; Phoebe Allred; Ruth Allred; Sesario Alvillar; American Smelting & Refining Company; A. A. Anderson; Hans Anderson; H. J. Anderson; John N. Anderson; Joseph J. Anderson; T. J. Anderson; R. H. Angie; J. C. Anglin; Mary A. Antenoil; Tom Aranda; Arizona Eastern Railroad Company; Fred T. Armstead, Administrator of the Estate of Elizabeth Schultz, deceased; T. W. Arnett; Fannie Bailey; Estate of Walt A. Baitty, Homer H. Martin, Administrator; J. W. Baker; Mrs. V. M. Baker; W. S. Baker; George P. Ballard; Henry Bamesberger; Albert L. Barber; Felix Bareda; Pablo Barela; Ruth R. Barham E. G. Barlow; Mrs. Sarah Barney; Mrs. Sophie Barney; W. T. Barney; E. D. Barry; Archie L. Bartlett; Pansy Kenower Bartlett; Innocente Bartolda; Severa Bartolda; Fred W. Bassler; Madslen Bassler; Maude M. Bassler; Thomas Batty; Walter Batty; Otis J. Baughn; C. M. Beal; J. H. Beal; Mrs. J. S. Beals; J. R. Beavers; Albert C. Becken; Grace R. Becken; William N. Beebe; Fran V. Beers, Administrator of the Estate of R. H. Beers, deceased; Thomas H. Bell; Charles F. Bennett; Jarvus D. Bennett; W. A. Bennett; D. Bertoglio; Pedro Bertolda; George A. Bigler; William Bigler; John Bilby; Florentino Billaba; B. F. Billingsley; Billingsley Extension Canal Company; John Billingsley; Hyrum Bingham; J. Bingham; J. H. Bingham; Lester Bingham; R. William Bingham; Warren Bingham; W. R. Bingham; D. W. Birdno; Mrs. John J. Birdno; Mary Lorraine Birdno; Black & McCleskey Canal Company; E. W. Black; Edsil Blain; Frances D. Blair; W. Blair; Ben Blake; Ed Blake; I. B. Blake; Mrs. Thomas Blake; W. Bleinstein; Clifton Bogard; T. F. Boggs; W. F. Bollinger; Charles Boots; C. B. Boren; William Boren; W. E. Bowers; H. C. Boy C. D. Bradley; Ida M. Bradley; John R. Bradshaw; Silas Bradshaw; Mrs. Artie Branam; L. S. Branaman; Wallace Branch; T. J. Branyon; Ira S. Brayton; Esther A. Brockway; George M. Brockway Marshall F. Brockway; C. M. Brooks; M. H. Brooks; R. W. Brooks; W. W. Brooks; Brown Canal Company; Charlotte Hall Brown; Elizabeth Brown; Gratz D. Brown; Jaared T. Brown; J. H. Brown; J. Brown; L. J. Brown, Jr.; Margaret P. Brown; S. A. Brown; Sarah B. Brown; Thresa Hall Brown; T. W. Brown; Estate of W. F. Brown, P. D. Overfield, Administrator; William Brunson; Adelaide M. Bryce; A. J. Bryce; David J. Bryce; E. P. Bryce; G. A. Bryce; Heber B. Bryce; J. W. Bryce; R. A. Bryce; Mrs. Sarah Bryce; W. C. Bryce; William E. Bryce; Nellie E. Buck, Administratrix the Estate of David Buck, deceased; John J. Buggs; E. G. Bullard; George W. Burgess; J. C. Burleson; Charles Burrell; George Burrell; Manuel Burrell; Lee Robinson Burris; John W. Burris T. D. Burton; J. D. Busby; Mary Butler; W. F. Butler, Jr.; L. B. Cadwell; David F. Campbell, Jr.; Mary E. Campbell; J. E. Cardon; Edward Carpenter; Frank Carpenter; John Carpenter; Lester Carpenter; William Carpenter; Mrs. Jesus Carrasco; V. Carrasco; Antone Carreon; Albert Carter; Alof P. Carter; Alof P. Carter, Administrator of the Estate of E. L. Carter, decease E. B. Carter; J. W. Carter; Mrs. Tom Carter; W. A. Carter, Jr.; W. A. Carter, Sr.; Casa Grande Valley Bank; Ypolita Cascarilla; Lewis Cathecer; Mrs. Maggie Cauthen; Mike Celeya; A. R. Chambers; J. A. Chapman; W. W. Chapman; John E. Charlton, Administrator of the Estate of W. B. Charlton, deceased; A. D. Cheatham; Betty Marsh Cheatham; E. V. Cheatham; I. M. Cheatham; Mary Ann Cheatham; S. C. Cheatham; P. Chendilla; D. W. Cheney; Mrs. A. W. Chesley; Edgar H. Chesley; J. E. Chesley; Pablo Chevarria; J. K. Chilton; H. R. Chlarson; Albert J. Christensen; Antone Christensen; L. T. Christensen; Victor Christenson; Church of Jesus Christ of Latter Day Saints; Citizens Bank; Edward M. Claridge; Charles S. Clark; Estate of Dora M. Clark; H. J. Clark; W. A. Clark; H. S. Clarke; Earl G. Clemans; Edith M. Clemans; Hazel H. Clemans; Mark Twain Clemans; Winnefred W. Clemans; W. J. Clemans, Jr W. P. Clements; Mrs. Charles E. Cleveland; Aeshel Clifford; Elijah Clifford; Henry Clifford, Sr.; L. A. Clifford; W. H. Clifford; R. F. Cloudt; M. A. Clouse; B. F. Cluff;

Benjamin F. Cluff, Administrator of the Estate of Joseph Cluff, deceased; Benjamin F. Cluff, Administrator of the Estate of Phoebe Cluff, deceased; Mrs. J. E. Cluff; John Cluff, W.
Cluff; Mrs. Jas. I. Cohn; Evans Coleman; G. W. Collins; H. L. Colvin; Colmenero Canal Company;John D. Colvin; Colvin-Jones Canal Company; Inez H. Conrad; C. S. Conway; C. S. Conway
Administrator of the Estate of F. W. Hays, deceased; Hazel A. Converse; C. L. Coombs; George Coombs; H. V. Coombs; Isaac Coombs; N. E. Coombs; William Coombs; Grady Coppedge; James
Corder; Alice H. Cosper; George H. Cosper; George H. Cosper, Jr., Administrator of the Estate of George Cosper, deceased; John C. Cosper; Mussett Cosper; Cosper & Windham Canal Co
Cosper & Windham Extension Canal Company; Henry Crabbe; J. L. Crabtree; F. M. Craig; Mrs. W. E. Craig; G. E. Crandall; R. D. Crandall; W. C. Craufurd; G. L. Crawford; J. H. Cready
Crockett; H. W. Crockett; W. W. Crockett; Thomas A. Crow; Eldora Curry; Roland Curry; A. J. Curtis; Ammon Curtis; Curtis Canal Company; Cleve Curtis; Don Curtis; Mrs. Elizabeth Cu
Emery Adelbert Curtis; Eugene Curtis; Ezra Curtis; Mrs. Frank Curtis; H. M. Curtis; Mrs. Virginia Curtis; L. C. Cutler; Charles E. Dallas; Mrs. Julia Daly; Willis K. Daly; Mrs. Heste
Mrs. M. J. Daniels; E. G. Davidson; Jennie Davidson; John H. Davidson; David Davis; E. Day; A. B. Decker; Z. B. Decker; Mrs. M. A. Dees; Etta G. Deller; John H. Denniston; Pearl De
Robert Denton; Robert Denton, Administrator of the Estate of George F. Gallagher, deceased; Mrs. Henry Dial; Guy Dixon; Maurice Dodd; A. J. Dodge; Dodge-Nevada Canal Company; Davi
Mrs. Lyman Dodge; Thomas Dodge; J. M. Dominges; Claro Dominques; Carl M. Donaldson; Mira B. Doran; Mrs. Lily Duke; Duncan Canal Company; Gus Duncan; Duncan Union High School Distri
Earven; Tracy Eastman; Benjamin Echols; Byron Echols; M. B. Echols; Ramolda Elias; H. B. Elledge; Joseph C. Elledge; R. E. Elledge; W. H. Elledge; Christobell G. Ellis; Davidsel E
Ernest Ellsworth; Francis Ellsworth; William Ellsworth; Mrs. Charlotte F. Elmer; G. I. Elmer; J. H. Elmer; Mrs. Sarah S. Elmer; Frank C. Elwell; Hart D. Empie; Miguel Encinas; Cat
Entzminger; Mrs. Belle Epley; John C. Epley; Joe Erny; Jesus Espinosa; Jose T. Espinosa; P. Estrada; Austin Evans; George C. Evans; John Evans; E. C. Eyring; Amadeo Fajardo; C. E.
J. A. Farley; Luther Farley; A. M. Farmer; F. A. Farrell; C. J. Farrington; Amos F. Fearin; Juan S. Feliz; Manuel S. Feliz; Pedro S. Feliz; Salvadore S. Feliz; J. T. Felshaw; H. M. F
M. P. Ferguson; F. M. Ferrell; C. E. Ferrin; Ether S. Ferrin; Robert Ferrin; W. M. Ferrin; Fidelity Savings & Loan Association; Jose Figuerroa; J. H. Fine; First National Bank of
C. A. Fitzgerald; Seth P. Fletcher; Florence-Casa Grande Water User's Association, Town of Florence; Elias Flores; Nora Floyd; Joseph E. Follett; I. A. Follett; L. L. Follett; F. L.
George Foote; J. W. Foote; Orson F. Foote; W. R. Foote; Fort Thomas Consolidated Canal Company; Hugh Foster; J. A. Foster; John H. Foster; Karl Foster; S. A. Foster; W. F. Foster;
Fourness Canal Company; Mrs. Clera Fourness; J. L. Foutz; J. R. Fowler; Ernesta Francese, Administratrix of the Estate of Frank Francese, deceased; Augustin Franco; Pedro Franco
Franklin Irrigation District; J. J. Fraser; James D. Freeman; J. L. Freeman; M. S. Freeman; Alma Freestone; Charles E. Freestone; R. L. Freestone; P. H. Freudenthal; R. H. Friesto
Archie Fuller; Lawrence Fuller; Thomas F. Fuller; William Fuller; J. B. Fullerton; Lissa J. Fulton; May E. Furback; Millard Fyfe; Kathrina Gack; B. J. Gale; Mrs. E. A. Gale; J. B.
Otto Gale; W. T. Gale; E. Gallego; James A. Gamble; L. D. Gamble; Casimiro Garcia; G. Garcia; Jesus Garcia; Jose B. Garcia; Juan Garcia; Marajilda Garcia; Rafael Garcia, Tomas Gar
Victoriano Garcia; Thomas Gardner; F. N. Gault; Ramon Gauna; Fernando Gervantez; Charles Gietz; Gila Valley Irrigation District; M. L. Gilbert; W. A. Gill; Albert Gillespie; Elvar
Gillespie; James Gillespie; Shell Gillespie; William H. Gillespie; Aubra Gilliland; Forrest Gilliland; J. M. Gilliland; R. C. Gilliland; J. R. Gillmore; Ecil Girard; T. H. B. Gles
Nellie R. Gochenouer; J. R. Golding; Mrs. S. C. Gonzales; Trivio Gonzales; Mrs. Francis Goodman; George A. Gourley; H. Grady; Graham Canal Company; County of Graham, State of Arizona;
Graham; Mattie Graham; Epitacio Granillo; J. L. Green; Reece D. Green; Joseph Greene; Joseph Greenhalgh; J. W. Greenhalgh; R. H. Greenhalgh; Christino Grijalva; J. M. Grijalva Me
Grijalva; C. J. Grover; A. C. Gruwell; John Hagan; Virginia Hales; John Hamilton; Hugh C. Hamman; A. T. Hammons, Receiver; Annie B. Hancock; E. E. Hancock, Ira Hancock; Jesse A. H
M. M. Hancock; May Catlin Hansen; H. B. Harms; A. Harper; John H. Harper; H. B. Harris; M. L. Harris; Waide Harris; J. B. Harsha; Delbert Hatch; George L. Hatch; G. J. Hatch;
Hatch; Vernon W. Havins; Elijah Hawkins; J. N. Hawkins; C. D. Haynie; L. B. Head; George W. Healy; J. L. Henderson; C. M. Hendricks; John Hendricks; Sam Henry; Grady L. Herring;
Herron; C. C. Hester; O. L. Hext; Spence C. Heywood; C. N. Higgins; Heber M. Higgins; Floyd Hightower; C. F. Hill; J. W. Hill; Mrs. Clara Hinton; Nellie R. Hoch; Calvin Hocker F.
Holiday; Scott Holladay; S. N. Holman; J. N. Holyoak; William H. Holyoak; Mrs. Arthus Hoopes; Bert Hoopes; H. E. Hoopes; John L. Hoopes; George A. Hoopes; C. F. Houlihan; E. D. Hou
E. D. Howard; J. M. Howard; Joesph Howard; S. D. Howard; Almera Hubbard; Thomas H. Hundley; A. C. Hunt; Sarah A. Hunt; Mrs. S. J. Hunter; Mrs. W. E. Irwin; Zeb Ison; George P. Jac
Martin Jacobson; P. J. Jacobson; Edith B. Jamieson; F. P. Jamieson; J. C. Jamieson; James C. Jayne; S. L. Jenkins; S. P. Jenkins; James Jensen; M. N. Jensen; Milton N. Jensen; Rac
Jensen; David Johns; Charles P. Johns; D. L. Johns; J. C. Johns; L. A. Johns; R. T. Johns; S. L. Johns; W. A. Johns; Mrs. William Johns; Delbert Johnson; D. C. Johnson; E. R. John

G. W. Johnson; Norman J. Johnson; P. Johnson; Thomas H. Johnson; Orlando Jolly; F. W. Jones; James E. Jones; John B. Jones; Mary Jane Jones; Parley P. Jones; Richard J. Jones; T. V. Jones; Willard E. Jones; Julia R. Julian; David Jurado; Culver Kartchner; Leo Kieffer; A. E. Keller; P. M. Kelly; Mrs. S. L. Kemp; Bell Kempton, Administratrix of the Estate of A. N. Bryce, deceased; A. J. Kempton; Asa B. Kempton; Calvin I. Kempton; Fred Kempton; Heber Kempton; Ira N. Kempton; Mrs. Margaret R. Kempton; R. H. Kempton; Donald Kennedy; J. D. Kennison; Fred R. Kenower; Ola R. Kenower; Charles Kerby; W. M. Kerby; W. O. Kidder; George Killian; Heber C. Kimball; Spencer Kimball; Thomas S. Kimball; F. E. Kirkpatrick; Richard Kirtland; H. B. Klingenberg; Edith Knapperberger; Frank Knapperberger; William G. Knight; Anna E. Kochsmeier; Frederick Kochsmeier; Henry Kochsmeier, Sr.; Henry D. Kochsmeier; Maria Kochsmeier; Gustav Kratzka; Charles Kruger; Cora Kruger; James J. Kruse; Ed Lacy; J. E. LaFleur; E. M. Lambson; A. O. Lamoreaux; A. O. Lamoreaux, Jr.; Guy W. Lamoreaux; R. D. Lamoreaux; W. W. Lane; Rafael O. Larona; Maude Larsen; Beatrice Larson; Charles S. Larson; C. O. Larson; Earl Larson; Ephriam Larson; James M. Larson; Joe Larson; Lehi Larson, Sr.; Maroni Larson; Mildred B. Larson; Mrs. Olivea Larson; Orvil Larson; William Larson; Dirk Ley; Elizabeth L. Lay; Alex Layton; Layton Corporation of the Church of Jesus Christ of Latter Day Saints; A. T. Layton; Charles M. Layton; C. M. Layton, Jr.; H. W. Layton; James Layton; Leslie W. Layton; M. M. Layton; Oscar G. Layton; R. G. Layton, Jr.; Roy A. Layton; Amy T. Leavitt; Lola LeBaron; Art Lee; Claude M. Lee; J. D. Lee; J. Y. Lee; Marion Lee; Mrs. W. A. Lewis; Mrs. Nisia Lindsey; Al Lines; Henry Lines; Joseph H. Lines; Milton Lines; W. A. Lines; David A. Little; A. N. Livvix; W. W. Lloyd; Minnie Lobb; T. A. Lonergan, Administrator of the Estate of W. H. Lonergan; Anna H. Lunt; Edward Lunt; George A. Lunt; G. V. Lunt; Heaton Lunt; Owen Lunt; P. L. Lunt; Randall Lunt, Administrator of the Estate of Jasper Gale, deceased; R. H. Lunt; Charles Luster; R. L. McAllister; May H. McBennett; D. C. McBride; Ether McBride; James A. McBride; Laura McBride; P. H. McBride; P. H. McBride, Jr.; W. E. McBride; A. L. McCann; Alpha E. McCann; Minnie M. McCann; James K. McCarty; W. V. McCarty; Mrs. Laura McCullom; Mitchel McDonald; Carrie McDowell; M. W. McDowell; C. J. McElroy; Martha McElroy; A. F. McEuen; E. W. McEuen; M. P. McEuen; Virgil R. McEuen; Ernest W. McFarland; Gertrude B. McGee; J. F. McGrath; Thomas McGuire; Glen C. McKenzie; R. J. McLaren; Gordon McMurray; Elizabeth P. McMurrey; H. H. McNeil; M. J. Mabin; A. O. Mack; C. M. Mack; Henry H. Mack; J. A. Mack; J. H. Mack; William S. Mack; Robert Mackey; Abran Madrid; James Mallon; W. J. Mallon; Angus Maloy; G. B. Maloy; H. D. Maloy; Melanie Mandell; Clark Mangum; William Manske; S. Marous; Rita Marquez; Ivey Marshall; Ralph K. Marshall; S. S. Marshall; W. G. Marshall; Joe Marta; C. C. Martin; Clarence Martin; David Omer Martin; Elizabeth M. Martin; J. A. Martin; J. B. Martin; J. S. Martin; Mrs. W. F. Martin; Juan Martinez; C. V. Massey; Mrs. L. A. Massey; Ian B. Mathews; George A. Mathews; George Clyde Mathews; Simon Mathews; C. A. Matthews; Mrs. Chloe Matthews; D. H. Matthews; Eliza Matthews; Jane L. Mattice; John W. Mattice; Lewis F. Mattice; Ben Mauer; Josiah J. Maxcy; Kimball Maxham; Mrs. F. M. Medhurst; R. D. Melick; Emma B. Mellinger; Miguel Mena; Manuel Mendez; Damesio O. Meraz; Lillian C. Merchant; E. A. Merrill; Fenley F. Merrill; Gerald Merrill; H. M. Merrill; Martha A. Merrill; Orson A. Merrill; P. C. Merrill; P. C. Merrill, Administrator of the estate of Joe Pensyl, deceased; P. M. Merrill; S. A. Merrill; T. S. Merrill; J. H. Merrian, Executor of the Estate of Alice E. Day, deceased; Miles Messinger; Louis Michelena; Mrs. M. Michelena; John B. Michea; Mrs. J. S. Miles; Mary L. Miles; G. W. Miller; R. E. Miller; R. M. Miller; J. L. Mills; Fred M. Mitchell; James A. Mitchell; Lillian I. Mitchell; Moddle Canal Company; Henry G. Moeller; Sisto Molino; Francisco Montez; Jesus Montez; Montezuma Canal Company; Robert M. Montgomery; E. E. Montierth; George Montierth; Leslie Montierth; M. G. Montierth; Wendell Montierth; Edward Moody; Edwin Moody; J. M. Moody; Theodore H. Moody; Winford Moody; Fayette Moore; J. R. Moore; R. C. Moore; Ethel M. Moorehouse; H. W. Moorehouse; Rolland H. Moorehouse; Vashti B. Moorehouse; Jose Morales; Mrs. Belle Morris; Cicero Morris; E. M. Morris; Frank Morris; George Albert Morris; John W. Morris; Robert Morris; William Morris; Hans Mortensen; Hiram K. Mortensen; J. Alfred Mortensen; M. Mortensen; O. Mortensen; Peter Mortensen; W. T. Mosley; C. N. Motes; D. T. Motes; Ernest Motes; P. L. Motes; L. D. Moyers; L. G. Moyers; W. F. Moyers; Anna M. Moyes; Joseph Moyes; Margarete L. Murphy; J. S. Murry; L. S. Nafziger; M. N. Nafziger; E. R. Naillon; J. R. Naillon; Robert L. Nash; Amanda Nations; Aron T. Nelson; L. A. Nelson; W. L. Nelson; Nevada Consolidated Copper Company; E. E. Newman, Administrator of the estate of H. H. Scorce, deceased; S. W. Newman; C. H. Niemeyer; H. L. Norton, Jr.; H. L. Norton, Sr.; J. E. Norton; Lloyd Norton; P. A. Norton; S. N. Norton; William R. Norton; Catherina A. Norviel; Leon M. Nowell; John Nulton; H. J. Nunn; T. A. Nunn; J. H. Nuttall; J. P. Oberholser; Braulio Ochoa; Lillian O'Connor; Olive J. O'Connor; O. G. Odell; Lewis Olesen; Victorino Olivas; W. Ollerton; Mrs. E. Olsen; Elam Olsen; Oscar Olsen; James Opie; N. Ortiz; Peter D. Overfield; Elsie L. Overly; J. T. Owens, Jr.; O. E. Owens; Mrs. C. R. Pace; Mrs. Isabelle Pace; Nancy O. Pace; W. W. Pace; Asa Packer; E. K. Packer; W. C. Packer; Antonio S. Padilla; Joaquin Padilla; Mrs. Marcelina Padilla; Florence Palamounter; Howard G. Palamounter; E. Palmer; I. J. Palmer; Isaac O. Palmer; J. I. Palmer; Lee L. Palmer; Mrs. Nancy Palmer; Roy Palmer; Van D. Palmer; C. C. Passmore; Lee Patrick; Roy F. Patrick; George W. Pattee; Hariet E. Pattee; Estate of Earl P. Patterson, Thomas D. Derry, Administrator; M. D. Patton; E. C. Payne; G. Q. Payne; Helen A. Payne; H. M. Payne, J. E. Payne, Trustee, Church of Jesus Christ of Latter Day Saints; Junius E. Payne; Leslie B. Payne; Willie K. Pearson; Dan T. Peart, Administrator of the

Estate of Thomas J. Barrett, deceased; George O. Peck; William A. Peck; Calista B. Peel; Emma Pennington; Walter J. Pennington; Mabel Perkins; Maranda Perkins; Juvenal Perolas, Administrator of the estate of Damas De Leon, deceased; Beatrice Perry; Amandus C. Peters; Jacob Peters; Alma Peterson; P. O. Peterson; Wilfred Peterson; Stowe Phelps; Addie Phillips; E. C. Phillips; Jesse C. Phillips; Rudger Phillips; W. U. Phillpott; Margaret E. Pierce; Pima Townsite; Pima Corporation of the Church of Jesus Christ of Latter Day Saints; Pinal Investment Company; Frank Pinkley; Eli E. Piper; C. Pirtle; W. A. Pitt; Mrs. M. E. Pittman; Ben T. Platt; W. E. Platt; E. M. Plumb; Henry E. Plumb; J. M. Plumb; S. V. Pollack; A. T. Pollock; W. M. Pollock; James H. Porter; S. V. Porter; W. A. Posy; W. A. Posy, Administrator of the Estate of Orson Elliott, deceased; Grace P. Pottebaum; Robert H. Pottebaum; D. T. Preston; M. F. Preston; W. F. Preston; W. J. Preston; Estate of W. Y. Price; Mrs. W. Y. Price; Mrs. Mattie Prina; Alice M. Prouty; Lloyd W. Prouty; W. Scott Prouty; James B. Pruett; Harriett Pulsipher; J. E. Pulsipher; O. I. Purdy; Charles M. Pursley; G. W. Quinn; Jesse B. Quinn; Anastacio Quiros; Margarete Ragsdale; Nance E. Ragsdale; Mrs. Ethel Rainbolt; Oscar Rainville; Edwin Ralph; D. Raper; B. O. Rapier; Henderson H. Raybourn; A. V. Read; Miles Reay; Martin J. Reed; Robert E. Reed; Sarah E. Reed; Mrs. W. R. Reed; T. J. Rex; O. Reyes; Carlysle Reynolds; George Reynolds; Mrs. Nancy Renolds; S. E. Reynolds; J. F. Rhinehart; W. G. Richards; George F. Richards; Farn M. Richardson; Gilbert Richardson; H. G. Richardson; Ralph Richardson; Rebecca Richardson; Sarah L. Richardson; Orson J. Richens; E. W. Richens; R. Richens; David L. Ridgeway; Lito Rios; W. H. Roach; J. R. Robbs; I. P. Robinson; Charles Rogers; David Rogers; H. P. Rogers; Joseph Rogers; Mrs. Louisa Rogers; A. Rohner; Ernest V. Romney; Eugene Romney; Julius Romney; S. H. Rorabaugh; C. N. Rose; Niels J. Roseberry; F. E. Ross; Ralph M. Rounds; P dro Ruiz; Espedion Sadilla; Town of Safford; Andris V. Salazar; Christiana Salazar; C. B. Sale; Ethlion Saline; John Saline; Roy Saline; W. D. Saline; Jose Samora; San Carlos Irrigation and Drainage District; Abel Sanchez; Adiel Sanchez; Danie[illegible] Sanchez; Eliseo Sanchez; F. Sanchez; Isias Sanchez; Manuel Sanchez; D. W. Sanders; George Sanders; W. T. Sanders; San Jose Canal Company; John Saxman; Clarence Scarlett; J. W. H. Scarlett; L. B. Scarlett; W. F. Scarlett; K. M. Schade; B. W. Scholtz; School District No. 1, County of Graha , State of Arizona; School District No. 2, County of Hidalgo, State of New Mexico; School District No. 7, County of Graham, State of Arizona; School District No. 7, County of Hidalgo, State of New Mexico; School District No. 8, County of Graham, State of Arizona; School District No. 11, County of Graham, State of Arizona; School District No. 12, County of Graham, State of Arizona; School District No. 27, County of Greenlee, State of Arizona; School District No. 31, County of Graham, State of Arizona; Frank Schultz; William J. Schultze; J. E. Schurtz; Charles M. Schwab; Emma B. Schwab; [illegible] Andy Scott; Clara C. Seagoe; S. E. D. Sears; George P. Sellers; Andreas Serna; Santos Serna; Sexton Canal Company; R. Sexton; Elizabeth Shannon; Charles M. Shannon; Mary L. Shannon; Walter Shayeb; Charles M. Scheafe; Helen S. Sheafe; James S. Sheafe; Mary S. Sheafe; Mrs. John Shields; A. J. Shiflet; Chloran B. Shifflet; J. S. Shifflet; R. R. Shipp; Delores B. Shirk; Laura Short; Shriver Ditch Company; W. F. Shriver; George R. Shurtz; John Sigfrid; Carrie S. Sigler; George W. Sigler; Mrs. E. M. Simmons; J. O. Simmons; Jesse B. Simms; Sinclair Realty Company; Maroni Skinner; Francis M. Skinner; Mrs. Martha Skinner; Helen Slaughter; A. A. Smith; Mrs. D. E. Smith; E. D. Smith; George W. Smith; Henry L. Smith; H. L. Smith; J. G. Smith; J. M. Smith; Joanna Smith; L. W. Smith; M. M. Smith; Nancy A. Smith; R. A. Smith, Sr.; Mrs. W. R. Smith; Mrs. J. B. Smithson; Smithville Canal Company; Charles F. Solomon; Townsite of Solomonville; V. Soto; Southern Arizona Bank & Trust Company; C. H. Southworth; J. W. Sowell; S. A. Sowell; W. H. Spafford; Herbert C. Sparks; W. D. Spear; Antonio Specia; Emma Spoon, Administratrix of the Estate of J. H. Spoon, deceased; G. C. Springer; Mrs. C. F. Stanley; Albert Stephens; Mary E. Stevens; [illegible] Stevenson; T. J. Steward; A. L. Stewart; Dugald Stewart; M. E. Stewart; Pratt Stewart; Mrs. R. S. Stewart; George W. Stinson; T. V. Stokes; Walter W. Stovall; W. P. Stover; John Stowe; Brigham Stowell; Lee N. Straton, Administrator of the Estate of Mrs. N. A. Bell, deceased; Mathews Stuart; E. P. Stuermer; Nicholas Saurez; Tim Sullivan; H. B. Summers; [illegible] Summers; Sunflower Canal Company; Sunset Canal Company; Surety Abstract & Realty Co.; J. C. Swan; Estate of John W. Sweeney, Sam Sweeney, Administrator; Florence R. Swofford; D. V. A. Talley; James M. Talley; J. T. Talley; T. Hugh Talley; Van Talley; K. V. B. Talley; Chas. F. Tantlinger; A. V. Tate; H. M. Tate; F. R. Taylor; John E. Taylor; L. M. Tayl[illegible] Sarah Taylor; William C. Taylor; William H. Taylor; P. H. Teeple; Charles Tellos; S. E. Tellyer; S. B. Tenny, Jr.; Frank A. Thackery; Alva Thatcher; L. M. Thatcher; Town of Thatc[illegible] Augusta Thor; Fred Thor; H. D. Thornton; E. Thygerson; John Tidwell and E. L. Tidwell, Jr., Administrators of the Estate of E. L. Tidwell, deceased; Ida Tidwell; Tidwell Canal Company; Mae Tiffiny; Sam R. Tilley; George A. Todd; John T. Traylor; Mrs. Billie Treat; James R. Treat; Don A. Trekell; Louise M. Trekell; S. Louise Trekell; Mary E. Truman; W. Tucker; E. S. Turville; W. O. Tuttle; Frank N. Tyler; Oscar Tyler; William O. Tyler; N. P. Tyron; Union Canal Company; Mrs. A. C. Urban; F. A. Urban; H. C. Usher; George Utter;

The Valley Bank and Trust Co.; Valley Canal Company; Calbert L. Vance; Viola C. Vance; George Van Gausig; Ed G. Van Haren; Harry Van Order, Administrator of the Estate of Harry Van Order, deceased; Jose Varale; Antonio Vasquez; Gregorio Vasquez; Emula Viala; Augustine Villar; Joe Villar; Jose Villareal; Virden Irrigation District; W. R. Waddell; Peter Wahlin; George P. Walker; Jerome Walker; J. P. Walker; Charles Wamslee; Mrs. J. C. Wamslee; Mattie Wamslee; T. W. Wamslee; William Wamslee; Harry Ward; Roy S. Ward; Alvin Warner; Mrs. H. E. Warner; C. E. Waterbury; Josie Waterbury; Henry A. Waters; Charles Watson; Lorenzo Watson; J. L. T. Watters; Fred Waughtal; Katie E. Weaver; Fred Webb; J. D. Webb; F. A. Webster; O. F. Webster; O. F. Webster, Administrator of the Estate of Thomas G. Webster, deceased; William Webster; A. E. Weech; Adam Welker; Arthur Welker; C. D. Welker; J. A. Welker; R. A. Welker; Willard Welker; A. T. West; John West; Adolphus Weyrick; B. Y. Whipple; Mrs. M. C. White; Natalia M. White; West White; Dorcas E. Whitlow; B. F. Whitmer, Jr.; B. F. Whitmer, Sr.; Mrs. Mildred Whitmer; Joe Whittridge; Fred H. Wiemer; H. B. Wiggins; W. W. Wild; W. W. Wilkey; A. A. Wilkins; Mrs. Charlotte Wilkins; D. E. Wilkins; E. J. Wilkins; J. D. Wilkins; Dan Williams; Lila Williams; Nephi Williams; Roy D. Williams; S. O. Williams; Isaac Williamson; Mrs. T. M. Williamson; T. L. Willis; Josephine R. Wills; B. A. Wilson; George A. Wilson; J. M. Wilson; Mrs. Virgia R. Wilson; Mrs. W. A. Wilson; Sophie Wind; Page S. Windham; Alonzo Winsor; F. M. Woodward; Jessie P. Woody; W. A. Woolsey; N. C. Wright; George W. Wyatt; Soren Yensen; Carrie B. Yett; York Canal Company; York Cattle Company; Dan Young; Mrs. G. R. Young; Elsie De Wolf Zellweger; and John Hicks; J. T. Kessey; Estate of Lola W. Lee, Dan T. Peart, Administrator; Ray Consolidated Copper Company; Valley Bank of Phoenix; and Kennecott Copper Corporation.

Defendants.

DECREE

This cause came on to be heard at this term, and thereupon it was shown to the court:

That the plaintiff and the parties defendant whose claims and rights have been presented by answer or stipulation and remain for determination herein, have concluded and settled all in this cause as between plaintiff and said parties defendant, and as between said defendants and each of them and every other thereof, and mutually have agreed — all as evidenced, plaintiff, by the assenting signatures, endorsed at the end hereof, of its solicitors of record and the Attorney General and Secretary of the Interior of the United States, and for sa defendants, by the assenting signatures, likewise endorsed at the end hereof personally, or of their several solicitors of record — that such settlement should be embodied in and confi and made effective by way of the within decree of the Court in this cause, defining and adjudicating their claims and rights as against each other in identical form and substance as hereinafter set forth; and the Court upon consideration thereof and of the record herein as to the disposal of the parties defendant who have been separated from the cause, and being duly informed in said premises, doth find, order, adjudge, and declare its decree herein to be as follows, namely:

I

That by the orders of this Court dated January 22, 1929, and March 11, 1930, this suit and the amended complaint herein, upon the motion of plaintiff, were dismissed as to defend

John S. Abbott; Charles A. Adams; A. Allen; Francisco Alvidrus; Paul Beeker; George P. Bennett; Mary E. Benscoe; Bentz Brothers; J. W. Bentz; George A. Bigler; C. O. Billingsley; Est. of Paul Blackmore; B. A. Boyles; Sam Brown; Newton Bradley; Juan Cachon; Ella Carpenter; J. C. Carpenter; Rachel Carr; John Castro; Chono Celayo; Tim Chapman; Ben M. Crawford; W. J. Davis; G. H. Dinsmore; John Eastman; Dud Eldridge; J. F. English; Helen T. French; Mattie M. Hall; Hawkins & Simms Milling & Irrigating Company; A. W. Heath; Mrs. Clara Hicks; James Henshall; Jacob Hildebaugh; J. I. Hinkle; J. P. Hinkle; A. M. Hooper; Roger Hoopes; J. G. Hopkins; R. T. Horrell; Arthur Houser; S. L. Johns; Bennet J. Kellner; Ernest F. Kellner; H. D. Kepper; J. H. Kerby; J. H. Lacey; John Laffey; Louise LeBaron; James LeHoxi; W. A. Leonard; Mrs. Frank Lewis; J. W. Lightfoot; George Lobb; Gordon McLean; B. Mately; Rafael Memos; Manrico Mijia; Sidney B. Moeur; E. C. Montgomery; Charles Morrell; Reputhio Moriz; George Olmstead; Lillian W. Peart; James A. Perkins; Marie C. Peters; S. K. Phillips; Frederick M. Putnam; John Ralston; Gabriel Robles; H. N. Russel; Victoriana Ruiz; J. Ryan; H. Salazar; Manuel Serano; S. Schultz; Charles H. Vann; Walter Shayeb; Estate of Charles R. Sligh; Nolberto Subia; Edward H. Sinclair; George Thompson; Jose Tonia; J. G. Turney; Manuel Urtiaga; Elijah Urtiaga; Judd Webster; George W. Wells; and O. H. Brown;

W. L. Cauthen; W. R. Elliott; William Jackson; J. F. Kepper; D. T. McGuire; and H. B. Sweeting;

it having been found and determined by the Court in that relation that they and each of them were not proper or necessary parties defendant in this cause; which said action of the C in these premises is hereby confirmed.

II

That by way of amended complaint, as filed herein on the 5th day of December, A. D., 1927, and orders of this Court bringing in new parties defendant under said amended complaint this suit and the amended complaint herein were directed against each and all of the defendants named below, to-wit:

D. Bertoglio; Beatrice Perry; and H. B. Wiggins;

Also, James R. Pruett; Antonio Specia and H. B. Summers;

Also, American Smelting and Refining Company; A. A. Anderson; John N. Anderson; Mary A. Antenoil; Estate of Walter Baitty, Homer H. Martin, Administrator; J. W. Baker; Henry Bamesberger; Ruth R. Barham; Estate of Thomas Barrett, Dan T. Peart, Administrator; Pansy Kenower Bartlett; Madelene Bassler; Albert C. Becken; Grace R. Becken; Charles F. Bennett; Jarvus D. Bennett; Francis D. Blair; Clifton Bogard; C. D. Bradley; Ida M. Bradley; John R. Bradshaw; Esther A. Brockway; Ira S. Brayton; Marshall F. Brockway; Charlotte Hall Brown; Elizabeth Brown; J. P. Brown; Sarah B. Brown; Thresa Hall Brown; Estate of W. F. Brown, P. D. Overfield, Administrator; John J. Buggs; John W. Burris; Lee Robinson Burris; L. B. Cadwell; Casa Grande Valley Bank; Mike Caleya; Estate of W. B. Charlton, John E. Charlton, Administrator; Albert J. Christensen; Edith M. Clemans; Hazel H. Clemans; Winnefred W. Clemans; W. J. Clemans, Jr.; W. P. Clements; Mrs. Charles E. Cleveland; Inez H. Conrad; Thomas A. Crow; Jennie Davidson; Maurice Dodd; Tracy Eastman; Christobell G. Ellis; Joe Erny; Jesus Espinosa; Jose T. Espinosa; Salvador S. Feliz; C. A. Fitzgerald; James D. Freeman; Fidelity Savings & Loan Association; First National Bank of Florence; May E. Furback; Kathrina Gack; Estate of George F. Gallagher, Robert Denton, Administrator; L. D. Gamble; M. L. Gilbert; George F. Graham; Nellie R. Gochenouer; Joseph Greene; Virginia Hales; John Hamilton; A. T. Hammons, Receiver; May Catlin Hansen; J. B. Harsha; Vernon W. Havins; John Hendricks; W. E. Herron; Edith B. Jamieson; James C. Jayne; E. R. Johnson; Richard J. Jones; Julia R. Julian; Fred R. Kenower; Ola R. Kenower; H. B. Klingenberg; Anna E. Kochsmeier; Frederick Kochsmeier; Henry Kochsmeier, Sr.; Henry D. Kochsmeier; Maria Kochsmeier; Gustav K. Kratzka; James J. Kruse; J. E. LaFleur; W. W. Lane; Dirk Lay; Elizabeth L. Lay; Estate of Lola W. Lee, Dan T. Peart, Administrator; David A. Little; Minnie Lobb; Estate of W. H. Lonergan, T. A. Lonergan, Administrator; May H. McBennett; A. L. McCann; Alpha E. McCann; Minnie M. McCann; James K. McCarty; Carrie McDowell; M. W. McDowell; Gertrude B. McGee; Glen C. McKenzie; Elizabeth P. McMurray; Melanie Mendell; Rita Marquez; Ivey Marshall; Ralph K. Marshall; Joe Martz; David Omer Martin; Ben B. Mathews; Josiah J. Maxcy; R. D. Melick; Lillian C. Merchant; John B. Michea; J. L. Mills; Mary L. Miles; R. M. Miller; Lillian I. Mitchell; Henry G. Moeller; Fayette Moore; Ethel M. Moorehouse; H. W. Moorehouse; Vashti B. Moorehouse; Margarete L. Murphy; J. S. Murry; C. H. Niemeyer; Lillian O'Connor; Olive J. O'Connor; Lewis Olesen; Antonio S. Padilla; Florence Palamounter; Howard G. Palamounter; Lee Patrick; Roy F. Patrick; George W. Pattee; Harriet E. Pattee; Estate of Earl P. Patterson, Thomas D. Derry, Administrator; Willie K. Pearson; Emma Pennington; Walter J. Pennington; Amandus C. Peters; Addie Phillips; Margaret E. Pierce; Pinal Investment Company; Frank Pinkley; Eli E. Piper; W. M. Pollock; Grace P. Pottebaum; Robert H. Pottebaum; Estate of W. Y. Price; Mrs. W. Y. Price; Alice M. Prouty; Lloyd W. Prouty; W. Scott Prouty; Edwin Ralph; Henderson H. Raybourn; A. V. Read; Martin J. Reed; Fern M. Richardson; H. G. Richardson; S. H. Rorabaugh; Ralph M. Rounds; Andris V. Salazar; Christiana Salazar; John Saxman; B. W. Scholtz; Estate of Elizabeth Schultz, Fred T. Armstead, Administrator; William J. Schultze; Charles M. Schwab; Emma B. Schwarz; Clara C. Seagoe; George P. Sellers; Mary S. Scheafe; Elizabeth Shannon; Mary L. Shannon; Chloren B. Shiflet; John Sigfrid; Carrie S. Sigler; George W. Sigler; J. O. Simmons; Southern Arizona Bank & Trust Company; Herbert G. Sparks; G. C. Springer; Mary E. Stevens; T. V. Stokes; Walter W. Stovall; Tim Sullivan; Surety Abstract & Realty Company; J. C. Swan; Estate of John W. Sweeney, Sam Sweeney, Administrator; Chas. F. Tantlinger; S. E. Tellyer; Frank A. Thackery; Augusta Thor; Fred Thor; Mae Tiffiny; Mrs. Billie

Treat; S. Louise Trekell; Mary E. Truman; E. S. Turville; Mrs. A. C. Urban; F. A. Urban; Valley Bank of Phoenix; Calbert L. Vance; Viola C. Vance; Ed G. Van Haren; Gregorio Vasquez; Augustine Villar; Joe Villar; George P. Walker; Harry Ward; Roy S. Ward; C. E. Waterbury; Josie Waterbury; Katie E. Weaver; Adolphus Weyrick; Natalia M. White; Dorcas E. Whitlow; Josephine R. Wills; Sophia Wind; Jessie P. Woody; Soren Yensen; and Elsie DeWolf Zellweger;

That original process thereunder by way of Subpoena Ad Respondendum, or by Court Order under section 57 of the Judicial Code, was duly issued and served, with a copy of the ame complaint, upon each of the aforenamed defendants, and each of said defendants failed and neglected to make or file an answer or otherwise defend or make a plea to said amended complaint as required by Rule 16 of the Rules of Practice for Courts of Equity of the United States; that orders taking the amended complaint as confessed by them and each of them were duly made herein and entered in the Order Book on the 25th day of November, 1929, the 11th day of March, 1930 and on the 19th day of December, 1934, in the office of the Clerk of this Court: each such order being so made and entered after the failure of each of the particular defendants named therein to make answer, defense or other plea as aforesa that no proceeding has been taken or initiated by them or any of them since the entry of said orders, and each thereof; and said defendants and each and every of them are now and remain in default of any answer, defense or other plea herein, and more than 30 days have elapsed since the entry of said orders and each thereof.

That under the orders Pro Confesso aforesaid, the amended complaint is taken as confessed, and it is ordered, adjudged and decreed herein, that the defendants above named in t article and each thereof, as against any of the parties plaintiff or defendant in this cause, their assigns or successors in interest, or their rights as herein decreed; that said defendants and each of them have no right to the use of water from the Gila River as against the parties to this action other than those set up in this decree, and they and each of them and, their heirs, executors, administrators and assigns or successors in interest are debarred and estopped from asserting or claiming any different or other, right, title or interest in or to the water or the use of any water from the Gila River as against the rights of the plaintiff and those of the defendants determined and set up in this decree

III

That, upon the motion of the plaintiff, by Order of this Court dated March 30, 1935, this suit and the amended complaint herein were dismissed without prejudice as to the fo defendants, to-wit:

S. B. Blake; Cluff & Mitchell; Colvin-Jones Consolidated Ditch Co.; John H. Davidson; W. P. Ferris; Jose Gonzales; T. Hinton; Layton & Ison; James Layton; E. D. McEuen; Roy A. Martin; Ed Moody; J. C. Norton; George A. Olney; Asa Packard; N. E. Platt; W. E. Posy; S. A. Powell; Pursley & Nash; Mrs. Mary Reynolds; Bert E. Rose; Smithville Extension Canal Company; Cinaco Telles; E. L. Tidwell; Louis Voelckel; W. J. Walton; T. W. Wamslee; Estate of Webster, F. A. Webster, Administrator; Estate of J. R. Williams; B. D. Wilson; Young & Ridgway;

Also, Bank of Duncan; D. E. Barlow; J. W. Becker; Billingsley Canal Company; R. T. Bishop; Harry H. Boyer; Burcher Ditch Company; Estate of W. C. Cheatham; Edward C. Cole; Consolidated Canal Company; J. H. T. Cosper; Cosper-Wilson Canal Company; Ethel M. Cunningham; E. C. DeMoss; Double Circle Cattle Company; Thomas Edwards; Bonnie Elrage; Mangus Elrage; Mrs. Geo. J. Filleman; J. J. Filleman; Franklin Canal Company; Fred J. Fritz; Mrs. Katie Fritz; Furr & Blain; Harve K. Catlin; Gila Ranch Company; Greenhorn Ditch Company; Greenhorn Irrigating Canal; County of Greenlee; O. C. Greenwell; Ole Hagan; William F. Hagan; S. P. Hale; Francelle Heywood; Mrs. Clara Hicks; County of Hidalgo; Hill Ditch; Francis M. Hodges; Lettie

F. Hunt; M. J. Jensen; M. L. Jensen; D. L. Johnson; F. E. Johnson; R. S. Johnson; A. L. Jones; J. H. Jones, Sr., Estate; Martin & Pearson Ditch; Martin & Pearson Irrigating Canal Company; Arven Mortensen; T. J. Nations; G. O. Payne; C. V. Peery; T. M. Peters; Dell M. Potter; Fred Powell; R. Richardson; Romney Brothers; Romney & Lunt; Rucker Ditch; School District No. 30; J. M. Smelley; A. F. Smith; The Estate of Spoon, Ira L. Spoon, Adm.; A. G. Stevenson; W. R. Stevenson; Sunset Irrigating Canal Company; D. H. Thompson; W. Plune Tibbets; H. P. Trainor; Virden Ward; Ward & Courtney Dam Company; T. M. Williamson; State of New Mexico;

Also, Phelps Dodge Corporation; Arizona Copper Company;

Also, Morenci Water Company;

Also, Aztec Mutual Canal Company; James LeRoy McCarthy; Richard E. Geyler; Frank C. Elwell.

Said action was had and taken in pursuance of those certain five stipulations between the plaintiff and the defendants above named through their solicitors of record, on file herein; wherein and wherefrom it appeared that said defendants and each of them had been named in this action and amended complaint, as parties defendant herein, through and by inadvertence, mistake and error, and that their claims and rights, if any, were and are outside the scope of said suit as same was and is outlined and defined in the amended complaint herein, and that they and each of them should be dismissed and eliminated from said cause, although some of them had filed their answers setting up their claims and rights to the use of certain waters from some of the tributaries of the Gila River, and said answers were filed through mistake and a misunderstanding as to the scope of said cause as outlined and defined in plaintiff's said amended complaint. It was agreed in said stipulations that the dismissal of said defendants should be accomplished upon motion of the plaintiff and Order of this Court as aforesaid, and that said Order should provide as in fact it does, as made and entered, of record herein that: said action and dismissal should be without prejudice to said defendants and each of them and/or to any of the other parties in this cause, or to any claim or rights to the use of water which said defendants, or any of them, or said other parties or any of them, now or hereafter may have, against the other or others, and that said defendants, and each of them, should be left as though they never had been named or made parties defendant herein; which said action heretofore taken by the Court in the premises, is hereby confirmed, and the provisions herein recited in reference thereto are made a part of this decree to protect their rights in that respect.

That, upon motion of the plaintiff, by Order of this Court dated March 30, 1935, this suit and the amended complaint were dismissed as to the following named defendants, to-wit:

A. P. Angle; Arizona Hercules Copper Company; Josephine Burks; Simon Cisneros; Louis Gilson; Gold Bullion Mining Company; Charles J. Gross; John M. Hatfield; G. H. Head; London Gila Mining Company; Theodore Lujan; Katherine S. Mellon; Luis Santos; and Manuel Tibbets;

Also, Frisco Placer Mining Company; Anna M. Gale; A. A. Larona; Brotten Lunt; Jose Sanchez; William Whelin; Harry C. White; and the White Mountain Lumber Company,

Said action having been taken for the reason that; from said motion on file herein it appeared that said defendants and each of them has no interest in the issues of this action and that none of them were or are necessary parties defendant; the action heretofore taken in these premises is hereby confirmed.

That, upon motion of the plaintiff, by Order of this Court dated March 30, 1935, this suit and the amended complaint were dismissed, without prejudice, as to the following named defendants, to-wit:

Castlio Ditch; Thomas Crabtree; Ed Elrage; Dale M. Garden; Jensen Brothers; J. B. Johns; F. Vernon Jones; William L. Keppler; Randall Lunt; Vernon
Lunt; M. J. McClaren; Hugh McKeen; William Milligan; Alfred Mortenson; Nichols & Company; Tomas Ponce; Serano R. Sexton; Ernest D. Shade; C. M.
Short; Frank Shriver; A. R. Snyder; S. Stewart; T. L. Stockton; J. A. Suydam; Luther T. Sweeting; Miss E. A. Swofford; O. F. Swofford; Bonnie
Ulrage; J. F. Wardner; and W. F. Willis;

said action having been taken, because it appeared from said motion on file herein and the records; that said defendants and each of them were brought into the action by inadvertence
and mistake and each was and is not a necessary party to this action, for the reason that they have no interests or that they are outside the scope of the suit as defined in the
amended complaint herein. The action taken heretofore in these premises is hereby confirmed.

That at the same time and in the same order this suit and amended complaint were dismissed as to the following defendants, to-wit:

W. B. Barham; J. M. Biddle; Mary W. Bradshaw; Jackson Branaman; Martha M. Brockway; Fred D. Carpenter; E. D. Chandler; Dessa Harbison; Jim Harper;
Jacob Helfenstein; A. S. Henry; Mrs. Alice Huntsman; John A. Johnson; A. E. Keoler; T. A. Lonergan; Clara B. McFarland; Gordon McMurray; William C.
McHatt; R. B. Maley; Martha M. Merrill; Estate of Lizzie B. Murphy, W. F. Murphy, Sr., Administrator; John Nash; Ansel Phelps; Georgiana Phelps;
George W. Sheerer; Chas. D. Stahlberg; Glodine Stahlberg; Phoebe E. Templeton; Estate of Jose Vasquez, Charles F. Bennett, Administrator; Albert
Warren; Alice E. Nixon; Virginia Griffin; Horace J. Johnson; Mary Johnson; Lula O. Lockerd; and John C. Swan;

said action having been taken and had, for the reasons shown in said motion, to wit: that each of said defendants had been brought in as parties defendant through inadvertence and
mistake or that they had transferred their interests to others who are parties defendant herein, and they are necessary parties defendant herein. The action heretofore taken in
these premises is hereby confirmed.

That upon motion of the plaintiff, by Order of this Court, dated March 30, 1935, this suit and the amended complaint herein were dismissed, as to the following defendants, to-wit:

Henry W. Blough; John F. Brown; Fred E. Gack; John MacGregor Goodale; Frank E. Hamilton; Frederick K. Kratzka; J. T. Lewis; James F. McManis; George
W. Morrell; John O'Brien; Margaret T. Randall; Jennie Roberts; Earl F. Smiley; Ole H. Smith; A. W. Sydnor; M. E. Templeton; Bert Vidans; Fannie
Wallrich; W. G. Williams; S. H. Wynn;

said action having been taken and had, for the reasons shown in said motion on file herein—as well as from the records herein, that; said and every of the last named parties are no
necessary parties defendant herein; that their lands are embraced within and constitute a part of the San Carlos Irrigation and Drainage District; that each of them has entered into
a contract with the United States, in relation to his land and water rights therefor and that because of said contractual relationship his lands have been and are designated as a pa
of the United States San Carlos Indian Irrigation Project; that their and each of their interests have been and are represented in this cause by said District and the plaintiff and
their and each of their water rights have been and are set up and provided for in this decree. The action taken heretofore by the Court in these premises is hereby confirmed.

That, upon motion of the plaintiff, by Order of this Court on the 30th day of March, 1935, this suit and the amended complaint were dismissed as to the defendants: Estate of Della Tharp, Edward Tharp, Administrator; Estate of James Tharp, Edward Tharp, Administrator; said action was taken and had pursuant to said motion on file herein and for the reasons therein given that; the lands and water rights thereunto belonging were by said parties covered into the Florence-Casa Grande Project by contract with the United States, the plaintiff herein; that their and each of their interests have been presented to the Court by the Florence-Casa Grande Water Users Association and their and each of their interests have been and are represented herein by the United States; that they are not necessary parties defendant in this action; that their and each of their interests are and have been set up and provided for in this decree and given their proper place in the Priority Schedule, a part of this decree, which said action is hereby confirmed.

That, upon motion duly made, by Order of this Court dated April 3rd, 1935, the Kennecott Copper Corporation, a corporation, was made a party defendant herein, by substitution, as the successor in interest of the Nevada Consolidated Copper Company and the Ray Consolidated Copper Company. The action heretofore taken in these premises is hereby confirmed.

IV

That the following named defendants own land as follows: Estate of Dora M. Clark, the NW¼, Section 22, Township 6 South, Range 7 East, Gila and Salt River Base and Meridian; Margaret P. Brown, the SW¼, Section 15, Township 6 South, Range 7 East, Gila and Salt River Base and Meridian; and H. H. McNeil, the N½ SE¼, Section 9, Township 5 South, Range 9 East, Gila and Salt River Base and Meridian; and Otis J. Baughn, 80 acres of land in the N½ SW¼ of Section 8, Township 6 South, Range 8 East, Gila and Salt River Base and Meridian; and that they and each of them in the past and prior to this decree, have made diligent and extensive efforts and have expended sums of money in an effort to secure water from the Gila River for the irrigation of their and each of their lands, but notwithstanding said efforts and expenditures, they and each of them were and have been unable to make use of said water upon their said lands and have not acquired any right to the use of said water from the Gila River upon their said lands, and that they and neither of them has a right to use water from the said river for the irrigation of their said lands as against the parties to this cause.

V

That each of the parties named in the Schedule of Rights and Priorities set out below and made part hereof (hereinafter for convenience often referred to as the Schedule or Priority Schedule), in proper person or in the representative capacity indicated, has acquired and owns the right or rights accredited to him in said Schedule; that the Gila River is the stream from which water called for under each of said rights is and may be diverted; that the point of such diversion, the name or description of the dam, canal, or other appliance through which said dive is accomplished and said waters are carried to the lands through the irrigation of which said right has been acquired, together with—as to individual defendants, and plaintiff where appropriation rights of others have been conveyed to it as hereinafter further described—the description of said lands and the number of irrigable acres thereof in each quarter or qua quarter section, or lot or lots as the case may be, to which said right applies, are as stated in said schedule opposite the name of each of said parties in appropriately designated co thereof; that the priority date of each of said rights is as stated for each owner in the column so designated, and such owner is entitled thereunder and as of the date of said priori divert from the natural flow of the stream, at the point of diversion so designated and to carry and convey to, and apply to beneficial use upon, said lands for the irrigation thereof, du each irrigation season, a total amount of water not exceeding 6 acre feet per each acre of said lands, which said amount shall not be diverted from the stream at any time during said se at a greater rate than one-eightieth (1/80) of a cubic foot per second for each acre of said lands, except as hereinafter provided; that the right of direct diversion from the natural fl the stream for each of said parties, therefore, may be readily calculated, for the area then being irrigated, as ollows:

No. of acres times 6 =Total allowable diversion in acre-feet during each irrigation season;

No. of acres times 1/80=Rate of diversion in cubic feet per second which shall not be exceeded in making said draft;

provided, however, that the water commissioner hereinafter provided for, in order to take proper advantage of sudden freshets or other periods of more plentiful natural flow in the str may authorize and provide for, and as to the lands of defendants above the San Carlos Reservoir shall permit, when no injury will result to others not being so accommodated, diversions therefrom under said rights at a greater rate than 1/80 of a cubic foot per second, but subject to the explicit condition that the total diversion for the lands involved shall not exceed du the irrigation season the said total of 6 acre feet per acre; that the right of each of said parties, based upon the total area involved in each instance, is stated in acre feet per irrig season, and in cubic feet per second (maximum rate of diversion as aforesaid), opposite the names of said party, respectively in the last two columns of said schedule; that this right for of said parties entitles him to a first and prior call to the extent thereof upon the available natural flow of the stream as against others whose rights as listed in said Schedule bear dates of priority than his own, while others, when their rights have earlier dates of priority than his, have a first and prior call to the extent thereof upon said stream flow as agai him; that each of said rights is gauged by and limited to the amount of water which has been and can be beneficially diverted and applied to the irrigation of said lands; that this qua is determined and adjudged herein to be the amount in acre-feet per acre for the irrigation season stated above, which shall include and be charged with all conveyance loss from the poi diversion from the stream to the lands; that said lands require that there be applied thereto, and therefore diverted from the stream, somewhat larger amounts of water in the hotter summer of the irrigation season than at any other times therein, of which account is taken by providing herein for a considerably larger diversion right than would be required at constant even fl produce 6 acre-feet per acre during each irrigation season; that where the figures and data given for a single water right priority are set opposite the names of more than one defendant in Schedule, each of the same is deemed and held to have an undivided interest in the whole there described under such mutual contractual relations as may obtain between them, which are not de or determined in this decree; that certain of the rights accredited to plaintiff in said Schedule may be classified as rights by purchase in that they were acquired by the United Stat by way of conveyances from the owners of the private lands through the irrigation of which they were acquired, said conveyances being made by way of the "Agreement of Landowners to in the Secretary of the Interior to undertake the Florence-Casa Grande Irrigation Project, and for the building and operation thereof in case the same is declared feasible" and the "Landow Agreement with the Secretary of the Interior, San Carlos Project, Act of June 7, 1924," entered into by the United States and such owners, which were executed and put into effect under a connection with the Florence-Casa Grande and San Carlos Projects; that these rights, having priorities in great number, ranging from the year 1868 to 1914 inclusive, are set down in order in said Schedule and totaled for each year under the name of the United States, with the description in each instance of the lands through the irrigation of which they were acquired by appropriation and beneficial use; also, in an appropriate column in each instance the names of the landowners making the conveyances, or their successors in interest, made formal parties defendant herein, are set down; all to the end that said rights may be identified and preserved; that plaintiff, in accord with said agreements and conveyances, is hereby authorized and empowered to divert from the Gila River the waters called for under said rights for use by irrigation upon the lands of the Florence-Casa Grande and San Carlos Projects as hereinafter further described; that the other rights of plaintiff, which may be generally described as those owned by the United States for and on account of the Indians of the Gila River and San Carlos Indian Reservations and as reservations and appropriations made by the United States for and on account of the Florence-Casa Grande and San Carlos Projects, are set down and outlined in their proper order in said Schedule as a matter of convenience, but each of said rights furthermore is specifically defined and decreed in later Articles hereof; including the right of the United States, as of the year 1924, to store the waters of the Gila River in the San Carlos Reservoir, which is specifically defined in Article VI and is of different character than the rights directly to divert from the natural flow of the stream, with which this Article of the Decree and the Priority Schedule made part hereof primarily has to do; that certain of the rights of plaintiff, as same are set down and referred to in said Schedule, do not accumulate, as is specifically stated and described in the last paragraph of Article VI of this decree; that also certain of the rights of the Nevada Consolidated Copper Company, as same are set down in said Schedule, do not accumulate, as is specifically stated in the first paragraph of Article IX hereof; that as to all other rights to divert the waters of the Gila River which are set down and defined in said Schedule, including the so-called rights by purchase of the United States (which for convenience here comes within the designation "concern"), when rights of different priorities are ascribed to the same person or concern, said rights as thus accredited to that person or concern do accumulate, so that the total amount of water in acre feet per season which can be taken from the stream, under the priority of any certain date and the priorities of previous dates (ascribed to that person or concern in said Schedule), with the maximum rate of diversion in cubic feet per second governing same, may and shall be ascertained by adding together the number of acre feet per season set down under each of said priorities; that maximum rate at which same can be diverted being also the sum of the maximum rates, in cubic feet per second, given under each of said dates of priority; that rights to divert the waters of the Gila River are decreed to the various canal companies and are set down under their names in the Priority Schedule as of various dates of priority; that the description in each instance of the lands through the irrigation of which said rights were acquired by appropriation and beneficial use and the names of the landowners or their successors in interest, made formal parties defendant herein (and set down under the heading "PARTIES OWNING SAID LANDS WHEN JURISDICTION ACQUIRED HEREIN"), whose beneficial application of water to said lands supported said appropriations are also listed under the names of each of said canal companies, the amounts of water in acre feet per season, with the maximum rates of diversion, allowed for the irrigation of the various subdivisions of said lands being given in the so-called individual columns under the general heading "Diversion Right" in said Priority Schedule; all to the end that the diversion rights of said canal companies may be adequately defined, and the individual rights of said defendant landowners to maintain, arrange or contract for, under applicable statutes and provisions of law, the diversion and carriage of water from the stream to said lands under and in accord with said rights may be identified and preserved; that the irrigation season referred to in this Article of the Decree, which shall as well apply to all rights adjudicated herein, is hereby defined as and determined to be the period beginning on January 1st of each year and ending on December 31st of the same year; that the Schedule above referred to and made part hereof is as follows:

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual
United States	Immemorial	Both	4S 4S	11E 6E	8 12	NW¼ SE¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal & Sacaton Diversion Dam.	35,000.	Gila River Indian Reservation				Pinal	For full statement of this right see Article VI (1).		210,000	
United States	1840	Both	At various points on the Gila River				Various Ditches and/or pumps & Ditches on or above Reservation	1,000.	San Carlos Indian Reservation				Gila & Graham	For full statement of this right see Article VI (2).		6,000	
United States	1868	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	957.00	Tracts described below:				Pinal	Ownership data as below:	240.00	5,742.[illegible]	.50
								40.00	4S	9E	34	SW¼ SE¼	"	Minnie Lobb	450.00		1.00
								80.00	4S	9E	34	E½ SE¼	"	" "	60.00		.13
								10.00	4S	9E	35	E½ SW¼ SE¼	"	Otis J. Baughn	106.08		.22
								17.68	4S	9E	35	SW¼ SE¼	"	Gertrude B. McGee	216.00		.45
								36.00	4S	9E	36	E½ SE¼	"	Lillian O'Connor	468.00		.97
								78.00	4S	9E	36	W½ NE¼	"	Lola S. Angulo	570.00		1.19
								95.00	4S	10E	30	SW¼	"	Lillian O'Connor	699.00		1.46
								116.50	4S	10E	31	NW¼ NW¼ & E½ NW¼	"	J. P. Brown	237.00		.49
								39.50	4S	10E	31	SW¼ NW¼	"	James D. Freeman	217.92		.45
								30.32	5S	9E	2	NW¼ NE¼	"	Gertrude B. McGee	120.00		.25
								20.00	5S	9E	3	N½ NW¼ NE¼	"	Minnie Lobb	120.00		.25
								20.00	5S	9E	3	N½ NE¼ NW¼	"	" "	108.00		.23
								18.00	5S	9E	5	W½ E½	"	(Earl G. Clemans & (Mark Twain Clemans	540.00		1.13
								90.00	5S	9E	7	N½	"	(" " " " "	1560.00		3.25
								260.00	5S	9E	8	N½	"	(" " " " "			
United States	1869	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	857.66	Tracts described below:				Pinal	Ownership data as below:		5,145.96	
								60.00	4S	9E	35	SW¼	"	James R. Treat	360.00		.75
								8.00	4S	9E	35	N½ S½ SE¼	"	Edward Tharp, Administrator of the estate of James Tharp, deceased, Edward Tharp, Administrator of the Estate of Della (Delphina) Tharp, dec.	48.00		[illegible]
								15.00	4S	9E	35	W½ SW¼	"	George W. Smith	90.00		[illegible]
								14.00	4S	9E	35	E½ E½ SW¼	"	James R. Treat	84.00		[illegible]
								14.00	4S	9E	35	E½ E½ SW¼	"	" " "	84.00		[illegible]
								20.00	4S	9E	36	W½ NE¼ NE¼	"	Ed G. Van Haren	120.00		[illegible]
								20.00	4S	9E	36	E½ NE¼ NE¼	"	Louis Cathemer	120.00		[illegible]
								38.00	4S	9E	36	E½ E½ NW¼	"	Roland H. Moorehouse	233.94		[illegible]
								1.01	4S	9E	36	SE¼ SE¼ NW¼	"	Encarnacion Sweeney	6.06		[illegible]
								100.00	4S	10E	29	NW¼	"	State of Arizona	960.00		[illegible]
								63.33	4S	10E	30	SE¼	"	Virginia Hales	379.98		[illegible]
								43.33	4S	10E	30	SE¼	"	" "	259.95		[illegible]
								[illegible]	4S	10E	30	S½ NE¼	"	Mary E. Stevens	480.00		[illegible]
													"	[illegible]	240.00		[illegible]

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
United States (continued)	1869							4.18	5S	9E	2	N½ NW¼ SW¼	Pinal	J. J. Fraser	25.08		.05	
								120.00	5S	9E	3	S½ N½ NE¼ & S½ NE¼	"	" " "	720.00		1.50	
								24.32	5S	9E	3	E½ W½ SW¼	"	" " "	145.92		.30	
								15.68	5S	9E	3	W½ E½ SW¼	"	" " "	94.08		.20	
								17.80	5S	9E	3	NE¼ SW¼	"	" " "	106.80		.22	
								18.02	5S	9E	3	NW¼ SE¼	"	" " "	108.12		.23	
United States	1872	Both	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	602.00	Tracts described below:				Pinal	Ownership data as below:		3612.00		7. 5
								10.00	4S	8E	36	NW¼ SE¼	"	Juan S. Felix	60.00		.12	
								2.00	4S	8E	36	NE¼ SE¼	"	" " "	12.00		.02	
								30.00	4S	8E	36	SE¼ SE¼	"	Pedro S. Felix	180.00		.37	
								1.18	4S	8E	36	NE¼ SE¼	"	" " "	7.08		.01	
								10.00	4S	8E	36	SE¼ SE¼	"	Manuel S. Felix	60.00		.12	
								34.82	4S	8E	36	NE¼ SE¼	"	" " "	208.92		.43	
								40.00	4S	8E	36	SW¼ SE¼	"	Salvadore S. Felix	240.00		.50	
								10.00	4S	8E	36	NW¼ SE¼	"	" " "	60.00		.12	
								2.00	4S	8E	36	NE¼ SE¼	"	" " "	12.00		.02	
								17.00	4S	9E	25	SE¼ SW¼	"	Roland H. Moorehouse	102.00		.21	
								20.00	4S	9E	36	E½ SE¼ NE¼	"	Lola LeBaron	120.00		.25	
								20.00	4S	9E	36	SE¼ NE¼	"	Ed G. Van Haren	120.00		.25	
								5.00	4S	9E	36	SE¼ SE¼	"	Gregorio Vasquez	30.00		.06	
								80.00	5S	8E	1	W½ NW¼	"	(E. B. Newman, Administra-	480.00		1.00	
								80.00	5S	8E	1	E½ NW¼	"	(tor of the Estate of H. H.	480.00		1.00	
								160.00	5S	8E	1	NE¼	"	(Scorce, deceased.	960.00		2.00	
								40.00	5S	8E	1	NW¼ SW¼	"		240.00		.50	
								40.00	5S	8E	1	NE¼ SW¼	"		240.00		.50	
Montezuma Canal Company	1872	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		180.00		
United States	1873	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	160.00	Tracts described below:				Pinal	Ownership data as below:		960.00		2.
								40.00	4S	8E	36	SW¼ SW¼	"	W. S. Lackner & F. R. Rendon	240.00		.50	
								20.00	4S	8E	36	N½ SE¼ SW¼	"	Juan S. Felix	120.00		.25	
								20.00	4S	8E	36	S½ SE¼ SW¼	"	Pedro S. Felix	120.00		.25	
								80.00	5S	9E	2	N½ NW¼	"	Gertrude B. McGee	480.00		1.00	
Montezuma Canal Company	1873	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		300.00		
United States	1874	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	17.00	5S	9E	2	S½ NE¼	Pinal	Thad Moore		102.00		
Montezuma Canal Company	1874	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		840.00		1.
San Jose Canal Company	1874	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600.00		1.
Tidwell Canal Company	1874	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		240.00		

Party entitled to divert from the stream	Date of priority	Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein.	For irrigation season in ac.-ft. Individual	Total	Maxi[mum] rate of [diver]sion i[n] ft. per Individual
Union Canal Company	1874	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for ownership data.		1500.00	
Sunflower Canal Company	1874	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for ownership data.		150.00	
Sunset Canal Company	1874	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	507.20	Tracts described below:				Hidalgo	Ownership data as below:		3043.20	
								10.62	19S	20W	7	NW¼ SW¼	"	S. A. Brown	63.72		.13
								37.30	19S	20W	7	SW¼ SW¼	"	" " "	223.80		.46
								12.20	19S	20W	7	SE¼ SW¼	"	R. T. Johns	73.20		.15
								13.25	19S	20W	17	SW¼ NW¼	"	Trivio Gonzales	79.50		.16
								39.18	19S	20W	18	NE¼ NW¼	"	R. T. Johns	235.08		.49
								26.00	19S	20W	18	NW¼ NW¼	"	" " "	156.00		.32
								6.60	19S	20W	18	SE¼ NW¼	"	" " "	39.60		.08
								25.25	19S	20W	18	NW¼ NE¼	"	C. M. Brooks	151.50		.31
								21.00	19S	20W	18	SW¼ NE¼	"	" " "	126.00		.26
								28.00	19S	20W	18	SE¼ NE¼	"	" " "	168.00		.35
								12.70	19S	20W	18	NE¼ NE¼	"	" " "	76.20		.16
								5.90	19S	20W	18	NW¼ NW¼	"	C. F. Houlihan	35.40		.07
								7.20	19S	21W	11	SE¼ NE¼	"	Willard E. Jones	43.20		.09
								4.30	19S	21W	11	NE¼ SE¼	"	" " "	25.80		.05
								.60	19S	21W	11	NE¼ NE¼	"	Ralph Richardson	3.60		.01
								1.30	19S	21W	11	SE¼ NE¼	"	John B. Jones	7.80		.02
								3.50	19S	21W	11	NE¼ SE¼	"	" " "	21.00		.04
								.10	19S	21W	11	SE¼ NE¼	"	M. L. Harris	.60		.01
								8.50	19S	21W	11	NE¼ SE¼	"	" " "	51.00		.11
								4.60	19S	21W	11	SE¼ NE¼	"	J. Alfred Mortensen	27.60		.06
								3.60	19S	21W	11	SW¼ NE¼	"	" " "	21.60		.05
								1.80	19S	21W	11	NE¼ NE¼	"	Leslie B. Payne	10.80		.02
								.40	19S	21W	11	NW¼ NW¼	"	" " "	2.40		.01
								.50	19S	21W	11	NE¼ NE¼	"	Parley P. Jones	3.00		.01
								8.10	19S	21W	11	SE¼ NE¼	"	" " "	48.60		.10
								5.30	19S	21W	11	SE¼ NE¼	"	Hiram K. Mortensen	31.80		.07
								4.10	19S	21W	11	NE¼ SE¼	"	J. E. Cardon	24.60		.05
								7.00	19S	21W	12	SW¼ NW¼	"	M. L. Harris	42.00		.09
								1.90	19S	21W	12	NW¼ SW¼	"	" " "	11.40		.02
								2.30	19S	21W	12	NW¼ SW¼	"	J. Alfred Mortensen	13.80		.03
								39.50	19S	21W	12	SE¼ SE¼	"	Orson J. Richens	237.00		.49
								15.30	19S	21W	12	N½ NE¼ SE¼	"	Nancy O. Pace	91.80		.19
								40.00	19S	21W	12	NW¼ SE¼	"	" " "	240.00		.50
								20.60	19S	21W	12	SW¼ SE¼	"	" " "	123.60		.26
								6.80	19S	21W	12	NW¼ SW¼	"	J. E. Cardon	40.80		.09
								20.00	19S	21W	12	S½ NE¼ SE¼	"	Carl M. Donaldson	120.00		.25
								28.70	19S	21W	12	NE¼ SW¼	"	James A. Mitchell	172.20		.36
								3.60	19S	21W	12	NW¼ SW¼	"	" " "	21.60		.05
								3.60	19S	21W	12	SW¼ SW¼	"	" " "	21.60		.05
								13.90	19S	21W	12	SE¼ SW¼	"	" " "	83.40		.17
								12.10	19S	21W	13	NE¼ NE¼	"	C. F. Houlihan	72.60		.15
United States	1875	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal.	309.00	Tracts described below:				Pinal	Ownership data as below:		1854.00	
								149.00	4S	10E	16	S½	"	(John Tidwell & E. L. Tidwell, Jr. Administrators (of the estate of E. L. (Tidwell, deceased.	894.00		1.86
								160.00	4S	10E	17	S½	"		960.00		2.00
Montezuma Canal Company	1875	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		1800.00	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
San Jose Canal Company	1875	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		1200.00		2.5
Tidwell Canal Company	1875	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		240.00		.5
Union Canal Company	1875	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		120.00		.2
Sunflower Canal Company	1875	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		510.00		1.0
Graham Canal Company	1875	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		180.00		.3
United States	1876	Both	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence - Casa Grande Canal	455.00	Tracts described below:				Pinal	Ownership data as below:		2730.00		5.6
								80.00	4S	10E	20	S½ NE¼	"	Rita Marquez	480.00		1.00	
								20.00	4S	10E	21	W½ SW¼ NW¼	"	" "	120.00		.25	
								35.00	4S	10E	21	E½ W½ NW¼	"	Donald F. Reed	210.00		.44	
								40.00	4S	10E	29	N½ N½ NE¼	"	John B. Michea	240.00		.50	
								120.00	5S	8E	2	NE¼ NW¼ & S½ NW¼	"	Edith Knappenberger & Frank Knappenberger	720.00		1.50	
								160.00	5S	8E	2	NE¼	"		960.00		2.00	
Montezuma Canal Company	1876	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		720.00		1.5
San Jose Canal Company	1876	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		1800.00		3.7
Tidwell Canal Company	1876	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		120.00		.
Union Canal Company	1876	Left	7S	27E	18	SE¼ NE¼	Union Canal	5575.00	See Table No. 4 for detailed description for these lands.				Graham	See Table No. 4 for Ownership data.		318.00		.
Sunflower Canal Company	1876	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		510.00		1.
Graham Canal Company	1876	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		120.00		.
Fort Thomas Consolidated Canal Company	1876	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		240.00		.
United States	1877	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence - Casa Grande Canal	159.99	Tracts described below:				Pinal	Ownership data as below:		959.94		2.
								26.66	4S	10E	20	S½ SE¼	"	Fern M. Richardson	159.96		.33	
								53.33	4S	10E	20	S½ SE¼	"	Natalia M. White	319.98		.67	
								20.00	4S	10E	29	N½ SW¼ NE¼	"	John B. Michea	120.00		.25	
								40.00	4S	10E	29	S½ N½ NE¼	"	" "	240.00		.50	
								20.00	4S	10E	15	E½ NE¼	"	Rafael A. Larona	120.00		.25	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Montezuma Canal Company	1877	Left	7S	27E	17	NE ¼ NE¼	Montezuma Canal	3750.00				See Table No. 1 for detailed description of these lands.	Graham	See Table No. 1 for Ownership data.		2160.00		4.50
San Jose Canal Company	1877	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00				See Table No. 2 for detailed description of these lands.	Graham	See Table No. 2 for Ownership data.		1200.00		2.50
Tidwell Canal Company	1877	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00				See Table No. 3 for detailed description of these lands.	Graham	See Table No. 3 for Ownership data.		300.00		.63
Union Canal Company	1877	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00				See Table No. 4 for detailed description of these lands.	Graham	See Table No. 4 for Ownership data.		690.00		1.44
Sunflower Canal Company	1877	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00				See Table No. 5 for detailed description of these lands.	Graham	See Table No. 5 for Ownership data.		30.00		.06
Graham Canal Company	1877	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00				See Table No. 6 for detailed description of these lands.	Graham	See Table No. 6 for Ownership data.		60.00		.13
Fort Thomas Consolidated Canal Company.	1877	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00				See Table No. 7 for detailed description of these lands.	Graham	See Table No. 7 for Ownership data.		300.00		.63
Brown Canal Company	1877	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00				See Table No. 8 for detailed description of these lands.	Graham	See Table No. 8 for Ownership data.		90.00		.19
Joseph J. Anderson	1877	Right	5S	15E	7	NW¼ SE¼	Anderson Ditch	27.90	4S	14E	35	SE¼ SE¼	Pinal	Joseph J. Anderson		167.40		.35
Dodge-Nevada Canal Company	1877	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00				See Table No. 9 for detailed description of these lands.	Graham	See Table No. 9 for Ownership data.		420.00		.83
United States	1878	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal.	30.00	4S	10E	21	NW¼ SW¼	Pinal	Donald F. Reed		180.00		.37
Montezuma Canal Company	1878	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00				See Table No. 1 for detailed description of these lands.	Graham	See Table No. 1 for Ownership data.		1200.00		2.5
San Jose Canal Company	1878	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00				See Table No. 2 for detailed description of these lands.	Graham	See Table No. 2 for Ownership data.		600.00		1.3
Tidwell Canal Company	1878	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00				See Table No. 3 for detailed description of these lands.	Graham	See Table No. 3 for Ownership data.		180.00		.3
Union Canal Company	1878	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00				See Table No. 4 for detailed description of these lands.	Graham	See Table No. 4 for Ownership data.		1950.00		4.0
Sunflower Canal Company	1878	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00				See Table No. 5 for detailed description of these lands.	Graham	See Table No. 5 for Ownership data.		30.00		.0

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Graham Canal Company	1878	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		60.00		.13
Brown Canal Company	1878	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		60.00		.13
Dodge-Nevada Canal Company	1878	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		60.00		.13
Nevada Consolidated Copper Company	1878	Right	5S	15E	14	SE¼ SW¼, SW¼ SE¼	Pumps		Use of water for Industrial, Municipal, Domestic and related purposes.				Gila	For further definition of this right see Article IX.		390.00		.81
			5S	15E	23	NE¼ NW¼												
Nevada Consolidated Copper Company.	1879	Right	5S	15E	14	SE¼ SW¼, SW¼ SE¼	Pumps		Use of water for Industrial, Municipal, Domestic and related purposes.				Gila	For further definition of this right see Article IX.		570.00		1.20
			5S	15E	23	NE¼ NW¼												
United States	1879	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion dam & Florence Casa Grande Canal	210.00	Tracts described below:				Pinal	Ownership data as below:		1260.00		2.63
								40.00	4S	10E	20	NW¼ SE¼	"	State of Arizona	240.00		.50	
								40.00	4S	10E	20	NE¼ SE¼	"	H. W. Johns	240.00		.50	
								80.00	4S	10E	21	N½	"	Mary T. Chaney	480.00		1.00	
								40.00	4S	10E	31	NW¼ SW¼	"	S. W. Newman	240.00		.50	
								10.00	4S	10E	31	NW¼ SW¼ SW¼	"	" " "	60.00		.13	
Montezuma Canal Company	1879	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		1800.00		3.75
San Jose Canal Company	1879	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		1200.00		2.50
Tidwell Canal Company	1879	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		120.00		.25
Union Canal Company	1879	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		30.00		.06
Sunflower Canal Company	1879	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		30.00		.06
Graham Canal Company	1879	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		120.00		.26
Brown Canal Company	1879	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		90.00		.19
Dodge-Nevada Canal Company	1879	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		120.00		.26
United States	1880	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal.	37.00	4S	10E	29	N½ SW¼	Pinal	John Hendricks		222.00		.46

Party entitled to divert from the stream	Date of priority	Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft. — Individual	Total	Maximum rate of diversion in cu. ft. per sec. — Individual	Total
Montezuma Canal Company	1880	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		540.00		1.13
San Jose Canal Company	1880	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600.00		1.30
Tidwell Canal Company	1880	Right	7S	27E	3	NE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		240.00		.50
Union Canal Company	1880	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		1092.00		2.28
Graham Canal Company	1880	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		300.00		.63
Brown Canal Company	1880	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		60.00		.13
Dodge-Nevada Canal Company.	1880	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		300.00		.65
Smithville Canal Company	1880	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		2100.00		4.28
Nevada Consolidated Copper Company	1880	Right	5S	15E	14	SE¼ SW¼, SW¼ SE¼	Pumps		Use of water for industrial, Municipal, domestic and related purposes.				Gila	For further definition of this right see Article IX.		780.00		1.62
			5S	15E	23	NE¼ NW¼												
Joseph J. Anderson	1880	Right	5S	15E	7	NW¼ SE¼	Anderson Ditch	171.40	Tracts described below:				Pinal	Ownership data as below: Joseph J. Anderson		1028.40		2.14
								37.10	4S	14E	35	NE¼ SE¼	"	" " "	222.60		.46	
								40.00	4S	14E	35	SE¼ NE¼	"	" " "	240.00		.50	
								27.20	4S	14E	35	NE¼ NE¼	"	" " "	163.20		.34	
								19.30	4S	14E	35	SW¼ NE¼	"	" " "	115.80		.24	
								15.00	4S	14E	36	SW¼ NW¼	"	" " "	90.00		.19	
								25.70	4S	14E	36	NW¼ SW¼	"	" " "	154.20		.32	
								7.10	4S	14E	36	SW¼ SW¼	"	" " "	42.60		.09	
Montezuma Canal Company	1881	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		180.00		.39
San Jose Canal Company	1881	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600.00		1.30
Tidwell Canal Company	1881	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		120.00		.26
Union Canal Company	1881	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		1308.00		2.71
Sunflower Canal Company	1881	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		60.00		.13
Graham Canal Company	1881	Right	7S	26E	9	NE¼ SW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		180.00		.37
Brown Canal Company	1881	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		60.00		.13

Party entitled to divert from the stream	Date of priority	Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein.	Diversion right — For irrigation season in ac.-ft. — Individual	Total	Maximum rate of diversion in cu. ft. per sec. — Individual	Total
Dodge-Nevada Canal Company	1881	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		660.00		1.
Smithville Canal Company	1881	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		1800.00		3. 7
Curtis Canal Company	1881	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		180.00		. 3
Sunset Canal Company	1881	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	461.40	Tracts described below:				Hidalgo	Ownership data as below:		2768.40		5. 7
								10.40	19S	21W	2	SW¼ SE¼	"	Junius E. Payne	62.40		.13	
								28.50	19S	21W	2	SE¼ SW¼	"	T. V. Jones	171.00		.36	
								1.10	19S	21W	2	NW¼ SW¼	"	M. B. Echols	6.60		.01	
								12.50	19S	21W	2	SW¼ SW¼	"	" " "	75.00		.16	
								14.50	19S	21W	2	SW¼ SW¼	"	Byron Echols	87.00		.18	
								4.80	19S	21W	2	NW¼ SW¼	"	Henry L. Smith	28.80		.06	
								9.30	19S	21W	2	SW¼ SW¼	"	" " "	55.80		.11	
								6.90	19S	21W	3	SE¼ NE¼	"	W. F. Foster	41.40		.09	
								30.10	19S	21W	3	NE¼ SE¼	"	" " "	180.60		.38	
								7.40	19S	21W	3	SE¼ SE¼	"	" " "	44.40		.09	
								9.20	19S	21W	3	SE¼ NW¼	"	Peter Mortensen	55.20		.13	
								16.80	19S	21W	3	SW¼ NW¼	"	J. R. Beavers	100.80		.21	
								8.20	19S	21W	3	SE¼ NW¼	"	O. Mortensen	49.20		.05	
								8.70	19S	21W	3	NE¼ SE¼	"	Henry L. Smith	52.20		.11	
								5.50	19S	21W	3	SE¼ SE¼	"	" " "	33.00		.07	
								23.30	19S	21W	3	SW¼ NE¼	"	George H. Cosper, Jr., Administrator of the Estate of George Cosper, deceased.	139.80		.29	
								5.20	19S	21W	11	NE¼ NE¼	"	Junius E. Payne	31.20		.07	
								22.30	19S	21W	11	NW¼ NW¼	"	Hans Mortensen	133.80		.28	
								4.00	19S	21W	11	SE¼ NE¼	"	Willard E. Jones	24.00		.05	
								.60	19S	21W	11	SE¼ NE¼	"	John B. Jones	3.60		.01	
								3.00	19S	21W	11	SE¼ NE¼	"	J. Alfred Mortensen	18.00		.04	
								11.80	19S	21W	11	SW¼ NE¼	"	" " "	70.80		.15	
								6.00	19S	21W	11	NE¼ NE¼	"	Leslie B. Payne	36.00		.08	
								23.30	19S	21W	11	SW¼ NE¼	"	M. N. Jensen	139.80		.29	
								9.90	19S	21W	11	NE¼ NE¼	"	Parley P. Jones	59.40		.12	
								2.10	19S	21W	11	SE¼ NE¼	"	" " "	12.60		.03	
								3.50	19S	21W	11	SE¼ NE¼	"	Hans Mortensen	21.00		.04	
								39.60	19S	21W	11	NW¼ NE¼	"	F. W. Jones	237.60		.50	
								40.00	19S	21W	11	NE¼ NW¼	"	(Hans Anderson & Delbert	240.00		.50	
								20.30	19S	21W	11	SE¼ NW¼	"	(Johnson	121.80		.25	
								4.40	19S	21W	11	SW¼ NW¼	"	Willard E. Jones	26.40		.06	
								1.40	19S	21W	12	NE¼ NE¼	"	J. Alfred Mortensen	8.40		.02	
								3.20	19S	21W	12	NW¼ NW¼	"	Ralph Richardson	19.20		.04	
								3.30	19S	21W	12	SW¼ NW¼	"	John B. Jones	19.80		.04	
								1.60	19S	21W	12	NW¼ SW¼	"	M. L. Harris	9.60		.02	
								1.90	19S	21W	12	NW¼ SW¼	"	J. Alfred Mortensen	11.40		.02	
								.50	19S	21W	12	SE¼ SE¼	"	Orson J. Richens	3.00		.01	
								13.80	19S	21W	12	SW¼ SE¼	"	Nancy O. Pace	82.80		.17	
								.70	19S	21W	12	SW¼ NW¼	"	Hans Mortenson	4.20		.01	
								1.50	19S	21W	12	SW¼ NW¼	"	J. E. Cardon	9.00		.02	
								6.60	19S	21W	12	NW¼ SW¼	"	" " "	39.60		.08	
								9.40	19S	21W	12	NE¼ SW¼	"	James A. Mitchell	56.40		.11	
								3.40	19S	21W	12	NW¼ SW¼	"	" " "	20.40		.04	
								12.30	19S	21W	12	SE¼ SW¼	"	" " "	73.80		.15	
								3.80	19S	21W	13	NE¼ NE¼	"	C. F. Houlihan	22.80		.05	
								4.80	19S	21W	13	NW¼ NE¼	"	" " "	28.80		.06	

Party entitled to divert from the stream	Date of priority	Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M.				Name of diverting and/or carrying structure	Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M.				County	Parties owning said lands when jurisdiction acquired herein.	For irrigation season in ac.-ft.		Maximum rate of diversion in cu. ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
Dodge-Nevada Canal Company	1881	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		660.00		1.3
Smithville Canal Company	1881	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		1800.00		3.7
Curtis Canal Company	1881	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		180.00		.3
Sunset Canal Company	1881	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	461.40	Tracts described below:				Hidalgo	Ownership data as below:		2768.40		5.7
								10.40	19S	21W	2	SW¼ SE¼	"	Junius E. Payne	62.40		.13	
								28.50	19S	21W	2	SE¼ SW¼	"	T. V. Jones	171.00		.36	
								1.10	19S	21W	2	NW¼ SW¼	"	M. B. Echols	6.60		.01	
								12.50	19S	21W	2	SW¼ SW¼	"	" " "	75.00		.16	
								14.50	19S	21W	2	SW¼ SW¼	"	Byron Echols	87.00		.18	
								4.80	19S	21W	2	NW¼ SW¼	"	Henry L. Smith	28.80		.06	
								9.30	19S	21W	2	SW¼ SW¼	"	" " "	55.80		.11	
								6.90	19S	21W	3	SE¼ NE¼	"	W. F. Foster	41.40		.09	
								30.10	19S	21W	3	NE¼ SE¼	"	" " "	180.60		.38	
								7.40	19S	21W	3	SE¼ SE¼	"	" " "	44.40		.09	
								9.20	19S	21W	3	SE¼ NW¼	"	Peter Mortensen	55.20		.13	
								16.80	19S	21W	3	SW¼ NW¼	"	J. R. Beavers	100.80		.21	
								8.20	19S	21W	3	SE¼ NW¼	"	O. Mortensen	49.20		.08	
								8.70	19S	21W	3	NE¼ SE¼	"	Henry L. Smith	52.20		.11	
								5.50	19S	21W	3	SE¼ SE¼	"	" " "	33.00		.07	
								23.30	19S	21W	3	SW¼ NE¼	"	George H. Cosper, Jr., Administrator of the Estate of George Cosper, deceased.	139.80		.29	
								5.20	19S	21W	11	NE¼ NE¼	"	Junius E. Payne	31.20		.07	
								22.30	19S	21W	11	NW¼ NW¼	"	Hans Mortensen	133.80		.28	
								4.00	19S	21W	11	SE¼ NE¼	"	Willard E. Jones	24.00		.05	
								.60	19S	21W	11	SE¼ NE¼	"	John B. Jones	3.60		.01	
								3.00	19S	21W	11	SE¼ NE¼	"	J. Alfred Mortensen	18.00		.04	
								11.80	19S	21W	11	SW¼ NE¼	"	" " "	70.80		.15	
								6.00	19S	21W	11	NE¼ NE¼	"	Leslie B. Payne	36.00		.08	
								23.30	19S	21W	11	SW¼ NE¼	"	M. N. Jensen	139.80		.29	
								9.90	19S	21W	11	NE¼ NE¼	"	Parley P. Jones	59.40		.12	
								2.10	19S	21W	11	SE¼ NE¼	"	" " "	12.60		.03	
								3.50	19S	21W	11	SE¼ NE¼	"	Hans Mortensen	21.00		.04	
								39.60	19S	21W	11	NW¼ NE¼	"	F. W. Jones	237.60		.50	
								40.00	19S	21W	11	NE¼ NW¼	"	(Hans Anderson & Delbert	240.00		.50	
								20.30	19S	21W	11	SE¼ NW¼	"	(Johnson	121.80		.25	
								4.40	19S	21W	11	SW¼ NW¼	"	Willard E. Jones	26.40		.06	
								1.40	19S	21W	12	NE¼ NE¼	"	J. Alfred Mortensen	8.40		.02	
								3.20	19S	21W	12	NW¼ NW¼	"	Ralph Richardson	19.20		.04	
								3.30	19S	21W	12	SW¼ NW¼	"	John B. Jones	19.80		.04	
								1.60	19S	21W	12	NW¼ SW¼	"	M. L. Harris	9.60		.02	
								1.90	19S	21W	12	NW¼ SW¼	"	J. Alfred Mortensen	11.40		.02	
								.50	19S	21W	12	SE¼ SE¼	"	Orson J. Richens	3.00		.01	
								13.80	19S	21W	12	SW¼ SE¼	"	Nancy O. Pace	82.80		.17	
								.70	19S	21W	12	SW¼ NW¼	"	Hans Mortenson	4.20		.01	
								1.50	19S	21W	12	SW¼ NW¼	"	J. E. Cardon	9.00		.02	
								6.60	19S	21W	12	NW¼ SW¼	"	" " "	39.60		.08	
								9.40	19S	21W	12	NE¼ SW¼	"	James A. Mitchell	56.40		.11	
								3.40	19S	21W	12	NW¼ SW¼	"	" " "	20.40		.04	
								12.30	19S	21W	12	SE¼ SW¼	"	" " "	73.80		.15	
								3.80	19S	21W	13	NE¼ NE¼	"	C. F. Houlihan	22.80		.05	
								4.80	19S	21W	13	NW¼ NE¼	"	" " "	28.80		.06	

Party entitled to divert from the stream	Date of priority	Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft. Individual	Total	Maximum rate of diversion in cu. ft. per sec. Individual	Total
Montezuma Canal Company	1882	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		540.00		1.13
San Jose Canal Company	1882	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		1200.00		2.50
Tidwell Canal Company	1882	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		240.00		.50
Union Canal Company	1882	Left	7S	27E	17	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		660.00		1.37
Graham Canal Company	1882	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		552.00		1.15
Fort Thomas Consolidated Canal Company	1882	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		240.00		.50
Brown Canal Company	1882	Right	6S	25E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		120.00		.26
Dodge-Nevada Canal Company	1882	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1.12
Smithville Canal Company	1882	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		1500.00		3.13
Curtis Canal Company	1882	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		480.00		1.00
Moddle Canal Company	1882	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	1.00	19S	21W	3	NW¼ SW¼	Hidalgo	G. W. Johnson		6.00		.01
Sunset Canal Company	1882	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	26.60	Tracts described below:				Hidalgo	Ownership data as below:		159.60		.33
								7.00	19S	21W	3	SE¼ NW¼	"	Peter Mortensen	42.00		.09	
								19.60	19S	21W	3	NE¼ SW¼	"	" "	117.60		.24	
Cosper & Windham Canal Company	1882	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal	57.60	Tracts described below:				Hidalgo	Ownership data as below:		345.60		.72
								9.40	19S	21W	3	SW¼ NW¼	"	J. R. Beavers	56.40		.12	
								13.50	19S	21W	3	NE¼ SW¼	"	O. Mortensen	81.00		.17	
								2.40	19S	21W	3	SE¼ NW¼	"	" "	14.40		.03	
								28.00	19S	21W	3	NW¼ SE¼	"	George H. Cosper, Jr., Administrator of the Estate of George Cosper, deceased.	168.00		.35	
								4.30	19S	21W	4	SE¼ NE¼	"	J. R. Beavers	25.80		.05	
Montezuma Canal Company	1883	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		300.00		.62
San Jose Canal Company	1883	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600.00		1.30
Tidwell Canal Company	1883	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		60.00		.13
Union Canal Company	1883	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		3576.00		7.45
Sunflower Canal Company	1883	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		30.00		.06

Party entitled to divert from the stream	Date of priority	Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft. — Individual	Total	Maximum rate of diversion in cu. ft. per sec. — Individual	Total
Graham Canal Company	1883	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		834.00		1.74
Fort Thomas Consolidated Canal Company	1883	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed descrition of these lands.				Graham	See Table No. 7 for Ownership data.		660.00		1.38
Brown Canal Company	1883	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		150.00		.33
Dodge-Nevada Canal Company	1883	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1.12
Smithville Canal Company	1883	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		900.00		1.88
Curtis Canal Company	1883	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		1650.00		3.44
United States	1884	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal.	26.66	4S	10E	29	SW¼ SE¼ & NW¼ SE¼	Pinal	John B. Michea		159.96		.33
Montezuma Canal Company	1884	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		240.00		.50
San Jose Canal Company	1884	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		1200.00		2.50
Tidwell Canal Company	1884	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		60.00		.13
Union Canal Company	1884	Left	7S	27E	18	SE¼ NW¼	Union Canal.	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		2646.00		5.51
Nevada Consolidated Copper Company	1884	Right	5S 5S	15E 15E	14 23	SE¼ SW¼, SW¼ SE¼ NE¼ NW¼	Pumps		Use of water for Industrial, Municipal, Domestic & related purposes.				Gila	For further definition of this right see Article IX.		990.00		2.06
Joseph J. Anderson	1884	Right	5S	15E	7	NW¼ SE¼	Anderson Ditch.	98.70	Tracts described below:				Pinal	Ownership data as below:		592.20		1.22
								12.70	4S	14E	35	NE¼ NE¼	"	Joseph J. Anderson	76.20		.16	
								30.00	4S	14E	35	NW¼ NE¼	"	" " "	180.00		.37	
								26.00	4S	14E	35	SW¼ NE¼	"	" " "	156.00		.32	
								30.00	4S	14E	35	NE¼ NW¼	"	" " "	180.00		.37	
Sunflower Canal Company	1884	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		60.00		.13
Graham Canal Company	1884	Right	7S	26E	9	NE¼ NW¼	Graham Canal.	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		60.00		.13
Fort Thomas Consolidated Canal Company	1884	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		744.00		1.55

Party entitled to divert from the stream	Date of priority	Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M.				Name of diverting and/or carrying structure	Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M.				County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft.		Maximum rate of diversion to cu ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
Brown Canal Company	1884	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		300.00		.63
Dodge-Nevada Canal Company	1884	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1.12
Smithville Canal Company	1884	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		480.00		1.00
Curtis Canal Company	1884	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		3870.00		8.06
Duncan Canal Company	1884	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	40.00	Tracts described below:				Greenlee	Ownership data as below:		240.00		.50
								9.00	8S	32E	19	NE¼ SE¼	"	F. M. Craig	54.00		.11	
								5.80	8S	32E	19	NE¼ SE¼	"	George Utter	34.80		.07	
								2.20	8S	32E	19	SE¼ SE¼	"	F. M. Craig	13.20		.03	
								1.10	8S	32E	20	SW¼ SW¼	"	J. W. Carter & M. H. Brooks	6.60		.01	
								10.90	8S	32E	20	SE¼ SW¼	"	" " " " " "	65.40		.14	
								2.30	8S	32E	29	NE¼ NW¼	"	" " " " " "	13.80		.03	
								8.70	8S	32E	29	NW¼ NW¼	"	" " " " " "	52.20		.11	
United States	1885	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	110.00	5S	8E	1	SE¼ N. part	Pinal	Bennie Ulmer		660.00		1.38
Montezuma Canal Company	1885	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		240.00		.50
San Jose Canal Company	1885	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600.00		1.25
Union Canal Company	1885	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		3438.00		7.16
Sunflower Canal Company	1885	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		60.00		.13
Graham Canal Company	1885	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		654.00		1.36
Fort Thomas Consolidated	1885	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		48.00		.01
Brown Canal Company	1885	Right	6S	26E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		240.00		.50
Dodge-Nevada Canal Company	1835	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1.10
Smithville Canal Company	1885	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		540.00		1.10
Curtis Canal Company	1885	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		1260.00		2.60

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac. ft.: Individual	Total	Maxi rate of sion ft. per: Individual
Valley Canal Company	1885	Right	19S	21W	4	NE¼ NW¼	Valley Canal	77.60	Tracts described below:				Greenlee	Ownership data as below:		465.60	
								18.90	8S	31E	11	SE¼ SE¼	"	J. F. McGrath	113.40		.24
								30.00	8S	31E	12	SW¼ SW¼	"	" " "	160.00		.37
								.30	8S	31E	12	SW¼ SE¼	"	" " "	1.80		.01
								22.50	8S	31E	12	SE¼ SW¼	"	" " "	135.00		.28
								5.30	8S	31E	13	NE¼ NW¼	"	" " "	31.80		.06
								.60	8S	31E	13	NW¼ NW¼	"	" " "	3.60		.01
Duncan Canal Company	1885	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	131.60	Tracts described below:				Greenlee	Ownership data as below:		789.60	
								10.10	8S	32E	19	SE¼ SE¼	"	Rebecca Richardson	60.60		.13
								31.50	8S	32E	20	SW¼ SW¼	"	" "	189.00		.40
								2.50	8S	32E	20	SE¼ SW¼	"	" "	15.00		.03
								1.00	8S	32E	20	SE¼ SW¼	"	Sarah L. Richardson	6.00		.01
								2.70	8S	32E	29	NW¼ NE¼	"	" " "	16.20		.03
								38.00	8S	32E	29	NE¼ NW¼	"	" " "	228.00		.48
								7.50	8S	32E	29	NW¼ NW¼	"	" " "	45.00		.09
								8.80	8S	32E	29	NW¼ NW¼	"	Rebecca Richardson	52.80		.12
								2.40	8S	32E	29	SW¼ NW¼	"	Sarah L. Richardson	14.40		.03
								25.60	8S	32E	29	SE¼ NW¼	"	" " "	153.60		.32
								1.50	8S	32E	30	NE¼ NE¼	"	Rebecca Richardson	9.00		.02
R. C. Gilliland	1885	Right	6S	30E	1	NE¼ SE¼	Pumping Plant Direct	9.90	Tracts described below:				Greenlee	Ownership data as below:		59.40	
								4.00	6S	30E	1	NE¼ SW¼	"	R. C. Gilliland	24.00		.05
								5.90	6S	30E	1	NW¼ SE¼	"	" " "	35.40		.07
Laura Short	1885	Left	6S	30E	3	NE¼ NE¼	Pumping Plant	36.50	Tracts described below:				Greenlee	Ownership data as below:		219.00	
								3.60	5S	30E	33	SW¼ SE¼	"	Laura Short	21.60		.04
								27.20	5S	30E	33	SE¼ SE¼	"	" "	163.20		.34
								.10	6S	30E	3	NE¼ NE¼	"	" "	.60		.01
								1.20	6S	30E	3	NE¼ NE¼	"	" "	7.20		.02
								4.40	6S	30E	3	NW¼ NE¼	"	" "	26.40		.05
Cooper & Windham Canal Company	1885	Right	19S	21W	11	NW¼ SE¼	/Cooper & Windham Canal	166.20	Tracts described below:				Hidalgo	Ownership data as below:		997.20	
								4.00	18S	21W	31	Lot 4	"	Owen Lunt	24.00		.05
								15.60	18S	21W	32	SW¼ SW¼	"	G. Lynn Hatch	93.00		.19
								26.10	18S	21W	32	SW¼ SE¼	"	Florence R. Swofford	156.60		.32
								1.90	18S	21W	32	SE¼ SE¼	"	A. C. Gruwell	11.40		.03
								7.40	18S	21W	32	SE¼ SW¼	"	C. Pirtle	44.40		.09
								22.20	18S	21W	33	SW¼ SW¼	"	R. H. Firestone	133.20		.27
								2.00	18S	21W	33	SW¼ SE¼	"	R. H. Lunt	12.00		.02
								17.90	18S	21W	33	SE¼ SW¼	"	E. G. Davidson	107.40		.22
								.80	18S	21W	33	SW¼ SW¼	"	A. C. Gruwell	4.80		.01
								6.30	19S	21W	4	Lot 1	"	J. R. Beavers	37.80		.07
								21.80	19S	21W	4	Lot 2	"	" " "	130.80		.27
								9.80	19S	21W	4	SE¼ NE¼	"	" " "	55.80		.11
								11.20	19S	21W	4	Lot 3	"	E. G. Davidson	67.20		.14
								1.00	19S	21W	4	Lot 4	"	A. C. Gruwell	6.00		.01
								5.00	19S	21W	5	Lot 4	"	G. Lynn Hatch	30.00		.06
								2.80	19S	21W	5	Lot 2	"	Florence R. Swofford	13.80		.02
								2.00	19S	21W	5	Lot 1	"	A. C. Gruwell	12.00		.25
								9.50	19S	21W	6	Lot 1	"	Owen Lunt	57.00		.12

Party entitled to divert — from the stream	Date of priority	Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	½ Name of diverting and/or carrying structure	Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft. Individual	Total	Maximum rate of diversion in cu. ft. per sec. Individual	Total
Sunset Canal Company	1885	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	22.70	Tracts described below:				Hidalgo	Ownership data as below:		136.20		.2
								17.20	18S	21W	32	SE¼ SE¼	"	Mrs. T. M. Williamson	103.20		.21	
								5.50	19S	21W	5	Lot 1	"	" " " "	33.00		.07	
Nevada Consolidated Copper Company.	1885	Right	5S	15E	14	SE¼ SW¼, SW¼ SE¼	Pumps		Use of water for Industrial, Municipal, Domestic and related purposes.				Gila	For further definition of this right see Article IX.		360.00		.7
			5S	15E	23	NE¼ NW¼												
United States	1886	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion dam & Florence Casa Grande Canal	24.00	4S	9E	25	S½ SE¼	Pinal	Thomas A. Crow		144.00		.3
Montezuma Canal Company	1886	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		960.00		2.0
Union Canal Company	1886	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		3972.00		8.2
Sunflower Canal Company	1886	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		60.00		.1
Graham Canal Company	1886	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		1650.00		3.4
Fort Thomas Consolidated Canal Company	1886	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		528.00		1.1
Brown Canal Company	1886	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		180.00		.3
Dodge-Nevada Canal Company	1886	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1.1
Smithville Canal Company	1886	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		480.00		1.0
Curtis Canal Company	1886	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		600.00		1.2
Duncan Canal Company	1886	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	30.35	Tracts described below:				Greenlee	Ownership data as below:		182.10		.4
								.60	8S	32E	19	SWNE¼ & NWSE¼	"	C. C. Martin	3.60		.01	
								1.10	8S	32E	19	SW¼ NE¼	"	T. J. Branyon	6.60		.01	
								8.80	8S	32E	19	SW¼ NE¼	"	" " "	52.80		.11	
								.30	8S	32E	19	SW¼ NE¼	"	J. P. Oberholser	1.80		.01	
								.20	8S	32E	19	SW¼ NE¼	"	W. U. Philpott	1.20		.01	
								.20	8S	32E	19	SW¼ NE¼	"	" "	1.20		.01	
								.40	8S	32E	19	NW¼ SE¼	"	David Davis	2.40		.01	
								.30	8S	32E	19	NW¼ SE¼	"	J. A. Martin	1.80		.01	
								.50	8S	32E	19	NW¼ SE¼	"	J. R. Fowler	3.00		.01	
								2.25	8S	32E	19	NW¼ SE¼	"	Mrs. S. L. Kemp	13.50		.03	
								.80	8S	32E	19	NW¼ SE¼	"	Mrs. Maggie Cauthen	4.80		.01	
								.20	8S	32E	19	SW¼ SE¼	"	J. A. Martin	1.20		.01	
								.30	8S	32E	19	SE¼ SE¼	"	Mrs. M. A. Does	1.80		.01	

(Continued on next page.)

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location referred to G. & S. R. B. & M. for N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
								1.00	8S	32E	19	NW¼ SE¼	Greenlee	John Evans	6.00		.01	
								.40	8S	32E	19	SE¼ SE¼	"	Ernest V. Romney & Eugene Romney	2.40		.01	
								2.30	8S	32E	19	SW¼ NE¼	"	W. U. Phillpott	13.80		.03	
								.30	8S	32E	19	SW¼ NE¼	"	Walde Harris	1.80		.01	
								3.20	8S	32E	19	NW¼ SE¼	"	B. F. Billingsley	19.20		.04	
								1.60	8S	32E	19	NW¼ SE¼	"	" " "	9.60		.02	
								.80	8S	32E	19	NW¼ SE¼	"	Mrs. T. M. Williamson	4.80		.01	
								.30	8S	32E	19	NW¼ SE¼	"	Page S. Windham	1.80		.01	
								.80	8S	32E	19	NW¼ SE¼	"	Mrs. Tom Carter	4.80		.01	
								.30	8S	33E	19	NW¼ SE¼	"	Thomas H. Johnson	1.80		.01	
								.80	8S	32E	19	NW¼ SE¼	"	O. Reyes	4.80		.01	
								.30	8S	32E	19	SE¼ SE¼	"	W. P. Stover	1.80		.01	
								.30	8S	32E	19	SE¼ SE¼	"	Mary E. Campbell	1.80		.01	
								.50	8S	32E	19	SE¼ SE¼	"	Mary Ann Cheatham, A. D. Cheatham, S. C. Cheatham, E. V. Cheatham, I. M. Cheatham & Lila Williams	3.00		.01	
								.20	8S	32E	19	SE¼ SE¼	"	Mrs. Jas. I. Cohn	1.20		.01	
								.90	8S	32E	19	SE¼ SE¼	"	James A. Gamble	5.40		.01	
								.40	8S	32E	19	SE¼ SE¼	"	Mrs. Ethel Rainbolt	2.40		.01	
Valley Canal Company	1886	Right	19S	21W	4	NE¼ NW¼	Valley Canal	81.20	Tracts described below:				Greenlee	Ownership data as below:		487.20		1.01
													"	Emil Girard	54.00		.11	
								9.00	8S	32E	28	SW¼ NE¼	"	" "	48.00		.10	
								8.00	8S	32E	28	SW¼ NE¼	"	" "	177.00		.37	
								29.50	8S	32E	28	NE¼ NW¼	"	" "	208.20		.43	
								34.70	8S	32E	28	SE¼ NW¼						
Moddle Canal Company	1886	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	51.20	Tracts described below:				Hidalgo	Ownership data as below:		307.20		.64
								17.30	19S	21W	3	NW¼ SW¼	"	G. W. Johnson	103.80		.22	
								3.10	19S	21W	3	SW¼ SW¼	"	" " "	18.60		.04	
								29.60	19S	21W	4	NE¼ SE¼	"	" " "	177.60		.37	
								1.20	19S	21W	4	NW¼ SE¼	"	" " "	7.20		.01	
Cosper & Windham Canal Company	1886	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal.	11.90	19S	21W	4	Lot 3	Hidalgo	E. G. Davidson		71.40		.1[illegible]
Shriver Ditch Company	1886	Left	19S	21W	10	NE¼ NE¼	Shriver Ditch	60.10	Tracts described below:				Hidalgo	Ownership data as below:		360.60		.7[illegible]
								13.30	19S	21W	4	SW¼ NE¼	"	W. F. Shriver	79.80		.17	
								20.90	19S	21W	4	SE¼ NW¼	"	" " "	125.40		.26	
								17.90	19S	21W	4	SW¼ NW¼	"	" " "	107.40		.22	
								8.00	19S	21W	5	SE¼ NE¼	"	" " "	48.00		.10	
T. H. B. Glasspie	1887	Left	5S	14E	2	NE¼ NW¼	Pumping Plant	35.10	Tracts described below:				Pinal	Ownership data as below:		210.60		.4[illegible]
								18.60	4S	14E	35	NW¼ SW¼ & S½ SW¼	"	T. H. B. Glasspie	111.60		.23	
								11.70	5S	14E	2	N½ NW¼	"	" " " "	71.00		.15	
								4.80	5S	14E	2	S½ NE¼ & NE¼ SE¼	"	" " " "	28.00		.06	
Montezuma Canal Company	1887	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		24.00		.0[illegible]

Party entitled to divert from the stream	Date of priority	Side of stream	Point of diversion: Location Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac. ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec: Individual	Total
Tidwell Canal Company	1887	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		120.00		.2[illegible]
Union Canal Company	1887	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		1962.00		4.0[illegible]
Sunflower Canal Company	1887	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		60.00		.1[illegible]
Graham Canal Company	1887	Right	7S	27E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		480.00		1.0[illegible]
Fort Thomas Consolidated Canal Company	1887	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		30.00		.0[illegible]
Brown Canal Company	1887	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		630.00		1.3[illegible]
Dodge-Nevada Canal Company	1887	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1.1[illegible]
Smithville Canal Company	1887	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		420.00		.8[illegible]
Curtis Canal Company	1887	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		720.00		1.5[illegible]
Duncan Canal Company	1887	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	10.30	Tracts described below:				Greenlee	Ownership data as below:		61.80		.1[illegible]
								3.30	8S	32E	19	SW¼ NE¼	"	A. N. Livvix	19.80		.04	
								1.20	8S	32E	19	SW¼ NE¼	"	(Ernest V. Romney & Eugene Romney	7.20		.02	
														(" " " "	34.80		.07	
								5.80	8S	32E	19	SW¼ NE¼						
Nevada Consolidated Copper Company	1887	Right	5S	15E	14	SE¼ SW¼ SW¼ SE¼	Pumps		Use of water for Industrial, Municipal, domestic and				Gila	For further definition of this right see Article IX		360.00		[illegible]
			5S	15E	23	NE¼ NW¼												
Cosper & Windham Canal Company	1887	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal	46.50	Tracts described below:				Hidalgo	Ownership data as below:		279.00		[illegible]
								7.60	19S	21W	3	SE¼ NW¼	"	Peter Mortensen	45.60		.09	
								11.60	19S	21W	3	SW¼ NW¼	"	J. R. Beavers	69.60		.15	
								5.60	19S	21W	3	SE¼ NW¼	"	O. Mortensen	33.60		.07	
								7.40	19S	21W	3	SW¼ NE¼	"	(George H. Cosper, Jr., (Administrator of the Estate (of George Cosper, deceased	44.40		.09	
														(" " " "	72.00		.15	
								12.00	19S	21W	3	NW¼ SE¼	"					
								2.30	19S	21W	4	SE¼ NE¼	"	J. R. Beavers	13.80		.03	
Montezuma Canal Company	1888	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		216.00		[illegible]
San Jose Canal Company	1888	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600.00		1.[illegible]
Union Canal Company	1888	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		978.00		2.[illegible]

Party entitled to divert from the stream	Date of priority	Point of diversion					Name of diverting and/or carrying structure	Lands for which right acquired						Parties owning said lands when jurisdiction acquired herein	Diversion	
		Side of stream	Location — Referred to G. & S. R. B. & M. or N. M. B. & M.					Number of acres	Description — Referred to G. & S. R. B. & M. or N. M. B. & M.				County		For irrigation season in ac.-ft.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total
Sunflower Canal Company	1888	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		30.0
Graham Canal Company	1888	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		342.0
Fort Thomas Consolidated Canal Company	1888	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		90.0
Brown Canal Company	1888	Right	6S	25E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		90.0
Dodge-Nevada Canal Company	1888	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.0
Smithville Canal Company	1888	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		780.0
Curtis Canal Company	1888	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		240.0
Valley Canal Company	1888	Right	19S	21W	4	NE¼ NW¼	Valley Canal	417.00	Tracts described below:				Greenlee	Ownership data as below:		2502.0
								21.30	8S	31E	11	SE¼ NW¼	"	W. W. Wilkey	127.80	
								4.00	8S	31E	11	SW¼ SE¼	"	" " "	24.00	
								8.50	8S	31E	13	NE¼ NE¼	"	W. T. Sanders	51.00	
								9.80	8S	32E	17	NW¼ SW¼	"	J. W. Hill & C. F. Hill	58.80	
								.30	8S	32E	17	NW¼ SW¼	"	T. W. Brown	1.80	
								28.40	8S	32E	17	SW¼ SW¼	"	" " "	170.40	
								5.60	8S	32E	17	SW¼ SW¼	"	J. W. Hill & C. F. Hill	33.60	
								10.30	8S	32E	17	SE¼ SW¼	"	T. W. Brown	61.80	
								2.10	8S	32E	18	NE¼ NE¼	"	William Manske	12.60	
								28.20	8S	32E	18	NW¼ NE¼	"	" "	169.20	
								17.30	8S	32E	18	SW¼ NE¼	"	" "	103.80	
								8.90	8S	32E	18	SE¼ NE¼	"	" "	53.40	
								17.80	8S	32E	18	NE¼ NW¼	"	Mrs. Eliza Alexander	106.80	
								14.50	8S	32E	18	NW¼ NW¼	"	W. T. Sanders	87.00	
								38.50	8S	32E	18	NE¼ SE¼	"	Andy Scott & Brooks Scott	231.00	
								33.50	8S	32E	18	SE¼ SE¼	"	" " " " "	201.00	
								23.50	8S	32E	21	NW¼ SW¼	"	H. J. Nunn & T. A. Nunn	141.00	
								38.10	8S	32E	21	SW¼ SW¼	"	" " " " " "	228.60	
								39.40	8S	32E	28	NW¼ NW¼	"	A. L. Stewart	236.40	
								11.70	8S	32E	28	SW¼ NW¼	"	" " "	70.20	
								10.00	8S	32E	28	SE¼ SE¼	"	Heaton Lunt	60.00	
								35.60	8S	32E	34	NE¼ NW¼	"	Julius Romney & Edward Lunt	213.60	
								9.70	8S	32E	34	SW¼ NW¼	"	" " " " "	58.20	
Duncan Canal Company	1888	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	13.00	Tracts described below:				Greenlee	Ownership data as below:		78.0
								.20	8S	32E	19	NE¼ NW¼	"	(Duncan Union High School	1.20	
								8.90	8S	32E	19	SE¼ NW¼	"	(District, County of Greenlee	53.40	
														(State of Arizona.		
								3.90	8S	32E	19	SE¼ NW¼	"	J. P. Oberholser	23.40	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion [illegible]: For irrigation season in ac. ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Black & McCleskey Canal Company	1888	Left	8S	32E	19	NE¼ SE¼	Black & McCleskey Canal	170.10	Tracts described below:				Greenlee	Ownership data as below:		1056.60		2.20
								17.60	8S	31E	13	SW¼ NE¼	"	W. W. Brooks	105.60		.22	
								8.10	8S	31E	13	SE¼ NE¼	"	" " "	48.60		.10	
								12.70	8S	31E	13	SE¼ NE¼	"	B. A. Wilson	76.20		.16	
								35.60	8S	31E	13	NE¼ SE¼	"	" " "	213.60		.44	
								6.80	8S	31E	13	NW¼ SE¼	"	" " "	40.80		.09	
								7.60	8S	31E	13	NW¼ SE¼	"	W. W. Brooks	45.60		.10	
								11.20	8S	32E	18	NE¼ SW¼	"	B. A. Wilson	67.20		.14	
								3.40	8S	32E	18	NW¼ SW¼	"	" " "	20.40		.04	
								20.30	8S	32E	18	NW¼ SW¼	"	Floyd Hightower	121.80		.25	
								4.80	8S	32E	18	SW¼ SW¼	"	" "	28.80		.06	
								9.80	8S	32E	18	SW¼ SW¼	"	B. A. Wilson	58.80		.12	
								37.80	8S	32E	18	SE¼ SW¼	"	" " "	226.80		.47	
								.40	8S	32E	18	SW¼ SE¼	"	" " "	2.40		.01	
United States	1889	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	205.00	Tracts described below:				Pinal	Ownership data as below:		1230.00		2.5
								25.00	5S	9E	11	NE¼ NE¼	"	Dugald Stewart	150.00		.31	
								70.00	5S	9E	15	W½ NW¼	"	Leon M. Nowell	420.00		.8[illegible]	
								80.00	5S	9E	15	W½ SW¼	"	" " "	480.00		1.00	
								30.00	5S	10E	6	NW¼	"	State of Arizona	180.00		.37	
Montezuma Canal Company	1889	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed descriptions of these lands.				Graham	See Table No. 1 for Ownership data.		360.00		.7
San Jose Canal Company	1889	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed descriptions of these lands.				Graham	See Table No. 2 for Ownership data.		300.00		.6
Union Canal Company	1889	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed descriptions of these lands				Graham	See Table No. 4 for Ownership data.		2820.00		6.
Sunflower Canal Company	1889	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands				Graham	See Table No. 5 for Ownership data.		60.00		.
Graham Canal Company	1889	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		328.00		1.
Fort Thomas Consolidated Canal Company	1889	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		300.00		.
Brown Canal Company	1889	Right	6S	25E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		60.00		.
Dodge-Nevada Canal Company.	1889	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1.
'urtis Canal Company	1889	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		600.00		1
n Canal Company	1889	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	17.00	Tracts described below:				Greenlee	Ownership data as below:		102.00		
								3.00	8S	32E	19	NW¼ NE¼	"	(Ernesta Francese, Adminis-	18.00		.04	
								4.00	8S	32E	19	SW¼ NE¼	"	(tratrix of the Estate of	24.00		.05	
								10.00	8S	32E	19	NE¼ NW¼	"	(Frank Francese, deceased.	60.00		.13	

Diversion right

Party entitled to divert from the stream	Date of priority	Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft. — Individual	Total	Maximum rate of diversion in cu. ft. per sec. — Individual	Total
Moddle Canal Company	1889	Left	19S	21E	11	NW¼ SE¼	Moddle Canal	90.90	Tracts described below:				Greenlee	Ownership data as below:		545.40		1. 1
								24.30	8S	32E	28	SE¼ SW¼	"	Silas Bradshaw	145.80		.30	
								6.20	8S	32E	28	SW¼ SE¼	"	" "	37.20		.08	
								28.30	8S	32E	33	NW¼ NE¼	"	" "	169.80		.35	
								32.10	8S	32E	33	NE¼ NW¼	"	" "	192.60		.40	
Nevada Consolidated Copper Company	1890	Right	5S	15E	14	SE¼ SW¼ SW¼ SE¼	Pumps		Use of water for industrial, municipal, domestic and related purposes.				Gila	For further definition of this right see Article IX		60.00		. 1
			5S	15E	23	NE¼ NW¼												
United States	1890	Left	4S	11E	S	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	143.00	Tracts described below:				Pinal	Ownership data as below:		853.00		1. 7
								20.00	4S	10E	29	SE¼	"	James R. Treat	120.00		.25	
								3.00	5S	9E	2	SW¼ NE¼	"	Thad Moore	18.00		.04	
								80.00	5S	9E	30	E½ NE¼	"	Earl G. Clemens	480.00		1.00	
								40.00	5S	9E	30	NE¼ NW¼	"	Mira B. Doran	240.00		.50	
Montezuma Canal Company	1890	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		360.00		. 7
Union Canal Company	1890	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		2870.00		5. 8
Sunflower Canal Company	1890	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		60.00		. 1
Graham Canal Company	1890	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		480.00		1. 0
Brown Canal Company	1890	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		300.00		. 6
Dodge-Nevada Canal Company	1890	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		540.00		1. 1
Smithville Canal Company	1890	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		600.00		1. 2
Curtis Canal Company	1890	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1650.00	See Table No. 11 for detailed description of these lands.				Graham	See Table No. 11 for Ownership data.		300.00		. 6
United States	1891	Left	4S	11E	S	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	974.00	Tracts described below:				Pinal	Ownership data as below:		5544.00		12 1
								12.00	4S	10E	28	NE¼ NW¼	"	Jennie Roberts	72.00		.15	
								160.00	5S	8E	23	SE¼	"	W. O. Kidder	960.00		2.00	
								70.00	5S	8E	24	E½ NE¼	"	L. S. Nafziger	420.00		.87	
								160.00	5S	8E	24	SE¼	"	M. N. Nafziger	960.00		2.00	
								80.00	5S	8E	25	N½ NW¼	"	Grace R. Becken	480.00		1.00	
								40.00	5S	8E	25	SE¼ NW¼	"	" " "	240.00		.50	
								160.00	5S	8E	25	NE¼	"	Grace R. Becken, Albert C. Becken & Clara L. Becken	960.00		2.00	
								30.00	6S	6E	19	SE¼ SE¼	"	Charles F. Bennett	180.00		.37	
								16.00	6S	6E	29	NW¼ SE¼	"	Robert Denton	96.00		.20	
								40.00	6S	6E	32	SE¼ SE¼	"	Ralph M. Rounds	240.00		.50	
								80.00	6S	6E	32	E½ NE¼	"	Louise M. Trekell	480.00		1.00	
								80.00	6S	6E	33	NW¼ SW¼ & SW¼ NW¼	"	Don A. Trekell	480.00		1.00	
								40.00	6S	6E	33	SW¼ SW¼	"	Louise M. Trekell	240.00		.50	
								6.00	6S	6E	34	Lot 1, Blk 38 Arizola Townsite.	"	Addie Phillips	36.00		.08	

Party entitled to divert from the stream	Date of priority	Side of stream	Point of diversion — Location — Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired — Number of acres	Description — Referred to G. & S. R. B. & M. or N. M. B. & M. — Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right — For irrigation season in ac.-ft. — Individual	Total	Maximum rate of diversion in cu. ft. per sec. — Individual	Total
Montezuma Canal Company	1891	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		360.00		.7
San Jose Canal Company	1891	Left	6S	27E	30	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		300.00		.6
Tidwell Canal Company	1891	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		60.00		.1
Union Canal Company	1891	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		1200.00		2.5
Sunflower Canal Company	1891	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		60.00		.1
Graham Canal Company	1891	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		1410.00		2.9
Brown Canal Company	1891	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		900.00		1.8
Dodge-Nevada Canal Company.	1891	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		300.00		.6
Fourness Canal Company	1891	Left	7S	26E	1	NW¼ NE¼	Fourness Canal	260.00	See Table No. 12 for detailed description of these lands.				Graham	See Table No. 12 for Ownership data.		1560.00		3.2
Cosper & Windham Extension Canal Company. Under Contract whereby Cosper & Windham Canal Company makes actual diversion	1891	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal & Cosper & Windham Extension Canal	28.20	Tracts described below:				Greenlee	Ownership data as below:		169.20		.3
								1.40	8S	32E	34	NW¼ NE¼	"	A. T. Layton	8.40		.02	
								25.20	8S	32E	34	SW¼ NE¼	"	" " "	151.20		.32	
								1.60	8S	32E	34	SW¼ NE¼		" " "	9.60		.02	
Duncan Canal Company	1891	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	5.20	Tracts described below:				Greenlee	Ownership data as below:		31.20		.
								5.00	8S	32E	19	NE¼ NW¼	"	Roy D. Williams	30.00		.05	
								.20	8S	32E	19	SE¼ NW¼	"	" " "	1.20		.01	
United States	1892	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	400.00	Tracts described below:				Pinal	Ownership data as below:		2400.00		5
								160.00	5S	8E	24	SW¼	"	Robert H. Pottebaum	960.00		2.00	
								40.00	5S	8E	25	SW¼ NW¼	"	Grace R. Becken	240.00		.50	
								80.00	5S	8E	35	N½ NW¼	"	Ed Lacy & Hazel A. Converse	480.00		1.00	
								20.00	5S	9E	10	SW¼ NW¼; NW¼ SW¼	"	H. G. Richardson	120.00		.25	
								20.00	5S	9E	10	SE¼ NW¼; NE¼ SW¼	"	H. M. Fennemore	120.00		.25	
								80.00	5S	9E	19	W½ NW¼	"	Lillian C. Merchant	480.00		1.00	
Montezuma Canal Company	1892	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		360.00		.
Union Canal Company	1892	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		660.00		1.
Sunflower Canal Company	1892	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		120.00		.

Party entitled to divert from the stream	Date of priority	Point of diversion						Lands for which right acquired							Diversion right			
		Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.				Name of diverting and/or carrying structure	Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.				County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft.		Maximum rate of diversion in cu. ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
Graham Canal Company	1892	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		960.00		2.00
Brown Canal Company	1892	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Tabel No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		270.00		.56
Dodge-Nevada Canal Company	1892	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for Ownership data.		180.00		.33
Smithville Canal Company	1892	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		150.00		.31
Sunset Canal Company	1892	Right	19S	21W	11	NW¼ NW¼	Sunset Canal	96.50	Tracts described below:				Hidalgo	Ownership data as below:		579.00		1.20
								3.90	19S	20W	18	NW¼ NW¼	"	C. F. Houlihan	23.40		.05	
								4.80	19S	20W	18	NW¼ NW¼	"	R. T. Johns	28.80		.06	
								3.30	19S	20W	18	SW¼ NW¼	"	" " "	19.80		.04	
								9.50	19S	20W	18	SE¼ NW¼	"	" " "	57.00		.12	
								2.20	19S	20W	18	SW¼ NE¼	"	C. M. Brooks	13.20		.02	
								.30	19S	21W	11	NE¼ SE¼	"	Hiram K. Mortensen	1.80		.01	
								14.80	19S	21W	11	NE¼ SE¼	"	James A. Mitchell	88.80		.19	
								4.80	19S	21W	11	NW¼ SE¼	"	" " "	28.80		.06	
								3.50	19S	21W	11	SE¼ SE¼	"	" " "	21.00		.04	
								18.80	19S	21W	12	SW¼ SW¼	"	" " "	112.80		.24	
								4.10	19S	21W	12	SE¼ SW¼	"	" " "	24.60		.05	
								20.50	19S	21W	13	NE¼ NE¼	"	C. F. Houlihan	123.00		.28	
								6.00	19S	21W	13	NW¼ NE¼	"	" " "	36.00		.08	
United States	1893	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	326.00	Tracts described below:				Pinal	Ownership data as below:		1956.00		4.07
								160.00	5S	9E	29	NW¼	"	Hazel H. Clemans	960.00		2.00	
								160.00	5S	9E	31	NW¼	"	George M. Brockway	960.00		2.00	
								6.00	6S	6E	34	Lot 2, Blk 39 Arizola Twnsite.	"	Addie Phillips	36.00		.07	
Montezuma Canal Company	1893	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		480.00		1.00
San Jose Canal Company]	1893	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600.00		1.25
Tidwell Canal Company	1893	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		60.00		.13
Union Canal Company	1893	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		150.00		.31
Graham Canal Company	1893	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		270.00		.56
Fort Thomas Consolidated Canal Company	1893	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		1260.00		2.63
Brown Canal Company	1893	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		420.00		.88

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Moddle Canal Company	1893	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	78.50	Tracts described below:				Hidalgo	Ownership data as below:		471.00		.
								26.00	19S	21W	3	SW¼ SW¼	"	G. W. Johnson	156.00		.31	
								14.30	19S	21W	3	SE¼ SW¼	"	W. W. Lloyd	85.80		.18	
								7.10	19S	21W	3	SW¼ SE¼	"	" " "	42.60		.09	
								.30	19S	21W	3	SE¼ SE¼	"	" " "	1.80		.01	
								7.00	19S	21W	4	NE¼ SE¼	"	G. W. Johnson	42.00		.09	
								13.30	19S	21W	4	NW¼ SE¼	"	" " "	79.80		.17	
								2.40	19S	21W	10	NE¼ NE¼	"	W. W. Lloyd	14.40		.03	
								8.10	19S	21W	10	NW¼ NE¼	"	" " "	48.60		.10	
United States	1894	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	192.00	Tracts described below:				Pinal	Ownership data as below:		1152.00		2.
								40.00	5S	8E	21	SE¼ NW¼	"	Robert Denton, Administrator of the Estate of George F. Gallagher, deceased.	240.00		.50	
								12.00	5S	8E	23	E½ SE¼ NE¼	"	John MacGregor Goodale	72.00		.15	
								40.00	6S	5E	23	SE¼ SE¼	"	John W. Burris	240.00		.50	
								15.00	6S	5E	23	E½ SE¼ NE¼	"	James E. Brophy	90.00		.19	
								10.00	6S	5E	24	E½ E½ SE¼ SW¼	"	Earl F. Smiley	60.00		.13	
								10.00	6S	5E	25	NE¼ SE¼	"	George W. Burgess	60.00		.12	
								65.00	6S	5E	25	E½ SW¼	"	Florence Pallamounter and Howard G. Pallamounter	390.00		.81	
Montezuma Canal Company	1894	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		240.00		.
Tidwell Canal Company	1894	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		60.00		.
Union Canal Company	1894	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for ownership data.		510.00		1.
Graham Canal Company	1894	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for ownership data.		180.00		.
Smithville Canal Company	1894	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		150.00		.
Valley Canal Company	1894	Right	19S	21W	4	NE¼ NW¼	Valley Canal	78.90	Tracts described below:				Greenlee	Ownership data as below:		465.40		.
								5.20	8S	32E	7	SW¼ SW¼	"	W. T. Sanders	31.20		.07	
								11.70	8S	32E	7	SE¼ SW¼	"	" " "	70.20		.14	
								19.40	8S	32E	18	NE¼ NW¼	"	" " "	116.40		.25	
								14.40	8S	32E	18	NW¼ NW¼	"	" " "	86.40		.18	
								7.40	8S	32E	18	SW¼ NW¼	"	" " "	44.40		.09	
								20.80	8S	32E	18	SE¼ NW¼	"	" " "	124.80		.26	
Moddle Canal Company	1894	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	177.50	Tracts described below:				Greenlee	Ownership data as below:		1065.00		2.
								19.00	8S	32E	33	NE¼ SE¼	"	L. G. Moyers	114.00		.23	
								28.30	8S	32E	33	NW¼ SE¼	"	" " "	169.80		.35	
								37.80	8S	32E	33	SW¼ SE¼	"	" " "	226.80		.47	
								38.80	8S	32E	33	SE¼ SE¼	"	" " "	232.80		.49	
								15.00	8S	32E	33	NE¼ SE¼	"	" " "	90.00		.19	
								38.60	9S	32E	4	NW¼ NE¼	"	" " "	231.60		.48	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac. ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
United States	1895	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal.	740.30	Tracts described below:				Pinal	Ownership data as below:		4441.80		9.25
								5.00	4S	9E	30	SW¼ NW¼	"	Elizabeth M. Martin	30.00		.06	
								35.29	4S	9E	36	W½ NW¼	"	Roland H. Moorehouse	211.74		.44	
								39.71	4S	9E	36	NW¼ NW¼	"	" " "	238.26		.50	
								10.29	4S	9E	36	NE¼ NW¼	"	" " "	61.74		.13	
								10.44	4S	9E	36	W½ E½ NW¼	"	" " "	62.64		.13	
								11.00	4S	9E	36	W½ E½ NW¼	"	Andris V. Salazar	66.00		.13	
								80.00	4S	10E	28	W½ NW¼	"	Valley Bank & Trust Company	480.00		1.00	
								8.00	4S	10E	28	NW¼ SW¼	"	" " " " "	48.00		.10	
								.57	5S	9E	2	Lots 5, 6, 7 & 8 Blk 6, Florence Townsite.	"	W. W. Lane	3.42		.01	
								50.00	5S	9E	6	W½ NW¼	"	George W. Pattee	300.00		.63	
								60.00	6S	5E	24	S½ SE¼	"	H. D. Thornton	360.00		.75	
								80.00	6S	5E	25	W½ NE¼	"	Maude M. Bassler & Fred W. Bassler	480.00		1.00	
								80.00	6S	5E	25	E½ NW¼	"	Edwin Ralph	480.00		1.00	
								50.00	6S	5E	26	E½ SE¼	"	Dan T. Peart, Administrator of the Estate of Lola W. Lee, deceased and Dan T. Peart, Administrator of the Estate of Thomas J. Barrett, deceased.	300.00		.63	
								40.00	6S	6E	28	SE¼ SW¼	"	Katie E. Weaver	240.00		.50	
								20.00	6S	7E	31	E½ SE¼ SE¼	"	Peter D. Overfield	120.00		.25	
								15.00	6S	7E	31	W½ SE¼ SE¼	"	" " "	90.00		.18	
								15.00	6S	7E	32	W½ SW¼ NW¼	"	Charles M. Schwab	90.00		.18	
								10.00	6S	7E	32	NW¼ NW¼ SW¼	"	" " "	60.00		.12	
								113.00	7S	6E	3	E½ SW¼, W½ SE¼	"	Valley Bank & Trust Company	678.00		1.41	
								7.00	7S	7E	5	N½ NW¼	"	Helen S. Sheafe	42.00		.09	
Montezuma Canal Company	1895	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		240.00		.50
San Jose Canal Company	1895	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		300.00		.63
Union Canal Company	1895	Left	7S	27E	18	SE¼ NE¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		150.00		.31
Sunflower Canal Company	1895	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		120.00		.25
Graham Canal Company	1895	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		1200.00		2.50
Fort Thomas Consolidated Canal Company	1895	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		210.00		.44
Colvin-Jones Canal Company	1895	Right	4S	23E	26	SW¼ SW¼	Colvin-Jones Canal	36.00	See Table No. 13 for detailed description of these lands.				Graham	See Table No. 13 for Ownership data.		180.00		.38

Party entitled to divert from the stream	Date of priority	Point of diversion					Name of diverting and/or carrying structure	Lands for which right acquired						Parties owning said lands when jurisdiction acquired herein	Diversion right			
		Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.					Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.				County		For irrigation season in ac.-ft.		Maximum rate of diversion in cu. ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
Valley Canal Company	1895	Right	19S	21W	4	NE¼ NW¼	Valley Canal	115.80	Tracts described below:				Greenlee	Ownership data as below:		694.80		1.
								7.20	8S	32E	20	NE¼ NW¼	"	H. J. Nunn & T. A. Nunn	43.20		.09	
								31.10	8S	32E	20	NE¼ SE¼	"	" " " " " "	186.60		.39	
								21.60	8S	32E	20	NW¼ SW¼	"	Culver Kartchner	129.60		.27	
								20.00	8S	32E	20	SE¼ SE¼	"	H. J. Nunn & T. A. Nunn	120.00		.25	
								19.90	8S	32E	28	SE¼ SE¼	"	Heaton Lunt	119.40		.25	
								8.20	8S	32E	29	NW¼ NE¼	"	Sarah L. Richardson	49.20		.11	
								7.80	8S	32E	33	NE¼ NE¼	"	Heaton Lunt	40.80		.09	
Cosper & Windham Extension Canal Company, Under contract whereby Cosper & Windham Canal Company makes actual diversion.	1895	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal & Cosper & Windham Extension Canal	133.50	Tracts described below:				Greenlee	Ownership data as below:		801.00		1.
								22.40	8S	32E	34	NE¼ SW¼	"	Betty Marsh Cheatham	74.40		.28	
								11.50	8S	32E	34	NW¼ SW¼	"	" " "	69.00		.14	
								35.60	8S	32E	34	NE¼ SE¼	"	John Hagan	213.60		.45	
								9.40	8S	32E	34	NW¼ SE¼	"	" "	56.40		.10	
								28.70	8S	32E	34	NW¼ SE¼	"	George A. Lunt	172.20		.36	
								5.60	8S	32E	34	SW¼ SE¼	"	" " "	33.60		.07	
								2.80	8S	32E	34	SW¼ SE¼	"	John Hagan	16.80		.04	
								17.50	8S	32E	34	SE¼ SE¼	"	" "	105.00		.22	
Moddle Canal Company	1895	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	72.20	Tracts described below:				Greenlee	Ownership data as below:		433.20		
								19.60	8S	32E	33	SW¼ NE¼	"	V. Soto	117.60		.24	
								8.70	8S	32E	33	SW¼ NW¼	"	" "	52.20		.11	
								5.10	8S	32E	33	SE¼ NE¼	"	" "	30.60		.07	
								1.30	8S	32E	33	SW¼ NE¼	"	Nicholas Suarez	7.80		.02	
								15.40	8S	32E	33	SW¼ NW¼	"	" "	92.40		.19	
								22.10	8S	32E	33	SE¼ NW¼	"	" "	132.60		.28	
Sunset Canal Company	1895	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	26.00	Tracts described below:				Hidalgo	Ownership data as below:		156.00		
								5.00	19S	21W	12	SW¼ NW¼	"	J. E. Cardon	30.00		.06	
								8.50	19S	21W	12	SE¼ NW¼	"	" " "	51.00		.11	
								0.60	19S	21W	12	NE¼ NW¼	"	M. L. Harris	3.60		.01	
								8.80	19S	21W	12	SW¼ NW¼	"	" " "	52.80		.11	
								3.10	19S	21W	12	SE¼ NW¼	"	" " "	18.60		.04	
Nevada Consolidated Copper Company	1895	Right	5S	15E	14	SE¼ SW¼, SW¼ SE¼	Pumps		Use of water for Industrial, Municipal, Domestic and related purposes.				Gila	For further definition of this right see Article IX.		240.00		
			5S	15E	23	NE¼ NW¼												
United States	1896	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	310.00	Tracts described below:				Pinal	Ownership data as below:		1860.00		3
								10.00	5S	8E	26	N½ N½ NW¼ NW¼	"	Archie L. Bartlett	60.00		.13	
								40.00	6S	5E	14	SE¼ SW¼	"	Frederick K. Kratzka	240.00		.50	
								25.00	6S	5E	15	SE¼ SE¼	"	Ed Drake	150.00		.31	
								95.00	6S	5E	15	S½ NE¼ & SE¼ NW¼	"	Gustav Kratzka	570.00		1.19	
								[illegible]	[illegible]									
								20.00	6S	5E	26	E½ NE¼ SW¼	"	Frederick Kochameier	120.00		.25	
								20.00	6S	5E	35	S½ NE¼ NE¼	"	Nellie R. Gochenouer	120.00		.25	
								20.00	6S	5E	35	N½ NE¼ NE¼	"	Dan T. Peart, Administrator of the Estate of Lola W. Lee, deceased.	120.00		.25	
								80.00	6S	7E	27	E½ NE¼	"	Roland Curry & Eldora Curry	480.00		1.00	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Montezuma Canal Company	1896	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750. 00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		540. 00		1.
San Jose Canal Company	1896	Left	6S	27E	30	SW¼ SW¼	San Jose Canal	3000. 00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		600. 00		1.
Tidwell Canal Company	1896	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450. 00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for Ownership data.		180. 00		.
Union Canal Company	1896	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575. 00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for Ownership data.		750. 00		1.
Sunflower Canal Company	1896	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400. 00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		30. 00		.
Graham Canal Company	1896	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577. 00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		540. 00		1.
Fort Thomas Consolidated Canal Company	1896	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200. 00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		1764. 00		3.
Brown Canal Company	1896	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820. 00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for Ownership data.		600. 00		1.
Smithville Canal Company	1896	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760. 00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		180. 0		.
Black & McCleskey Canal Company	1896	Left	8S	32E	19	NE¼ SE¼	Black & McCleskey Canal	29. 70	Tracts described below:				Greenlee	Ownership data as below:		178. 20		.
								16. 40	8S	32E	19	NW¼ NE¼	"	(Ernesta Francese, Adminis-	98. 40		. 21	
								4. 40	8S	32E	19	NW¼ NE¼	"	(tratrix of the Estate of	26. 40		. 06	
								. 90	8S	32E	19	SW¼ NE¼	"	(Frank Francese, deceased	5. 40		. 01	
								8. 00	8S	32E	19	NE¼ NW¼	"	(	48. 00		. 10	
Moddle Canal Company	1896	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	172. 80	Tracts described below:				Greenlee	Ownership data as below:		1036. 80		2.
								7. 30	8S	32E	29	SW¼ NE¼	"	Mrs. M. E. Pittman	43. 80		. 09	
								8. 40	8S	32E	29	NW¼ SE¼	"	" " " "	60. 40		. 10	
								11. 70	8S	32E	33	NW¼ SW¼	"	L. D. Moyers	70. 20		. 14	
								22. 50	9S	32E	3	NE¼ NE¼	"	Joseph C. Elledge	135. 00		. 25	
								36. 00	9S	32E	3	NW¼ NE¼	"	" " "	216. 00		. 45	
								37. 40	9S	32E	3	NE¼ NW¼	"	" " "	224. 40		. 46	
								38. 10	9S	32E	3	NW¼ NW¼	"	" " "	228. 60		. 47	
								11. 40	19S	21W	3	SE¼ SW¼	Hidalgo	W. W. Lloyd	68. 40		. 14	
Sunset Canal Company	1896	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	94. 10	Tracts described below:				Hidalgo	Ownership data as below:		564. 60		1.
								19. 20	19S	21W	2	SW¼ SE¼	"	Junius E. Payne	115. 20		. 24	
								4. 70	19S	21W	2	SE¼ SE¼	"	" " "	28. 20		. 06	
								2. 10	19S	21W	2	NE¼ SW¼	"	Mary Jane Jones	12. 60		. 03	
								9. 00	19S	21W	2	SE¼ SW¼	"	T. V. Jones	54. 00		. 11	
								23. 30	19S	21W	2	NW¼ SW¼	"	M. B. Echols	139. 80		. 29	
								3. 40	19S	21W	2	NW¼ SW¼	"	Bryon Echols	20. 40		. 04	
								2. 30	19S	21W	2	SW¼ SW¼	"	" "	13. 80		. 03	
								3. 40	19S	21W	2	NE¼ SW¼	"	F. W. Jones	20. 40		. 04	
								1. 50	19S	21W	2	NW¼ NE¼	"	" " "	10. 80		. 02	
								1. 20	19S	21W	2	SW¼ NW¼	"	Henry L. Smith	7. 20		. 01	
								5. 10	19S	21W	2	SW¼ SW¼	"	" " "	30. 60		. 05	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
(Continuation of Sunset Canal Company)	1896							7. 80	(Continuation) 19S	21W	3	Lot 4	Hidalgo	H. M. Payne	46. 80		. 10	
								4. 80	19S	21W	11	NE¼ NE¼	"	Junius E. Payne	28. 80		. 06	
								. 40	19S	21W	11	NW¼ NE¼	"	F. W. Jones	2. 40		. 01	
Montezuma Canal Company	1897	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750. 00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		600. 00		1.
San Jose Canal Company	1897	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000. 00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for Ownership data.		60. 00		.
Sunflower Canal Company	1897	Left	7S	26E	9	NW¼ NE¼	Sunflower Canal	400. 00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for Ownership data.		30. 00		.
Graham Canal Company	1897	Ri ht	7S	26E	9	NE¼ NW¼	Graham Canal	2577. 00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		300. 00		.
Fort Thomas Consolidated Canal Company	1897	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200. 00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		606. 00		1
Smithville Canal Company	1897	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760. 00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for Ownership data.		120. 00		
Colmenero Canal Company	1897	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	74. 30	Tracts described below:				Greenlee	Ownership data as below:		445. 80		
								2. 30	7S	31E	33	SE¼ NE¼	"	W. A. Gill	13. 80		. 03	
								6. 20	7S	31E	33	SE¼ NE¼	"	J. B. Fullerton	37. 20		. 08	
								28. 10	7S	31E	33	NE¼ SE¼	"	" " "	168. 60		. 35	
								14. 00	7S	31E	33	SE¼ SE¼	"	" " "	84. 00		. 18	
								. 90	7S	31E	34	NW¼ NW¼	"	W. A. Gill	5. 40		. 01	
								18. 50	7S	31E	34	SW¼ NW¼	"	" " "	111. 00		. 23	
								. 20	7S	31E	34	SW¼ NW¼	"	J. B. Fullerton	1. 20		. 01	
								. 40	7S	31E	34	NW¼ SW¼	"	" " "	2. 40		. 01	
								. 40	7S	31E	34	SW¼ SW¼	"	" " "	2. 40		. 01	
								3. 30	8S	31E	3	NW¼ NW¼	"	Charles Telles	19. 80		. 04	
Valley Canal Company	1897	Right	19S	21W	4	NE¼ NW¼	Valley Canal	331. 30	Tracts described below:				Greenlee	Ownership data as below:		1957. 80		
								. 70	8S	32E	19	NE¼ NE¼	"	Joe Whittridge	4. 20		. 01	
								7. 60	8S	32E	19	NE¼ NE¼	"	" "	45. 60		. 12	
								13. 20	8S	32E	20	SE¼ NW¼	"	Julius Romney & Edward Lunt	79. 20		. 16	
								25. 20	8S	32E	20	NE¼ SW¼	"	" " " " "	151. 20		. 32	
								1. 70	8S	32E	20	SE¼ SW¼	"	" " " " "	10. 20		. 03	
								29. 70	8S	32E	20	NW¼ SE¼	"	" " " " "	178. 20		. 37	
								35. 50	8S	32E	20	SW¼ SE¼	"	" " " " "	213. 00		. 44	
								29. 30	8S	32E	27	SW¼ SW¼	"	" " " " "	175. 80		. 37	
								20. 70	8S	32E	27	SE¼ SW¼	"	" " " " "	124. 20		. 26	
								37. 90	8S	32E	29	NE¼ NE¼	"	" " " " "	227. 40		. 47	
								9. 70	8S	32E	29	NW¼ NE¼	"	" " " " "	58. 20		. 13	
								9. 90	8S	32E	29	SE¼ NE¼	"	" " " " "	59. 40		. 13	
								3. 30	8S	32E	34	SW¼ NE¼	"	" " " " "	19. 80		. 01	
								42. 70	8S	32E	34	NE¼ NE¼	"	" " " " "	256. 20		. 53	
								27. 30	8S	32E	34	SW¼ NW¼	"	" " " " "	163. 80		. 32	
								36. 90	8S	32E	34	SE¼ NW¼	"	" " " " "	221. 40		. 40	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximu rate of di sion in c ft. per s: Individual	To
Moddle Canal Company	1897	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	718.06	Tracts described below:				Greenlee	Ownership data as below:		4308.36		[illegible]
								25.90	8S	32E	33	NE¼ SW¼	"	W. F. Moyers	155.40		.32	
								.90	8S	32E	33	NW¼ NW¼	"	Mrs. R. S. Stewart	5.40		.01	
								6.60	8S	32E	33	NW¼ SW¼	"	" " " "	39.60		.09	
								37.60	8S	32E	33	SW¼ SW¼	"	" " " "	225.60		.47	
								35.70	8S	32E	33	SE¼ SW¼	"	W. F. Moyers	214.20		.45	
								4.50	8S	32E	34	NW¼ SW¼	"	T. J. Anderson	27.00		.06	
								31.60	8S	32E	34	SW¼ SW¼	"	" " "	189.60		.40	
								26.00	8S	32E	34	SE¼ SW¼	"	" " "	156.00		.32	
								11.80	9S	32E	3	SW¼ NE¼	"	W. T. Gale	70.80		.15	
								17.90	9S	32E	3	SW¼ NE¼	"	T. W. Arnett	107.40		.22	
								16.20	9S	32E	3	SE¼ NE¼	"	" " "	97.20		.20	
								19.10	9S	32E	3	SW¼ NW¼	"	L. T. Christensen	114.60		.24	
								18.60	9S	32E	3	SW¼ NW¼	"	J. F. McGrath	111.60		.23	
								38.00	9S	32E	3	SE¼ NW¼	"	W. T. Gale	228.00		.48	
								1.20	9S	32E	3	NE¼ SW¼	"	" " "	7.20		.02	
								37.80	9S	32E	4	NE¼ NE¼	"	Alvin Warner	226.80		.47	
								39.50	9S	32E	4	SW¼ NE¼	"	O. G. O'Dell	237.00		.49	
								39.40	9S	32E	4	SE¼ NE¼	"	R. E. Elledge	236.40		.49	
								38.60	9S	32E	4	NE¼ NW¼	"	Jesse B. Simms	231.60		.48	
								38.20	9S	32E	4	NW¼ NW¼	"	" " "	229.20		.48	
								8.90	9S	32E	4	SW¼ NW¼	"	R. J. McLaren	53.40		.11	
								16.10	9S	32E	4	SW¼ NW¼	"	M. A. Clouse	96.60		.20	
								20.30	9S	32E	4	SE¼ NW¼	"	George W. Wyatt	121.80		.25	
								20.30	9S	32E	4	SE¼ NW¼	"	Aubra Gilliland	121.80		.25	
								4.50	9S	32E	4	NE¼ SE¼	"	Dolores B. Shirk	27.00		.06	
								20.20	9S	32E	4	NW¼ SE¼	"	" " "	121.20		.25	
								14.60	19S	21W	5	SW¼ NW¼	Hidalgo	W. C. Packer	87.60		.18	
								12.90	19S	21W	5	Lot 4	"	" " "	77.40		.16	
								3.90	19S	21W	5	Lot 2	"	Otto Gale	23.40		.05	
								5.00	19S	21W	5	SW¼ NE¼	"	" "	30.00		.06	
								5.50	19S	21W	5	SW¼ NE¼	"	School District #7, County of Hidalgo, State of New Mexico.	33.00		.07	
								14.00	19S	21W	5	SW¼ NW¼	"	E. G. Barlow	84.00		.18	
								33.30	19S	21W	5	Lot 3	"	T. S. Merrill	199.80		.42	
								11.10	19S	21W	5	SE¼ NW¼	"	" " "	66.60		.14	
								8.00	19S	21W	6	Lot 2	"	M. E. Stewart	48.00		.10	
								16.70	19S	21W	6	Lot 2	"	J. L. Crabtree	100.20		.21	
								2.00	19S	21W	6	Lot 3	"	" " "	12.00		.03	
								8.24	19S	21W	6	Lot 2	"	E. A. Merrill	49.44		.10	
								7.42	19S	21W	6	Lot 3	"	" " "	44.52		.09	
Sunset Canal Company	1897	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	1.70	18S	21W	33	NW¼ SW¼	"	John B. Jones		10.20		
United States	1898	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	38.22	Tracts described below:				Pinal	Ownership data as below:		229.32		
								20.00	4S	9E	36	SE¼	"	State of Arizona	120.00		.25	
								4.21	5S	9E	1	NE¼ NE¼ NW¼	"	Ernest W. McFarland	25.26		.05	
								10.00	6S	6E	30	SW¼ SW¼ NE¼	"	Nath Parks	60.00		.13	
								4.01	5S	9E	1	NE¼ NE¼ NW¼	"	C. H. Southworth	24.06		.05	
Montezuma Canal Company	1898	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for Ownership data.		480.00		

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac. ft.: Individual	Total	Maxim[um] rate of d[iver]sion in ... ft. per ...: Individual
Graham Canal Company	1898	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for Ownership data.		372.00	
Fort Thomas Consolidated Canal Company	1898	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for Ownership data.		660.00	
Valley Canal Company	1898	Right	19S	21W	4	NE¼ NW¼	Valley Canal	74.10	Tracts described below:				Greenlee	Ownership data as below:		444.60	
								1.90	8S	31E	12	SW¼ SE¼	"	Robert M. Montgomery	11.40		.02
								32.30	8S	31E	13	NW¼ NE¼	"	" " "	193.80		.40
								11.70	8S	32E	18	SW¼ NE¼	"	Valley Bank & Trust Co.	70.20		.14
								13.30	8S	32E	18	SE¼ NE¼	"	" " " " "	79.80		.17
								14.90	8S	32E	18	SE¼ NW¼	"	" " " " "	89.40		.19
Moddle Canal Company	1898	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	483.60	Tracts described below:				Greenlee	Ownership data as below:		2,901.60	
								13.80	8S	32E	29	NE¼ SW¼	"	F. M. Crockett	82.80		.17
								3.30	8S	32E	29	NW¼ SW¼	"	Nellie R. Hoch	19.80		.04
								21.80	8S	32E	29	SE¼ SW¼	"	F. M. Crockett	130.80		.28
								6.10	8S	32E	31	NE¼ NE¼	"	J. D. Wilkins	36.60		.08
								19.00	8S	32E	31	SE¼ NE¼	"	" " "	114.00		.24
								1.80	8S	32E	32	NW¼ NE¼	"	D. E. Wilkins	10.80		.02
								8.40	8S	32E	32	SE¼ NE¼	"	G. W. Quinn	50.40		.10
								19.20	8S	32E	32	NE¼ NW¼	"	D. E. Wilkins	115.20		.24
								3.40	8S	32E	32	NE¼ NW¼	"	J. D. Wilkins	20.40		.04
								31.60	8S	32E	32	NW¼ NW¼	"	" " "	189.60		.40
								1.10	8S	32E	32	NW¼ NW¼	"	D. E. Wilkins	6.60		.01
								6.00	8S	32E	32	SW¼ NW¼	"	J. D. Wilkins	36.00		.07
								15.90	8S	32E	32	SW¼ NW¼	"	C. C. Passmore	95.40		.20
								41.40	8S	32E	32	SE¼ NW¼	"	D. E. Wilkins	248.40		.52
								40.60	8S	32E	32	NE¼ SW¼	"	J. R. Robbs	243.60		.51
								14.30	8S	32E	32	NW¼ SW¼	"	C. C. Passmore	85.80		.18
								2.00	8S	32E	32	SW¼ SW¼	"	" " "	12.00		.02
								8.30	8S	32E	32	SW¼ NW¼	"	David F. Campbell, Jr.	49.80		.10
								14.70	8S	32E	32	NW¼ SW¼	"	" " " "	88.20		.18
								27.10	8S	32E	32	SE¼ SW¼	"	George W. Stinson	162.60		.34
								34.10	8S	32E	32	NE¼ SE¼	"	G. W. Quinn	204.60		.43
								.30	8S	32E	32	NE¼ SE¼	"	E. J. Wilkins	1.80		.01
								33.80	8S	32E	32	NW¼ SE¼	"	" " "	202.80		.43
								.40	8S	32E	32	NW¼ SE¼	"	G. W. Quinn	2.40		.01
								10.10	8S	32E	32	SW¼ SE¼	"	George W. Stinson	60.60		.13
								10.20	8S	32E	32	SW¼ SE¼	"	Mrs. E. A. Gale	61.20		.13
								15.30	8S	32E	32	SW¼ SE¼	"	I. B. Gale	91.80		.19
								10.80	8S	32E	32	SE¼ SE¼	"	Mrs. E. A. Gale	64.80		.13
								9.50	8S	32E	32	SE¼ SE¼	"	G. W. Quinn	57.00		.12
								24.70	8S	32E	32	SW¼ NE¼	"	R. E. Miller	148.20		.31
								1.20	8S	32E	32	SE¼ NE¼	"	" " "	7.20		.02
								11.40	9S	32E	5	NE¼ NE¼	"	W. T. Mosley	68.40		.14
								4.80	9S	32E	5	NW¼ NE¼	"	" " "	28.80		.06
								4.10	19S	21W	3	SE¼ SW¼	Hidalgo	W. W. Lloyd	24.60		.05
								13.10	19S	21W	3	SW¼ SE¼	"	" " "	76.60		.16

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Cosper & Windham Canal Company	1898	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal	226.70	Tracts described below:				Hidalgo	Ownership data as below:		1360.20		2.8
								22.50	18S	21W	31	Lot 4	"	Owen Lunt	135.00		.28	
								35.50	18S	21W	31	Lot 3	"	Randall Lunt, Administrator of the Estate of Jasper Gale, deceased.	213.00		.44	
								22.10	18S	21W	31	Lot 4	"	B. J. Gale	132.60		.28	
								12.40	18S	21W	31	Lot 1	"	" " "	74.40		.16	
								11.50	18S	21W	32	SW¼ SE¼	"	Florence R. Swofford	69.00		.14	
								24.00	18S	21W	32	NW¼ SW¼	"	Peter Wahline	144.00		.30	
								1.80	18S	21W	32	SE¼ SE¼	"	A. C. Gruwell	10.80		.03	
								12.30	18S	21W	32	SW¼ SW¼	"	G. Lynn Hatch	73.80		.15	
								6.70	18S	21W	32	NE¼ SW¼	"	R. W. Brooks	40.20		.08	
								17.80	18S	21W	33	SW¼ SW¼	"	R. H. Friestone	106.80		.22	
								12.70	18S	21W	33	SW¼ SE¼	"	R. H. Lunt	76.20		.16	
								11.40	18S	21W	33	SW¼ SW¼	"	G. V. Lunt	68.40		.14	
								20.10	18S	21W	33	SE¼ SW¼	"	E. G. Davidson	120.60		.25	
								.60	18S	21W	33	NW¼ SW¼	"	Orson A. Merrill	3.60		.01	
								.70	18S	21W	33	SW¼ SW¼	"	A. C. Gruwell	4.20		.01	
								11.50	19S	21W	4	Lot 1	"	J. R. Beavers	69.00		.14	
								1.60	19S	21W	4	SE¼ NE¼	"	" " "	9.60		.02	
								1.50	19S	21W	6	Lot 1	"	Owen Lunt	9.00		.02	
Sunset Canal Company	1898	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	40.60	Tracts described below:				Hidalgo	Ownership data as below:		243.60		.5
								15.60	18S	21W	32	SE¼ SE¼	"	Mrs. T. M. Williamson	93.60		.20	
								2.60	19S	21W	3	SE¼ NE¼	"	W. F. Foster	15.60		.03	
								18.70	19S	21W	3	SE¼ SE¼	"	" " "	112.20		.23	
								3.70	19S	21W	10	NE¼ NE¼	"	" " "	22.20		.05	
United States	1899	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence - Casa Grande Canal:	5.00	4S	10E	28	NW¼ SW¼	Pinal	United Bank & Trust Company		30.00		.0
Montezuma Canal Company	1899	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		1140.00		2.3
San Jose Canal Company	1899	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for ownership data.		240.00		.5
Tidwell Canal Company	1899	Right	7S	27E	3	SE¼ NW¼	Tidwell Canal	450.00	See Table No. 3 for detailed description of these lands.				Graham	See Table No. 3 for ownership data.		300.00		.6
Union Canal Company	1899	Left	7S	27E	18	SE¼ NW¼	Union Canal	5575.00	See Table No. 4 for detailed description of these lands.				Graham	See Table No. 4 for ownership data.		160.00		.3
Sunflower Canal Company	1899	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for ownership data.		60.00		.1
Graham Canal Company	1899	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for ownership data.		450.00		.9
Fort Thomas Consolidated Canal Company	1899	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for ownership data.		1200.00		2.5

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of di[version] in c[u.] ft. per s[ec.]: Individual	To[tal]
Montezuma Canal Company	1900	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		1740.00		3
San Jose Canal Company	1900	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for ownership data.		600.00		1
Graham Canal Company	1900	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for ownership data.		354.00		
Fort Thomas Consolidated Canal Company	1900	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for ownership data.		1800.00		3
Smithville Canal Company	1900	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760.00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for ownership data.		300.00		
Colvin-Jones Canal Company	1900	Right	4S	23E	26	SW¼ SW¼	Colvin-Jones Canal	36.00	See Table No. 13 for detailed description of these lands.				Graham	See Table No. 13 for ownership data.		36.00		
Billingsley-Extension Canal Company	1900	Right	7S	31E	16	NE¼ NW¼	Billingsley-Extension Canal	63.80	Tracts described below:				Greenlee	Ownership data as below:		352.80		
								31.20	7S	31E	5	NE¼ NE¼	"	B. F. Billingsley	187.20		.39	
								23.40	7S	31E	5	NW¼ NE¼	"	" " "	140.40		.29	
								9.20	7S	31E	5	SW¼ NE¼	"	" " "	55.20		.11	
Cosper & Windham Extension Canal Company. Under contract whereby Cosper & Windham Ditch makes actual diversions.	1900	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Ditch & Cosper & Windham Extension Canal.	6.40	8S	32E	28	NE¼ SE¼	Greenlee	B. F. Billingsley		38.40		
Colmenero Canal Company	1900	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	11.50	Tracts described below:				Greenlee	Ownership data as below:		69.00		
								7.50	7S	31E	34	NE¼ NW¼	"	Waide Harris	45.00		.09	
								3.30	7S	31E	34	NW¼ NW¼	"	" "	19.80		.04	
								.30	7S	31E	34	SW¼ NW¼	"	" "	1.80		.01	
								.40	7S	31E	34	SE¼ NW¼	"	" "	2.40		.01	
Valley Canal Company	1900	Right	19S	21W	4	NE¼ NW¼	Valley Canal	35.10	Tracts described below:				Greenlee	Ownership data as below:		210.60		
								2.40	8S	32E	18	NE¼ SW¼	"	Valley Bank & Trust Company	14.40		.03	
								19.50	8S	32E	18	NW¼ SE¼	"	" " " " "	117.00		.24	
								7.20	8S	32E	18	SW¼ SE¼	"	" " " " "	43.20		.09	
								6.00	8S	32E	20	NW¼ N ½	"	Emma Spoon, Administratrix of the estate of J. H. Spoon, deceased	36.00		.08	
Moddle Canal Company	1900	Right	19S	21W	11	NW¼ SE¼	Moddle Canal	89.40	Tracts described below:				Greenlee	Ownership data as below:		536.40		
								8.20	8S	32E	28	SW¼ NW¼	"	(S. A. Foster and W. F. Foster,	49.20		.10	
								6.90	8S	32E	28	NE¼ SW¼	"	(and J. H. Merrian, Executor (of the Estate of Alice E.	41.40		.07	
								6.70	8S	32E	28	NW¼ SW¼	"	(Day, deceased.	40.20		.09	

(continued)

Party entitled to divert from the stream	Date of priority	Point of diversion					Name of diverting and/or carrying structure	Lands for which right acquired						Parties owning said lands when jurisdiction acquired herein	Diversion right			
		Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M.					Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M.				County		For irrigation season in ac.-ft.		Maximum rate of diversion in cu. ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
												(Continuation)						
Moddle Canal Company (continuation)	1900							17.80	8S	32E	29	NE¼ SW¼	Greenlee	J. L. Aker	106.80		0.22	
								4.20	8S	32E	29	SE¼ SW¼	"	" " "	25.20		.05	
								12.70	8S	32E	29	SE¼ SE¼	"	W. H. Elledge	76.20		.16	
								7.60	8S	32E	32	NE¼ NE¼	"	" " "	45.60		.10	
								25.30	8S	32E	32	NW¼ NE¼	"	James Opie	151.80		.32	
Sunset Canal Company	1900	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	244.80	Tracts described below:				Hidalgo	Ownership data as below:		1468.80		3.
								1.10	Virden Townsite			Blk 1 Lot 2	"	E. Thygerson	6.60		.01	
								1.10	"	"		" 1 " 3	"	Randall Lunt, Administrator of the Estate of Jasper Gale, deceased	6.60		.01	
								1.10	"	"		" 2 " 1	"	Delbert Johnson	6.60		.01	
								1.10	"	"		" 2 " 2	"	Parley P. Jones	6.60		.01	
								1.10	"	"		" 2 " 3	"	Ralph Richardson	6.60		.01	
								1.10	"	"		" 2 " 4	"	John B. Jones	6.60		.01	
								1.10	"	"		" 3 " 1	"	G. Q. Payne	6.60		.01	
								2.20	"	"		" 3 " 2, 3	"	H. M. Payne	13.20		.03	
								1.10	"	"		" 4 " 1	"	J. E. Payne, Trustee of the Church of Jesus Christ of Latter Day Saints	6.60		.01	
								1.10	"	"		" 4 " 2	"	Orson A. Merrill	6.60		.01	
								1.10	"	"		" 4 " 3	"	Maude Larsen	6.60		.01	
								1.10	"	"		" 4 " 4	"	Helen A. Payne	6.60		.01	
								1.10	"	"		" 5 " 1	"	Willard E. Jones	6.60		.01	
								1.10	"	"		" 5 " 2	"	Rachel Jensen	6.60		.01	
								1.10	"	"		" 5 " 3	"	Anna H. Lunt	6.60		.01	
								1.10	"	"		" 5 " 4	"	Mary Jane Jones	6.60		.01	
								2.20	"	"		" 6 " 1, 4	"	B. Y. Whipple	13.20		.03	
								1.10	"	"		" 6 " 2	"	J. Alfred Mortensen	6.60		.01	
								1.10	"	"		" 6 " 3	"	M. L. Harris	6.60		.01	
								.50	"	"		" 7 " 1	"	B. Y. Whipple	3.00		.01	
								1.10	"	"		" 7 " 2	"	R. Richens	6.60		.01	
								1.10	"	"		" 7 " 3	"	Edward Lunt	6.60		.01	
								.50	"	"		" 7 4 W½	"	W. E. Bowers & E. W. Richens	3.00		.01	
								.60	"	"		" 7 " 4 E½	"	A. E. Keller	3.60		.01	
								1.10	"	"		" 8 " 1	"	T. V. Jones	6.60		.01	
								1.10	"	"		" 8 " 2	"	Nancy A. Smith	6.60		.01	
								1.10	"	"		" 8 " 3	"	Milton N. Jensen	6.60		.01	
								1.10	"	"		" 9 " 1	"	Henry L. Smith	6.60		.01	
								1.10	"	"		" 8 " 4	"	M. N. Jensen	6.60		.01	
								1.10	"	"		" 9 " 2	"	M. D. Patton	6.60		.01	
								1.10	"	"		" 9 " 3	"	Mitchell McDonald	6.60		.01	
								1.10	"	"		" 9 " 4	"	S. A. Brown	6.60		.01	
								10.20	19S	21W	2	SW¼ SE¼	"	Junius E. Payne	61.20		.13	
								26.80	19S	21W	2	SE¼ SE¼	"	" " "	160.80		.34	
								12.90	19S	21W	2	NE¼ SW¼	"	Mary Jane Jones	77.40		.17	
								13.90	19S	21W	2	SW¼ NW¼	"	Florentino Billaba	83.40		.18	
								2.30	19S	21W	2	NW¼ SW¼	"	" "	13.80		.03	
								13.30	19S	21W	2	NE¼ SW¼	"	F. W. Jones	79.80		.17	
								26.70	19S	21W	2	NW¼ NE¼	"	" " "	160.20		.33	
								2.40	19S	21W	3	Lot 2	"	School District No. 2, Hidalgo County, State of New Mexico	14.40		.03	
								2.70	19S	21W	3	Lot 2	"	George H. Cosper, Jr., Administrator of the Estate				

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maxim[um] rate of d[iver]sion in [cu.] ft. per [sec.]: Individual	T[otal]
Sunset Canal Company (continuation)	1900											(Continuation)						
								8.70	19S	21W	11	NE¼ NE¼	"	Ralph Richardson	22.20		.05	
								3.00	19S	21W	11	NE¼ NE¼	"	Parley P. Jones	18.00		.04	
								8.30	19S	21W	12	NW¼ NW¼	"	" " "	49.80		.10	
								6.10	19S	21W	12	NW¼ NW¼	"	Hans Mortensen	36.60		.08	
								.20	19S	21W	12	SW¼ NW¼	"	J. Alfred Mortensen	1.20		.01	
								7.20	19S	21W	12	SE¼ NW¼	"	" " "	43.20		.09	
								.70	19S	21W	12	NE¼ SW¼	"	" " "	4.20		.01	
								1.10	19S	21W	12	NW¼ SW¼	"	" " "	6.60		.01	
								6.50	19S	21W	12	NW¼ NW¼	"	" " "	39.00		.09	
								4.70	19S	21W	12	N½ NE¼ SE¼	"	Nancy O. Pace	28.20		.07	
								9.10	19S	21W	12	NW¼ NW¼	"	Willard E. Jones	54.60		.11	
								4.60	19S	21W	12	SW¼ NW¼	"	" " "	27.60		.07	
								.40	19S	21W	12	NW¼ NW¼	"	Ralph Richardson	2.40		.01	
								.60	19S	21W	12	NE¼ NW¼	"	John B. Jones	3.60		.01	
								1.50	19S	21W	12	NW¼ NW¼	"	" " "	9.00		.03	
								4.20	19S	21W	12	SW¼ NW¼	"	" " "	25.20		.06	
								13.70	19S	21W	12	SW¼ NE¼	"	H. M. Payne	82.20		.15	
								1.40	19S	21W	12	SE¼ NE¼	"	" " "	8.40		.01	
								7.50	19S	21W	12	SE¼ NW¼	"	" " "	45.00		.09	
United States	1901	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	40.00	5S	9E	6	NW¼ SW¼	Pinal	Harriett E. Pattee		240.00		
Montezuma Canal Company	1901	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		540.00		
San Jose Canal Company	1901	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for ownership data.		600.00		
Sunflower Canal Company	1901	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for ownership data.		60.00		
Graham Canal Company	1901	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for ownership data.		264.00		
Fort Thomas Consolidated Canal Company	1901	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for ownership data.		1320.00		
Brown Canal Company	1901	Right	6S	28E	30	SE¼ SE¼	Brown Canal	820.00	See Table No. 8 for detailed description of these lands.				Graham	See Table No. 8 for ownership data.		300.00		
Dodge-Nevada Canal Company	1901	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for ownership data.		300.00		
Sexton Canal Company	1901	Left	7S	31E	21	SW¼ SE¼	Sexton Ditch	50.10	Tracts described below:				Greenlee	Ownership data as below:		300.60		
								8.60	7S	31E	8	NE¼ SE¼	"	Mussett Cosper	51.60		.11	
								1.70	7S	31E	8	SE¼ SE¼	"	" "	10.20		.02	
								6.40	7S	31E	9	NW¼ SW¼	"	" "	38.40		.08	
								31.90	7S	31E	9	SW¼ SW¼	"	" "	191.40		.40	
								1.50	7S	31E	9	SE¼ SW¼	"	" "	9.00		.02	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Montezuma Canal Company	1902	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750. 00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		1740. 00		3. 6
San Jose Canal Company	1902	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000. 00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for ownership data.		600. 00		1. 2
Sunflower Canal Company	1902	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400. 00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for ownership data.		60. 00		. 1
Graham Canal Company	1902	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577. 00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for ownership data.		210. 00		. 4
Smithville Canal Company	1902	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	1760. 00	See Table No. 10 for detailed description of these lands.				Graham	See Table No. 10 for ownership data.		60. 00		. 1
Sexton Canal Company	1902	Left	7S	31E	21	SW¼ SE¼	Sexton Ditch	52. 90 15. 10 26. 40 9. 00 2. 40	Tracts described below: 7S 7S 7S 7S	 31E 31E 31E 31E	 16 16 16 16	 NE¼ NW¼ NW¼ NW¼ SW¼ NW¼ SE¼ NW¼	Greenlee " " "	Ownership data as below: George H. Cosper " " " " " "	 90. 60 158. 40 54. 00 14. 40	317. 40	 . 19 . 33 . 11 . 03	. 6
Colmenero Canal Company	1902	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	31. 30 9. 70 9. 90 11. 00 . 70	Tracts described below: 7S 7S 7S 7S	 31E 31E 31E 31E	 27 28 34 34	 SW¼ SW¼ SE¼ SE¼ NW¼ NW¼ SW¼ NW¼	Greenlee " " "	Ownership data as below: F. E. Ross " " " " " "	 58. 20 59. 40 66. 00 4. 20	187. 80	 . 12 . 12 . 14 . 01	. 3
York Canal Company	1902	Right	6S	31E	29	SW¼ NW¼	York Canal	77. 80 15. 00 14. 00 37. 40 11. 40	Tracts described below: 6S 6S 6S 6S	 31E 31E 31E 31E	 17 18 20 20	 SW¼ SW¼ SE¼ SE¼ NW¼ NW¼ SW¼ NW¼	Greenlee " " "	Ownership data as below: K. M. Schade Ypolita Cascarilla " " " "	 90. 00 84. 00 224. 40 68. 40	466. 80	 . 19 . 18 . 47 . 14	.
Montezuma Canal Company	1903	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750. 00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		540. 00		1.
San Jose Canal Company	1903	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000. 00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for ownership data.		600. 00		1.
Sunflower Canal Company	1903	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400. 00	See Table No. 5 for detailed description of these lands.				Graham	See table No. 5 for ownership data.		60. 00		.
Graham Canal Company	1903	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577. 00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for ownership data.		804. 00		1.
Fort Thomas Consolidated Canal Company	1903	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	2200. 00	See Table No. 7 for detailed description of these lands.				Graham	See Table No. 7 for ownership data.		600. 00		1.

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in c... ft. per a...: Individual	To...
Colmenero Canal Company	1903	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	63.60	Tracts described below:				Greenlee	Ownership data as below:		411.60		
								27.90	7S	31E	21	NW¼ NE¼	"	J. K. Chilton	167.40		.35	
								.20	7S	31E	21	NE¼ NW¼	"	"	1.20		.02	
								3.90	7S	31E	21	NE¼ NW¼	"	"	23.40		.05	
								.60	8S	31E	3	NW¼ NE¼	"	J. H. Cready	3.00		.01	
								14.40	8S	31E	3	SW¼ NE¼	"	"	86.40		.18	
								7.20	8S	31E	3	SW¼ NE¼	"	"	43.20		.09	
								.20	8S	31E	3	SE¼ NE¼	"	"	1.20		.02	
								.50	8S	31E	3	NE¼ NW¼	"	"	3.00		.01	
								1.80	8S	31E	3	SE¼ NW¼	"	"	10.80		.02	
								2.70	8S	31E	3	NE¼ SE¼	"	"	16.20		.03	
								5.40	8S	31E	3	NE¼ SE¼	"	"	32.40		.07	
								3.90	8S	31E	3	NW¼ SE¼	"	"	23.40		.05	
York Canal Company	1903	Right	6S	31E	29	SW¼ NW¼	York Canal	22.70	6S	31E	17	SW¼ SW¼	Greenlee	K. M. Schade		136.20		
United States	1904	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal.	45.00	5S	8E	23	E½ NE¼	Pinal	John MacGregor Goodale		270.00		
Montezuma Canal Company	1904	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	3750.00	See Table No. 1 for detailed description of these lands.				Graham	See Table No. 1 for ownership data.		540.00		
San Jose Canal Company	1904	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	3000.00	See Table No. 2 for detailed description of these lands.				Graham	See Table No. 2 for ownership data.		1200.00		
Sunflower Canal Company	1904	Left	7S	26E	9	NW¼ SE¼	Sunflower Canal	400.00	See Table No. 5 for detailed description of these lands.				Graham	See Table No. 5 for ownership data.		60.00		
Graham Canal Company	1904	Right	7S	26E	9	NE¼ NW¼	Graham Canal	2577.00	See Table No. 6 for detailed description of these lands.				Graham	See Table No. 6 for ownership data.		1248.00		
Fort Thomas Consolidated Canal Company	1904	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	2200.00	See Table No. 7 for detiled description of these lands.				Graham	See Table No. 7 for ownership data.		600.00		
Dodge-Nevada Canal Company	1904	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	1250.00	See Table No. 9 for detailed description of these lands.				Graham	See Table No. 9 for ownership data.		300.00		
Curtis Canal Company	1904	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	207.30	Tracts described below:				Graham	Ownership data as below:		1243.80		
								17.60	5S	24E	7	SE¼ SE¼	"	E. W. McEuen	105.60		.22	
								3.10	5S	24E	8	SW¼ SW¼	"	Virgil R. McEuen	18.60		.04	
								15.40	5S	24E	17	NW¼ NW¼	"	M. P. McEuen	92.40		.19	
								5.10	5S	24E	17	SW¼ NW¼	"	F. M. Ferrell	30.60		.06	
								38.40	5S	24E	18	NE¼ SE¼	"	M. P. McEuen	230.40		.48	
								3.00	5S	24E	18	SE¼ SE¼	"	Virgil R. McEuen	18.00		.04	
								1.90	5S	24E	20	NE¼ NW¼	"	C. E. Ferrin	11.40		.02	
								13.20	5S	24E	20	NW¼ NW¼	"	Scott Holladay	79.20		.16	
								29.80	5S	24E	20	SE¼ NW¼	"	E. G. Bullard	178.80		.37	
								8.80	5S	24E	28	NW¼ NW¼	"	J. D. Busby	52.80		.11	
								10.20	5S	24E	28	NE¼ SW¼	"	Henry A. Waters	61.20		.13	

(Continued)

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
												(Continuation)						
Curtis Canal Company (continuation)	1904							1.70	5S	24E	28	NE¼ SW¼	Graham	Calvin I. Kempton	10.20		.02	
								6.90	5S	24E	28	NE¼ SW¼	"	B. O. Rapier	41.40		.09	
								6.30	5S	24E	28	NW¼ SW¼	"	W. D. Saline	37.80		.08	
								9.60	5S	24E	28	NW¼ SW¼	"	Henry A. Waters	57.60		.12	
								8.60	5S	24E	28	SW¼ SW¼	"	Lee L. Palmer	51.60		.11	
								20.10	5S	24E	28	SW¼ SW¼	"	W. D. Saline	120.60		.25	
								5.40	6S	24E	4	SE¼ NE¼	"	Amy T. Leavitt	32.40		.07	
								2.10	6S	24E	4	NE¼ SE¼	"	" " "	12.60		.03	
								.10	6S	24E	4	NW¼ SE¼	"	" " "	.60		.01	
Smithville Canal Company	1904	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	86.60	Tracts described below:				Graham	Ownership data as below:		519.60		1.0
								12.60	6S	24E	13	SE¼ NE¼	"	H. J. Anderson	75.60		.16	
								1.50	6S	24E	13	NE¼ SE¼	"	" " "	9.00		.02	
								4.10	6S	24E	13	SE¼ NW¼	"	Karl Foster	24.60		.05	
								20.00	6S	24E	13	NE¼ SW¼	"	" "	120.00		.25	
								28.40	6S	24E	13	NW¼ SW¼	"	" "	170.40		.35	
								20.00	6S	25E	34	NW¼ NE¼	"	H. V. Coombs	120.00		.25	
Fort Thomas Consolidated Canal Company	1904	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	50.30	Tracts described below:				Graham	Ownership data as below:		301.80		.6
								40.20	4S	23E	35	SW¼ SE¼	"	Oscar Tyler	241.20		.50	
								10.10	5S	23E	2	NE¼ NE¼	"	" "	60.60		.13	
Graham Canal Company	1904	Right	7S	26E	9	NE¼ NW¼	Graham Canal	194.40	Tracts described below:				Graham	Ownership data as below:		1166.40		2.
								8.00	6S	25E	7	NE¼ NW¼	"	John L. Hoopes	48.00		.10	
								13.90	6S	25E	7	NW¼ NW¼	"	" " "	83.40		.17	
								20.50	6S	25E	8	SE¼ SW¼	"	Simon Mathews	123.00		.26	
								15.00	6S	25E	17	SW¼ NE¼	"	J. I. Palmer	90.00		.19	
								16.00	6S	25E	17	NE¼ SE¼	"	J. L. Fouts	96.00		.20	
								13.20	6S	25E	21	NE¼ NE¼	"	Mattie Wamslee	79.20		.16	
								17.80	6S	25E	21	NE¼ NE¼	"	J. A. Allen	106.80		.22	
								14.00	6S	25E	21	NE¼ SE¼	"	Brigham Stowell	84.00		.17	
								13.50	6S	25E	21	NE¼ SE¼	"	C. M. Mack	81.00		.17	
								11.30	6S	25E	22	SW¼ NE¼	"	Mary Butler	67.80		.14	
								7.30	6S	25E	22	SW¼ NW¼	"	" "	43.80		.09	
								18.30	6S	25E	22	SW¼ NW¼	"	Brigham Stowell	109.80		.24	
								1.10	6S	25E	22	SE¼ NW¼	"	Mary Butler	6.60		.01	
								21.70	6S	25E	22	SE¼ NW¼	"	J. A. Allen	130.20		.27	
								2.70	6S	25E	26	NW¼ SW¼	"	Joseph Howard & J. M. Howard	16.20		.03	
								.10	6S	25E	36	SW¼ NE¼	"	D. W. Sanders	.60		.01	
Montezuma Canal Company	1904	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	968.20	Tracts described below:				Graham	Ownership data as below:		5809.20		12.
								4.00	7S	25E	2	SW¼ SW¼	"	Town of Thatcher	24.00		.05	
								5.00	7S	25E	2	SE¼ SW¼	"	" " "	30.00		.06	
								3.80	7S	25E	3	SE¼ SW¼	"	Mrs. Nisla Lindsey	22.80		.05	
								1.40	7S	25E	3	SE¼ SW¼	"	J. A. Farley	8.40		.02	
								9.30	7S	25E	10	NE¼ NE¼	"	Town of Thatcher	55.80		.11	
								2.40	7S	25E	10	NE¼ NE¼	"	Roy A. Layton	14.40		.03	
								7.00	7S	25E	10	NW¼ NE¼	"	A. A. Allred	42.00		.09	
								26.00	7S	25E	11	NE¼ NE¼	"	Town of Thatcher	156.00		.33	
								30.00	7S	25E	11	NW¼ NE¼	"	" " "	180.00		.38	
								20.00	7S	25E	11	NE¼ NW¼	"	" " "	120.00		.25	
								36.00	7S	25E	11	SW¼ NW¼	"	" " "	216.00		.45	
								19.60	7S	25E	11	NE¼ SW¼	"	" " "	117.00		.24	
												(continued)						

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Max rate o sion ft. p: Individual
Montezuma Canal Company (continuation)	1904											(continuation)					
								15.50	7S	25E	11	NE ¼SE¼	Graham	Town of Thatcher	93.00		.19
								6.70	7S	25E	11	NE¼ SE¼	"	Evans Coleman	40.20		.08
								1.80	7S	25E	11	NW¼ SE¼	"	Spence C. Heywood	10.80		.02
								.70	7S	25E	11	NW¼ SE¼	"	Guy W. Lamoreaux	4.20		.01
								.70	7S	25E	12	SW¼ NW¼	"	S. V. Pollock	4.20		.01
								1.60	7S	25E	12	SW¼ NW¼	"	Mrs. Sarah S. Elmer	9.60		.02
								1.40	7S	25E	12	SE¼ NW¼	"	C. N. Motes	8.40		.02
								5.20	7S	25E	12	NW¼ SW¼	"	S. L. Johns & D. L. Johns	31.20		.06
								.80	7S	25E	12	NW¼ SW¼	"	Arizona Eastern Railroad Company	4.80		.01
								.30	7S	25E	12	NW¼ SW¼	"	Evans Coleman	1.80		.01
								12.90	7S	25E	12	SE¼ SW¼	"	Mrs. Isabelle Pace	77.40		.16
								1.10	7S	25E	12	SE¼ SW¼	"	Marion Lee	6.60		.01
								2.30	7S	25E	12	SE¼ SW¼	"	M. Mortensen	13.80		.03
								6.10	7S	25E	12	SW¼ SE¼	"	Davidsel Ellsworth	36.60		.08
								5.90	7S	25E	13	NE¼ NE¼	"	R. G. Layton, Jr.	35.40		.07
								12.90	7S	25E	13	NW¼ NE¼	"	J. D. Lee	77.40		.16
								4.70	7S	25E	13	SW¼ NE¼	"	L. B. Scarlett	28.20		.06
								3.00	7S	25E	13	SW¼ NE¼	"	W. H. Clifford	18.00		.04
								1.60	7S	25E	13	SE¼ NE¼	"	" " "	9.60		.02
								4.80	7S	25E	13	SE¼ NE¼	"	R. L. Freestone	28.80		.06
								1.60	7S	25E	13	NW¼ NW¼	"	W. W. Wild	9.60		.02
								4.60	7S	25E	13	SW¼ NW¼	"	Alex Layton	27.60		.06
								7.00	7S	25E	13	SE¼ NW¼	"	George Killian	42.00		.09
								3.00	7S	25E	13	NE¼ SE¼	"	J. L. Freeman	18.00		.04
								1.10	7S	25E	13	NE¼ SE¼	"	Mrs. Belle Morris	6.60		.01
								6.90	7S	25E	13	NW¼ SE¼	"	Aeshel Clifford	41.40		.09
								5.20	7S	25E	14	NE¼ NE¼	"	Marion Lee	31.20		.06
								5.00	7S	26E	13	SW¼ NW¼	"	William H. Gillespie	30.00		.06
								12.50	7S	26E	13	SW¼ NW¼	"	Shell Gillespie	75.00		.16
								6.40	7S	26E	13	SW¼ SW¼	"	Charles Boots	38.40		.08
								11.50	7S	26E	13	SE¼ SW¼	"	James Gillespie	69.00		.14
								3.00	7S	26E	13	NE¼ SE¼	"	Edward L. Gillespie	18.00		.04
								14.50	7S	26E	13	NW¼ SE¼	"	Albert Gillespie	87.00		.19
								14.60	7S	26E	13	SE¼ SE¼	"	Edward L. Gillespie	87.60		.18
								4.00	7S	26E	14	SE¼ NE¼	"	Edward M. Claridge	24.00		.05
								4.00	7S	26E	14	NW¼ SW¼	"	" " "	24.00		.05
								39.50	7S	26E	14	NW¼ SE¼	"	" " "	237.00		.49
								3.80	7S	26E	14	SE¼ SE¼	"	" " "	22.80		.05
								6.40	7S	26E	15	NE¼ SE¼	"	Charles M. Pursley & Robert L. Nash	38.40		.08
								14.00	7S	26E	15	SE¼ SE¼	"	N. W. Stevenson	84.00		.17
								5.50	7S	26E	15	NE¼ SW¼	"	W. A. Johns & L. A. Johns	33.00		.07
								36.20	7S	26E	15	SW¼ SW¼	"	" " " " " " "	217.20		.45
								10.00	7S	26E	15	SE¼ SW¼	"	" " " " " " "	60.00		.13
								2.30	7S	26E	16	SE¼ NE¼	"	J. T. Owens, Jr.	13.80		.03
								6.00	7S	26E	16	NE¼ SW¼	"	L. A. Nelson	36.00		.07
								5.00	7S	26E	16	SE¼ SW¼	"	Mrs. Thomas Blake	30.00		.06
								9.00	7S	26E	16	NE¼ SE¼	"	O. E. Owens	54.00		.11
								9.90	7S	26E	16	NW¼ SE¼	"	Hugh Foster	59.40		.12
								2.00	7S	26E	16	SW¼ SE¼	"	" "	12.00		.0[illegible]
								2.30	7S	26E	16	SE¼ SE¼	"	Ramon Gauna	13.80		.03
								3.40	7S	26E	16	SE¼ SE¼	"	Joaquin Padilla	20.40		.0[illegible]
								7.30	7S	26E	16	SW¼ NW¼	"	Lawrence Fuller	43.80		.09
								[illegible]	7S	26E	16	SE¼ NW¼	"	P. Chendilla	5.40		.0[illegible]

Party entitled to divert from the stream	Date of priority	Point of diversion					Name of diverting and/or carrying structure	Lands for which right acquired						Parties owning said lands when jurisdiction acquired herein	Diversion right			
		Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M.					Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M.				County		For irrigation season in ac. ft.		Maximum rate of diversion in cu. ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
Montezuma Canal Company (continuation)	1904							9.20	7S	26E	17	(continuation) SE¼ NE¼	Graham	Austin Evans	55.20		.11	
								4.90	7S	26E	17	NW¼ NW¼	"	Town of Safford	29.40		.66	
								2.40	7S	26E	17	SW¼ NW¼	"	George P. Jacobson	14.40		.03	
								.50	7S	26E	17	SW¼ NW¼	"	George Van Gausig	3.00		.01	
								.50	7S	26E	17	SW¼ NW¼	"	Clarence Scarlett	3.00		.01	
								.80	7S	26E	17	SW¼ NW¼	"	J. M. Wilson	4.80		.01	
								.70	7S	26E	17	SE¼ NW¼	"	Ben T. Platt	4.20		.01	
								.40	7S	26E	17	SE¼ NW¼	"	Church of Jesus Christ of Latter Day Saints	2.40		.01	
								.40	7S	26E	17	NE¼ SW¼	"	R. A. Smith, Sr.	2.40		.01	
								.40	7S	26E	17	NE¼ SW¼	"	H. P. Rogers	2.40		.01	
								1.90	7S	26E	17	NE¼ SW¼	"	Jesse B. Quinn	11.40		.02	
								1.70	7S	26E	17	NE¼ SE¼	"	W. D. Cluff & Fred M. Mitchell	10.20		.02	
								2.50	7S	26E	17	NW¼ SE¼	"	John W. Morris	15.00		.03	
								1.10	7S	26E	17	NW¼ SE¼	"	W. A. Bennett	6.60		.01	
								5.60	7S	26E	17	NW¼ SE¼	"	George Foote	33.60		.07	
								.50	7S	26E	17	NW¼ SE¼	"	W. D. Spear	3.00		.01	
								1.30	7S	26E	17	NW¼ SE¼	"	William Brunson	7.80		.02	
								1.20	7S	26E	17	SE¼ NW¼	"	Mrs. M. C. White	7.20		.02	
								1.30	7S	26E	17	SW¼ SE¼	"	Mrs. E. Olsen	7.80		.02	
								1.30	7S	26E	17	SW¼ SE¼	"	Mrs. V. M. Baker	7.80		.02	
								.40	7S	26E	17	NE¼ SW¼	"	Lee N. Straton, Administrator of the Estate of Mrs. N. A. Bell, deceased.	2.40		.01	
								.90	7S	26E	17	NW¼ SW¼	"	John West	5.40		.01	
								.40	7S	26E	17	NW¼ SW¼	"	C. B. Sale	2.40		.01	
								.90	7S	26E	17	NW¼ SW¼	"	J. F. Rhinehart	5.40		.01	
								.80	7S	26E	17	NW¼ SW¼	"	S. E. D. Sears	4.80		.01	
								1.50	7S	26E	17	NW¼ SW¼	"	J. A. Chapman	9.00		.02	
								.50	7S	26E	17	SE¼ SW¼	"	Mrs. Virginia Curtis	3.00		.01	
								.50	7S	26E	17	SE¼ SW¼	"	S. A. Sowell	3.00		.01	
								6.20	7S	26E	17	SE¼ SW¼	"	J. W. Greenhalgh	37.20		.08	
								3.10	7S	26E	17	SE¼ SW¼	"	Calista B. Peel	18.60		.04	
								.40	7S	26E	17	SW¼ SE¼	"	Francis Ellsworth	2.40		.01	
								1.10	7S	26E	17	SW¼ SE¼	"	Mrs. H. E. Warner	6.60		.01	
								10.90	7S	26E	17	SE¼ SE¼	"	C. M. Mack	65.40		.12	
								15.00	7S	26E	18	NE¼ NE¼	"	Town of Safford	90.00		.18	
								.90	7S	26E	18	NW¼ NE¼	"	Donald Kennedy	5.40		.01	
								1.20	7S	26E	18	NW¼ NE¼	"	Myron J. Allred	7.20		.02	
								.60	7S	26E	18	NW¼ NE¼	"	William N. Beebe	3.60		.01	
								2.00	7S	26E	18	NW¼ NE¼	"	Mrs. Francis Goodman	12.00		.02	
								2.80	7S	26E	18	SW¼ NE¼	"	William N. Beebe	16.80		.03	
								3.50	7S	26E	18	SE¼ NE¼	"	Martin Jacobson	21.00		.04	
								1.50	7S	26E	18	SE¼ NE¼	"	County of Graham, State of Arizona	9.00		.02	
								.90	7S	26E	18	SE¼ NE¼	"	J. Bingham	5.40		.01	
								.90	7S	26E	18	SE¼ NE¼	"	J. H. Bingham	5.40		.01	
								2.00	7S	26E	18	SE¼ NE¼	"	F. E. Kirkpatrick	12.00		.02	
								.40	7S	26E	18	SE¼ NE¼	"	Lester Bingham	2.40		.01	
								2.00	7S	26E	18	NE¼ NW¼	"	Mary Lorraine Birduo	12.00		.03	
								1.80	7S	26E	18	NE¼ NW¼	"	Mildred B. Larson	10.80		.02	
								4.20	7S	26E	18	NW¼ NW¼	"	C. O. Larson	25.20		.05	
								7.50	7S	26E	18	SW¼ NW¼	"	Elam Olsen	45.00		.09	
								11.40	7S	26E	18	SE¼ NW¼	"	M. G. Montierth	68.40		.14	
								3.30	7S	26E	18	SE¼ NW¼	"	Charles F. [illegible]	[illegible]		[illegible]	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion ri[ght] For irrigation season in ac.-ft.: Individual	Total
Montezuma Canal Company (continuation)	1904											(Continuation)				
								1.70	7S	26E	18	SW¼ SE¼	Graham	Joseph Greenhalgh	10.20	
								2.00	7S	26E	18	SW¼ SE¼	"	Mrs. W. R. Reed	12.00	
								2.60	7S	26E	18	SE¼ SE¼	"	Hart D. Empie	15.60	
								3.20	7S	26E	20	NE¼ NE¼	"	John R. Davidson	19.20	
								.80	7S	26E	20	NW¼ NE¼	"	Mrs. C. F. Stanley	4.80	
								4.90	7S	26E	20	NE¼ SE¼	"	Mrs. W. R. Smith	29.40	
								35.80	7S	26E	20	SE¼ NE¼	"	William Ellsworth	214.80	
								38.60	7S	26E	21	SW¼ NW¼	"	William Ellsworth	231.60	
								37.00	7S	26E	21	NW¼ NW¼	"	Elam Olsen	222.00	
								2.20	7S	26E	21	NE¼ NE¼	"	Victoriano Garcia	13.20	
								14.30	7S	26E	21	NW¼ NE¼	"	Henry Clifford, Sr.	85.80	
								5.20	7S	26E	21	NE¼ NW¼	"	Mrs. Nancy Palmer	31.20	
								3.50	7S	26E	21	NE¼ NW¼	"	Oscar Olsen	21.00	
								4.00	7S	26E	21	SE¼ NW¼	"	William Ellsworth	24.00	
								8.10	7S	26E	22	NE¼ NE¼	"	W. L. Nelson	48.60	
								4.00	7S	26E	22	SW¼ NE¼	"	William Ellsworth	24.00	
								6.60	7S	26E	22	NE¼ NW¼	"	W. L. Nelson	39.60	
								6.60	7S	26E	22	NW¼ NW¼	"	Fred H. Wiemer	39.60	
								7.10	7S	26E	22	SW¼ NW¼	"	E. E. Montierth	42.60	
								3.80	7S	26E	22	SE¼ NW¼	"	L. A. Clifford	22.80	
								12.80	7S	26E	22	SE¼ NW¼	"	Elijah Clifford	76.80	
								8.70	7S	26E	23	NE¼ NE¼	"	Ben Mauer	52.20	
								6.90	7S	26E	23	NW¼ NE¼	"	Maroni Larson	41.40	
								13.40	7S	26E	23	SW¼ NE¼	"	S. A. Merrill	80.40	
								6.80	7S	26E	23	SE¼ NW¼	"	Mrs. Margaret R. Kempton	40.80	
								7.70	7S	26E	23	NW¼ NW¼	"	W. T. Barney	46.20	
								6.20	7S	26E	23	SW¼ NW¼	"	" "	37.20	
								.40	7S	26E	23	NE¼ SW¼	"	" " "	2.40	
								5.10	7S	26E	23	NW¼ SW¼	"	" " "	30.60	
								.50	7S	26E	24	NE¼ NE¼	"	W. S. Baker	3.00	
								2.50	7S	26E	24	NW¼ NE¼	"	Isaac Williamson	15.00	
								5.20	7S	26E	24	NE¼ NW¼	"	Arthur Welker	31.20	
								8.60	7S	26E	24	SW¼ NW¼	"	Ernest Motes	51.60	
								2.60	7S	27E	18	NE¼ SW¼	"	Merejildo Grijalva	15.60	
								3.00	7S	27E	18	NE¼ SW¼	"	Christino Grijalva	18.00	
								13.30	7S	27E	18	NE¼ SW¼	"	H. M. Merrill	79.80	
San Jose Canal Company	1904	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	123.20	Tracts described below:				Graham	Ownership data as below:		739.20
								11.70	7S	26E	25	NW¼ NE¼	"	P. H. Fruedenthal	70.20	
								17.00	7S	27E	3	NE¼ SE¼	"	Cleve Curtis & Don Curtis	102.00	
								22.00	7S	27E	3	[illegible]W¼ SE¼	"	" " " " "	132.00	
								21.70	7S	27E	3	[illegible]W¼ SE¼	"	" " " " "	130.20	
								29.00	7S	27E	3	SE¼ SE¼	"	" " " " "	174.00	
								.20	7S	27E	9	SW¼ SW¼	"	S. N. Holman	1.20	
								20.70	7S	27E	9	SE¼ SW¼	"	" " "	124.20	
								.90	7S	27E	16	NE¼ NE¼	"	" " "	5.40	
Union Canal Company	1904	Left	7S	27E	18	SE¼ SW¼	Union Canal	68.80	Tracts described below:				Graham	Ownership data as below:		412.80
								1.70	7S	25E	12	NW¼ NE¼	"	Mrs. William Johns	10.20	
								.20	7S	25E	12	[illegible]W¼ NE¼	"	" " "	1.20	
								20.00	7S	26E	6	[illegible]W¼ SW¼	"	D. C. Johnson	120.00	
								38.00	7S	26E	6	SW¼ SW¼	"	" " "	228.00	
								8.90	7S	26E	7	NE¼ NW¼	"	John L. Hoopes & H. E. Hoopes	53.40	

Party entitled to divert from the stream	Date of priority	Point of diversion					Name of diverting and/or carrying structure	Lands for which right acquired						Parties owning said lands when jurisdiction acquired herein	Diversion right			
		Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.					Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.				County		For irrigation season in ac. ft.		Maximum rate of diversion in cu. ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
Colmenero Canal Company	1904	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	42.90	Tracts described below:				Greenlee	Ownership data as below:		257.40		
								23.80	7S	31E	28	NE¼ NE¼	"	J. G. Smith	142.80		.30	
								1.90	7S	31E	28	NW¼ NE¼	"	" " "	11.40		.02	
								1.90	7S	31E	28	SW¼ NE¼	"	" " "	11.40		.02	
								15.30	7S	31E	28	SE¼ NE¼	"	" " "	91.80		.20	
Valley Canal Company	1904	Right	19S	21W	4	NE¼ NW¼	Valley Canal	39.20	Tracts described below:				Greenlee	Ownership data as below:		235.20		
								15.00	8S	31E	12	SE¼ SE¼	"	G. I. Elmer	90.00		.20	
								24.20	8S	32E	7	SW¼ SW¼	"	" " "	145.20		.30	
Cosper & Windham Extension Canal Company. Under Contract whereby Cosper & Windham Ditch makes actual diversions	1904	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Ditch & Cosper & Windham Extension Canal.	11.00	8S	32E	34	SE¼ NE¼	Greenlee	A. T. Layton		66.00		
Cosper & Windham Canal Company	1904	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal	45.30	Tracts described below:				Hidalgo	Ownership data as below:		273.60		
								17.30	18S	21W	33	SE¼ SE¼	"	Fenley F. Merrill	103.80		.22	
								11.20	19S	21W	3	Lot 4	"	J. R. Beavers	87.20		.14	
								17.10	19S	21W	4	Lot 1	"	" " "	102.60		.21	
Sunset Canal Company	1904	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	20.30	Tracts described below:				Hidalgo	Ownership data as below:		121.80		
								14.10	18S	21W	34	SW¼ SW¼	"	Orson A. Merrill	84.60		.18	
								6.20	18S	21W	33	SE¼ SE¼	"	" " "	37.20		.07	
Graham Canal Company	1905	Right	7S	26E	9	NE¼ NW¼	Graham Canal	95.30	Tracts described below:				Graham	Ownership data as below:		571.80		
								1.90	6S	24E	1	NE¼ NW¼	"	James A. McBride	11.40		.02	
								4.30	6S	24E	1	NW¼ NW¼	"	" " "	25.80		.04	
								27.60	6S	24E	1	SE¼ NW¼	"	" " "	165.60		.38	
								22.00	6S	24E	2	NE¼ SW¼	"	W. E. Platt	132.00		.27	
								29.50	6S	24E	2	NW¼ SE¼	"	" " "	177.00		.36	
								9.00	6S	24E	12	SW¼ NE¼	"	H. R. Chlarson	54.00		.11	
								1.00	6S	24E	12	SE¼ NE¼	"	" " "	6.00		.01	
Fort Thomas Consolidated Canal Company	1905	Left	6S	24E	4	NE¼ NW¼	Forth Thomas Consolidated Canal	70.30	Tracts described below:				Graham	Ownership data as below:		421.80		
								29.10	4S	23E	20	SE¼ SE¼	"	Alonzo Winsor	174.60		.36	
								10.60	4S	23E	27	NW¼ SW¼	"	T. L. Willis	63.60		.13	
								9.40	4S	23E	27	SW¼ SW¼	"	" " "	56.40		.12	
								21.20	4S	23E	28	NE¼ NW¼	"	Leslie Montierth & Wendell Montierth	127.20		.27	
San Jose Canal Company	1905	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	87.70	Tracts described below:				Graham	Ownership data as below:		526.20		1.
								1.50	7S	26E	21	NE¼ SE¼	"	Cicero Morris	9.00		.02	
								35.80	7S	26E	21	NW¼ SE¼	"	"	214.80		.45	
								37.30	7S	26E	21	SW¼ SE¼	"	Williard Welker	223.80		.47	
								13.10	7S	26E	21	SW¼ NE¼	"	Cicero Morris	78.60		.16	
Colmenero Canal Company	1905	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	33.20	Tracts described below:				Greenlee	Ownership data as below:		199.20		
								17.20	7S	31E	21	SW¼ SE¼	"	Mrs. M. J. Daniels	103.20		.21	
								16.00	7S	31E	21	SE¼ SE¼	"	" " " "	96.00		.20	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion righ[ts]: For irrigation season in ac. ft.: Individual	Total
Valley Canal Company	1905	Right	19S	21W	11	NW¼ SE¼	Valley Canal	12.90	Tracts described below:				Greenlee	Ownership data as below:		77.40
								10.40	8S	31E	12	NE¼ SE¼	"	Sinclair Realty Company	62.40	
								2.50	8S	32E	7	NW¼ SW¼		" " "	15.00	
Moddle Canal Company	1905	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	49.00	Tracts described below:				Greenlee	Ownership data as below:		294.00
								19.30	8S	32E	29	NW¼ SE¼	"	O. L. Hext	115.80	
								29.70	8S	32E	29	SW¼ SE¼	"	Frank Schultz	178.20	
Fort Thomas Consolidated Canal Company	1906	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	73.80	Tracts described below:				Graham	Ownership data as below:		442.80
								14.20	4S	23E	28	NE¼ SW¼	"	J. H. Fine	85.20	
								1.10	4S	23E	28	SE¼ SW¼	"	" " "	6.60	
								33.30	4S	23E	28	NW¼ SE¼	"	" " "	199.80	
								25.20	4S	23E	28	SW¼ SE¼	"	" " "	151.20	
Graham Canal Company	1906	Right	7S	26E	9	NE¼ NW¼	Graham Canal	143.50	Tracts described below:				Graham	Ownership data as below:		861.00
								18.40	6S	24E	1	NW¼ SW¼	"	John L. Hoopes	110.40	
								6.70	6S	24E	1	SE¼ SW¼	"	Heber B. Bryce	40.20	
								18.00	6S	24E	1	SW¼ SE¼	"	John L. Hoopes	108.00	
								16.40	6S	25E	17	NE¼ NE¼	"	Mrs. A. W. Chesley	98.40	
								19.50	6S	25E	17	NW¼ NE¼	"	" " " "	117.00	
								2.50	6S	25E	21	NW¼ NW¼	"	A. T. West	15.00	
								9.30	6S	25E	21	SW¼ NW¼	"	A. T. West	55.80	
								30.80	6S	25E	21	SE¼ NW¼	"	" " "	184.80	
								.10	6S	25E	21	NE¼ SW¼	"	" " "	.60	
								9.80	6S	25E	21	NW¼ SE¼	"	" " "	58.80	
								12.00	6S	25E	36	SE¼ SE¼	"	Francis M. Skinner	72.00	
Nevada Consolidated Copper Company.	1906	Right	5S	15E	14	SE¼ SW¼, SW¼ SE¼	Pumps		Use of water for Industrial, Municipal, domestic and related purposes.				Gila	For further definition of this right see Article IX.		90.00
			5S	15E	23	NE¼ NW¼										
Montezuma Canal Company	1906	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	8.00	Tracts described below:				Graham	Ownership data as below:		48.00
								5.50	7S	25E	10	NE¼ NW¼	"	J. A. Farley	48.00	
								2.50	7S	25E	10	NE¼ NW¼	"	Mrs. Nisia Lindsey	15.00	
San Jose Canal Company	1906	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	76.30	Tracts described below:				Graham	Ownership data as below:		457.80
								20.00	7S	26E	21	SE¼ SW¼	"	Oscar Olsen	120.00	
								30.60	7S	26E	21	NE¼ SE¼	"	Ernest Ellsworth	183.60	
								5.10	7S	26E	21	SW¼ NE¼	"	" "	30.60	
								20.60	7S	26E	21	SE¼ NE¼	"		123.60	
Union Canal Company	1906	Left	7S	27E	18	SE¼ NW¼	Union Canal	63.80	Tracts described below:				Graham	Ownership data as below:		382.80
								33.80	6S	24E	24	NW¼ SE¼	"	P. C. Merrill	202.80	
								4.50	6S	24E	24	NW¼ SE¼	"	G. B. Maloy	27.00	
								3.20	6S	25E	19	NW¼ SW¼	"	Sarah Taylor	19.20	
								22.30	6S	25E	19	SW¼ SW¼	"	W. E. McBride	133.80	

Party entitled to divert from the stream	Date of priority	Point of diversion					Name of diverting and/or carrying structure	Lands for which right acquired						Parties owning said lands when jurisdiction acquired herein	Diversion right			
		Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M.					Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M.				County		For irrigation season in ac. ft.		Maximum rate of diversion in cu. ft. per sec.	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	Total
York Canal Company	1906	Right	6S	31E	29	SW¼ NW¼	York Canal	68. 30	Tracts described below:				Greenlee	Ownership data as below:		409. 80		. 8
								3. 20	6S	31E	17	SW¼ NW¼	"	Gus Duncan	19. 20		. 04	
								23. 50	6S	31E	17	NW¼ SW¼	"	" "	141. 00		. 29	
								23. 10	6S	31E	10	NE¼ NE¼	"	George A. Wilson	138. 60		. 29	
								18. 50	6S	31E	19	SE¼ NE¼	"	" " "	110. 00		. 23	
Moddle Canal Company	1906	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	20. 70	8S	32E	29	NE¼ SE¼	Greenlee	Mrs. M. E. Pittman		124. 20		. 2
Colvin-Jones Canal Company	1907	Right	4S	23E	26	SW¼ SW¼	Colvin-Jones Canal	34. 10	Tracts described below:				Graham	Ownership data as below:		204. 60		. 4
								1. 10	4S	23E	22	NE¼ SW¼	"	C. N. Higgins	6. 60		. 01	
								11. 50	4S	23E	22	NW¼ SW¼	"	" " "	69. 00		14	
								. 10	4S	23E	22	SW¼ SW¼	"	" " "	. 60		. 01	
								21. 40	4S	23E	22	SE¼ SW¼	"	" " "	128. 40		. 27	
Curtis Canal Company	1907	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	32. 20	Tracts described below:				Graham	Ownership data as below:		193. 20		. 4
								7. 00	5S	24E	20	SE¼ SE¼	"	L. M. Thatcher	42. 00		. 09	
								5. 00	5S	24E	29	NE¼ SW¼	"	A. J. Kempton	30. 00		. 06	
								15. 00	5S	24E	29	SE¼ SW¼	"	Calvin I. Kempton & Heber Kempton	90. 00		. 19	
								5. 20	6S	24E	2	NE¼ SW¼	"	Joseph Moyes	31. 20		. 07	
Graham Canal Company	1907	Right	7S	26E	9	NE¼ NW¼	Graham Canal	82. 00	Tracts described below:				Graham	Ownership data as below:		492. 00		1. 0
								5. 70	6S	24E	2	NW¼ NE¼	"	M. M. Hancock	34. 20		. 07	
								20. 80	6S	24E	2	NE¼ NW¼	"	" " "	124. 80		. 25	
								17. 00	6S	24E	2	SW¼ NE¼	"	John Billingsley	102. 00		. 21	
								5. 30	6S	24E	2	SE¼ NW¼	"	" "	31. 80		. 07	
								9. 50	6S	24E	2	SW¼ NE¼	"	Robert Mackey	57. 00		. 12	
								23. 70	6S	24E	2	SE¼ NW¼	"	" "	142. 20		. 30	
Smithville Canal Company	1907	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	282. 50	Tracts described below:				Graham	Ownership data as below:		1695. 00		3. 5
								2. 90	6S	24E	13	NE¼ NW¼	"	John H. Foster	17. 40		. 04	
								1. 30	6S	24E	13	NE¼ NW¼	"	Roy Saline	7. 80		. 02	
								9. 70	6S	24E	13	NW¼ NW¼	"	P. H. McBride, Jr.	58. 20		. 12	
								9. 90	6S	24E	13	SW¼ NW¼	"	P. H. McBride	59. 40		. 12	
								9. 00	6S	24E	13	SW¼ NW¼	"	P. H. McBride, Jr.	54. 00		. 11	
								14. 90	6S	24E	13	SE¼ NW¼	"	John H. Foster	89. 40		. 18	
								12. 80	6S	24E	13	SE¼ NW¼	"	Roy Saline	76. 80		. 16	
								5. 20	6S	24E	13	SW¼ NW¼	"	Laura McBride	31. 20		. 06	
								18. 30	6S	24E	13	NE¼ SW¼	"	Karl Foster	109. 80		. 24	
								7. 50	6S	24E	13	NW¼ SW¼	"	W. J. Preston	45. 00		. 09	
								6. 50	6S	24E	13	SW¼ SW¼	"	" " "	39. 00		. 08	
								18. 20	6S	24E	13	SE¼ SW¼	"	" " "	109. 20		. 23	
								12. 00	6S	24E	13	NW¼ SE¼	"	Karl Foster	72. 00		. 15	
								2. 40	6S	24E	14	NE¼ NE¼	"	Mrs. Sarah Barney	14. 40		. 05	
								5. 50	6S	24E	14	NE¼ NE¼	"	Albert Carter	33. 00		. 07	
								4. 10	6S	24E	14	NE¼ NE¼	"	Ether McBride	24. 60		. 05	
								1. 70	6S	24E	14	NE¼ NE¼	"	L. L. Follett	10. 20		. 02	
								1. 50	6S	24E	14	NW¼ NE¼	"	Mrs. Olivea Larson	9. 00		. 02	
								3. 30	6S	24E	14	NW¼ NE¼	"	H. J. Clark	19. 80		. 04	
								14. 60	6S	24E	14	SW¼ NE¼	"	W. A. Carter, Jr.	87. 60		. 18	
								4. 80	6S	24E	14	SW¼ NE¼	"	Mrs. Olivea Larson	28. 80		. 06	

(continued)

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac. ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Tot
Smithville Canal Company (Continuation)	1907											(continuation)	Graham	Ether McBride	12.00		.03	
								2.00	6S	24E	14	SE¼ NE¼	"	Karl Foster	159.60		.33	
								26.60	6S	24E	14	SE¼ NE¼	"	Mrs. Sarah Bryce	47.40		.10	
								7.90	6S	24E	14	SE¼ NE¼	"	Ethel B. Carter & Walter Batty	26.40		.05	
								4.40	6S	24E	14	NE¼ NW¼	"	" " " " " "	96.60		.20	
								16.10	6S	24E	14	NW¼ NW¼	"	Mrs. Sarah Bryce	135.00		.28	
								22.50	6S	24E	14	NE¼ SE¼	"	Lehi Larson, Sr.	8.40		.02	
								1.40	6S	24E	14	NW¼ NE¼	"	C. B. Boren	52.20		.11	
								8.70	6S	24E	14	NW¼ NE¼	"	W. A. Carter, Jr.	63.60		.12	
								10.60	6S	24E	14	NE¼ NW¼	"	" " " "	97.20		.20	
								16.20	6S	24E	14	SE¼ NW¼						
Fort Thomas Consolidated Canal Company	1907	Left	6S	24E	4	NW¼ NW¼	Fort Thomas Consolidated Canal	38.40	Tracts described below:				Graham	Ownership data as below:		230.40		
								7.20	4S	23E	19	NE¼ NE¼	"	L. M. Taylor	43.20		.09	
								16.20	4S	23E	27	SW¼ SW¼	"	T. L. Willis	97.20		.20	
								2.50	4S	23E	28	NE¼ SW¼	"	Edgar H. Chesley	15.00		.03	
								12.40	4S	23E	34	NW¼ NW¼	"	George P. Ballard	74.40		.15	
								.10	4S	23E	34	SW¼ NW¼	"	" " "	.60		.01	
Montezuma Canal Company	1907	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	4.10	7S	25E	10	SE¼ NE¼	Graham	John Stowe		24.60		
San Jose Canal Company	1907	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	417.40	Tracts described below:				Graham	Ownership data as below:		2,504.40		5.
								20.30	7S	26E	17	SW¼ SW¼	"	Austin Evans	121.80		.25	
								3.30	7S	26E	17	SE¼ SW¼	"	Calista B. Peel	19.80		.04	
								2.70	7S	26E	18	NW¼ SW¼	"	M. G. Montierth	16.20		.03	
								31.00	7S	26E	18	SW¼ SW¼	"	J. W. N. Scarlett	186.00		.39	
								21.80	7S	26E	18	SE¼ SW¼	"	" " " "	130.80		.27	
								4.10	7S	26E	18	SW¼ SE¼	"	F. E. Kirkpatrick	24.60		.05	
								18.70	7S	26E	18	SW¼ SE¼	"	John H. Harper	112.20		.23	
								7.30	7S	26E	18	SE¼ SE¼	"	" " "	43.80		.09	
								15.90	7S	26E	18	SE¼ SE¼	"	Hart D. Empie	95.40		.20	
								27.30	7S	26E	19	NE¼ NE¼	"	W. R. Waddell	163.80		.34	
								22.10	7S	26E	19	NW¼ NE¼	"	" " "	132.60		.28	
								36.60	7S	26E	19	NE¼ NW¼	"	Alma Freestone	219.60		.45	
								7.70	7S	26E	19	NW¼ NW¼	"	" "	46.20		.10	
								2.80	7S	26E	20	NW¼ NE¼	"	John R. Davidson	16.80		.04	
								.90	7S	26E	20	SW¼ NE¼	"	" " "	5.40		.01	
								34.70	7S	26E	20	NE¼ NW¼	"	J. W. Greenhalgh	208.20		.43	
								31.00	7S	26E	20	NW¼ NW¼	"	John West	186.00		.39	
								2.50	7S	26E	20	NE¼ SE¼	"	Mrs. W. R. Smith	15.00		.03	
								1.70	7S	26E	20	SE¼ SE¼	"	" " " "	10.20		.02	
								19.00	7S	26E	20	SW¼ NE¼	"	William Ellsworth	114.00		.24	
								8.70	7S	26E	20	SW¼ NE¼	"	W. A. Woolsey	52.20		.11	
								19.20	7S	26E	20	SE¼ NW¼	"	Wallace Branch	115.20		.24	
								7.60	7S	26E	20	SE¼ NW¼	"	W. R. Foote	45.60		.10	
								15.20	7S	26E	20	NE¼ SW¼	"	" " "	91.20		.19	
								6.70	7S	26E	20	NE¼ SW¼	"	James Jensen	40.20		.08	
								6.20	7S	26E	20	NW¼ SE¼	"	W. A. Woolsey	37.20		.08	
								33.60	7S	26E	20	NW¼ SE¼	"	Delbert Hatch	201.60		.42	
								6.30	7S	26E	20	SW¼ SE¼	"	A. C. Hunt	37.80		.08	
								1.90	7S	26E	25	NE¼ NW¼	"	Mrs. F. M. Medhurst	11.40		.02	
								.30	7S	26E	25	SE¼ NW¼	"	Braulio Ochoha	1.80		.01	
								.30	7S	26E	25	SW¼ NE¼	"	" "	1.80		.01	

Party entitled to divert from the stream	Date of priority	Point of diversion					Name of diverting and/or carrying structure	Lands for which right acquired						Parties owning said lands when jurisdiction acquired herein	Diversion right			
		Side of stream	Location: Referred to G. & S. R. B. & M. or N. M. B. & M.					Number of acres	Description: Referred to G. & S. R. B. & M. or N. M. B. & M.				County		For irrigation season in ac.-ft.		Maxin rate of d sion in ft. per	
			Twp.	Rge.	Sec.	Subdivision			Twp.	Rge.	Sec.	Subdivision			Individual	Total	Individual	T
Union Canal Company	1907	Left	7S	27E	18	SE¼ NW¼	Union Canal	1045. 90	Tracts described below:				Graham	Ownership data as below:		6275. 40		
								21. 30	6S	24E	13	SW¼ SE¼	"	I. B. Blake	127. 80		. 27	
								13. 70	6S	24E	13	SE¼ SW¼	"	" " "	82. 20		. 17	
								10. 00	6S	24E	13	SW¼ SW¼	"	W. J. Preston	60. 00		. 13	
								28. 20	6S	24E	24	NE¼ NE¼	"	Milton Lines	169. 20		. 35	
								28. 00	6S	24E	24	NW¼ NE¼	"	I. B. Blake	168. 00		. 35	
								17. 40	6S	24E	24	SW¼ NE¼	"	Mrs. Virgia R. Wilson	104. 40		. 22	
								19. 70	6S	24E	24	SW¼ NE¼	"	Fred Webb	118. 20		. 25	
								7. 60	6S	24E	24	SE¼ NE¼	"	Reece D. Green	45. 60		. 10	
								11. 20	6S	24E	24	NE¼ NW¼	"	C. E. Ferrin	67. 20		. 14	
								1. 30	6S	24E	24	NE¼ NW¼	"	I. B. Blake	7. 80		. 02	
								21. 50	6S	24E	24	SW¼ NW¼	"	G. B. Maloy	129. 00		. 27	
								35. 30	6S	24E	24	SE¼ NW¼	"	Fred Webb	211. 80		. 44	
								34. 50	6S	24E	24	NE¼ SW¼	"	Clark Mangum	207. 00		. 43	
								5. 50	6S	24E	24	SW¼ SW¼	"	Joseph Rogers	33. 00		. 07	
								37. 50	6S	24E	24	SE¼ SW¼	"	Mrs. Louisa Rogers	225. 00		. 47	
								1. 70	6S	24E	24	NE¼ SE¼	"	P. C. Merrill	10. 20		. 02	
								7. 30	6S	24E	24	NE¼ SE¼	"	E. C. Eyring	43. 80		. 09	
								26. 10	6S	24E	24	SW¼ SE¼	"	" " "	156. 60		. 31	
								1. 90	6S	24E	24	SE¼ SE¼	"	" " "	11. 40		. 02	
								11. 20	6S	24E	25	NW¼ NE¼	"	P. C. Merrill	67. 20		. 14	
								1. 20	6S	24E	25	NW¼ NE¼	"	Joseph Rogers	7. 20		. 02	
								2. 40	6S	24E	25	SW¼ NE¼	"	P. C. Merrill	14. 40		. 03	
								22. 50	6S	24E	25	NE¼ NW¼	"	Joseph Rogers	135. 00		. 28	
								5. 80	6S	24E	25	NE¼ NW¼	"	P. C. Merrill	34. 80		. 07	
								18. 80	6S	24E	25	NW¼ NW¼	"	Joseph Rogers	112. 80		. 24	
								11. 80	6S	24E	25	SW¼ SW¼	"	Mrs. Louisa Rogers	70. 80		. 15	
								5. 80	6S	24E	25	SE¼ NW¼	"	P. C. Merrill	34. 80		. 07	
								1. 30	6S	24E	25	SE¼ NW¼	"	Joseph Rogers	7. 80		. 02	
								4. 80	6S	25E	29	SW¼ NW¼	"	Joseph Alder	28. 80		. 06	
								27. 30	6S	25E	29	NW¼ SW¼	"	John W. Allen	163. 80		. 34	
								37. 80	6S	25E	29	SW¼ SW¼	"	M. F. Preston	226. 80		. 47	
								17. 20	6S	25E	29	SE¼ SW¼	"	Joseph Alder	103. 20		. 22	
								4. 20	6S	25E	30	NW¼ NE¼	"	Ether S. Ferrin	25. 20		. 05	
								12. 50	6S	25E	30	SW¼ NE¼	"	" " "	75. 00		. 16	
								18. 00	6S	25E	30	SW¼ NE¼	"	C. E. Ferrin	108. 00		. 23	
								10. 80	6S	25E	30	SE¼ NE¼	"	C. M. Beal	64. 80		. 14	
								8. 40	5S	25E	30	NW¼ NW¼	"	P. M. Kelly	50. 40		. 11	
								16. 20	6S	25E	30	NE¼ NW¼	"	John Cluff	97. 20		. 20	
								10. 10	6S	25E	30	SW¼ NW¼	"	C. D. Haynie	60. 60		. 13	
								35. 90	6S	25E	30	SE¼ NW¼	"	" " "	215. 40		. 45	
								36. 00	6S	25E	30	NE¼ SW¼	"	W. F. Preston	216. 00		. 45	
								24. 00	6S	25E	30	NW¼ SW¼	"	" " "	144. 00		. 30	
								11. 60	6S	25E	30	SW¼ SW¼	"	" " "	69. 60		. 15	
								27. 80	6S	25E	30	SE¼ SW¼	"	A. Rohner	166. 80		. 35	
								26. 10	6S	25E	30	NW¼ SE¼	"	J. H. Beal	156. 60		. 31	
								40. 00	6S	25E	30	NE¼ SE¼	"	C. M. Beal	240. 00		. 50	
								9. 10	6S	25E	30	SW¼ SE¼	"	Mrs. Layman Dodge	54. 60		. 11	
								29. 20	6S	25E	30	SW¼ SE¼	"	W. F. Preston	175. 20		. 37	
								15. 70	6S	25E	30	SE¼ SE¼	"	S. E. Allen	94. 20		. 20	
								16. 30	6S	25E	30	SE¼ SE¼	"	W. J. Mallon	97. 80		. 20	
								35. 30	6S	25E	31	NE¼ NE¼	"	S. E. Allen	211. 80		. 44	
								. 90	6S	25E	31	NE¼ NE¼	"	James Mallon	5. 40		. 01	
								35. 80	6S	25E	31	NW¼ NE¼	"	" "	214. 80		. 45	
								10. 60	6S	25E	31	SW¼ NE¼	"	W. M. Ferrin	63. 60		. 12	
								7. 30	6S	25E	31	SE¼ NE¼	"	W. M. [illegible]	[illegible]		[illegible]	

Party entitled to divert from the stream	Date of priority	Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft. Individual	Total	Maxi[illegible] rate of [illegible] sion [illegible] ft. pe[illegible] Individual
R. H. Angle	1907	Right	Direct from river				Pumping Plant	4.00	6S	30E	1	NE¼ SW¼	Greenlee	R. H. Angle		24.00	
								5.90	6S	30E	1	NW¼ SE¼	"	" " "		35.40	
Colmenero Canal Company	1907	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	129.90	Tracts described below:				Greenlee	Ownership data as below:		779.40	
								15.70	7S	31E	10	NE¼ SW¼	"	George H. Cosper	94.20		.02
								13.70	7S	31E	16	NW¼ SW¼	"	" " "	82.20		.17
								8.60	7S	31E	21	SW¼ SE¼	"	Albert L. Barber	51.60		.11
								27.00	7S	31E	21	SW¼ NE¼	"	Roy D. Williams	162.00		.34
								4.50	7S	31E	21	NE¼ SE¼	"	Sam R. Tilley	27.00		.06
								20.50	7S	21E	21	NW¼ SE¼	"	" " "	123.00		.26
								5.90	7S	31E	27	NW¼ SW¼	"	F. N. Gault	35.40		.07
								1.50	7S	31E	27	SW¼ SW¼	"	" " "	9.00		.02
								.40	7S	31E	28	SW¼ NE¼	"	H. B. Harris	2.40		.05
								9.20	7S	31E	28	SE¼ NE¼	"	" " "	55.20		.13
								13.30	7S	31E	2S	NE¼ SE¼	"	" " "	79.80		.17
								9.00	7S	31E	28	NE¼ SE¼	"	F. N. Gault	57.60		.13
Duncan Canal Company	1907	Left	8S	32E	2S	NE¼ NW¼	Duncan Canal	3.10	8S	32E	29	NW¼ NW¼	Greenlee	J. W. Carter & M. H. Brooks		16.60	
United States	1908	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence – Casa Grande Canal.	430.00	Tracts described below:				Pinal	Ownership data as below:		2560.00	
								40.00	5S	9E	3	S½ N½ NW¼	"	J. J. Fraser	240.00		.50
								80.00	5S	9E	3	S½ NW¼	"	" " "	480.00		1.00
								31.69	5S	9E	3	W½ SW¼	"	" " "	190.14		.40
								122.18	5S	9E	4	NE¼	"	" " "	733.08		1.50
								107.82	5S	9E	4	SE¼	"	" " "	646.92		1.35
								48.31	5S	9E	4	E½ SE¼	"	" " "	289.86		.62
Dodge-Nevada Canal Company	1908	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	4.10	6S	24E	10	NW¼ SE¼	Graham	C. E. Farley		24.60	
Fort Thomas Consolidated Canal Company	1908	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	110.50	Tracts described below:				Graham	Ownership data as below:		663.00	
								4.00	4S	23E	17	NW¼ SW¼	"	J. E. Pulsipher	24.00		.05
								20.10	4S	23E	19	SE¼ NE¼	"	J. N. Holyoak	120.60		.25
								14.80	4S	23E	29	NE¼ SE¼	"	S. E. Reynolds	88.80		.19
								1.50	4S	23E	29	NW¼ SE¼	"	" " "	9.00		.02
								4.10	4S	23E	34	SW¼ NE¼	"	George W. Healy	24.60		.05
								8.70	4S	23E	34	NE¼ NW¼	"	George P. Ballard	52.20		.11
								12.50	4S	23E	34	NW¼ NW¼	"	" " "	75.00		.16
								7.00	4S	23E	34	SW¼ NW¼	"	" " "	42.00		.09
								17.90	4S	23E	34	SE¼ NW¼	"	George W. Healy	107.40		.22
								2.70	4S	23E	34	NE¼ SW¼	"	" " "	16.20		.03
								17.20	4S	23E	34	NW¼ SE¼	"	" " "	103.20		.22
Graham Canal Company	1908	Right	7S	26E	9	NE¼ NW¼	Graham Canal	196.60	Tracts described below:				Graham	Ownership data as below:		1179.60	
								25.00	6S	24E	1	SW¼ NW¼	"	John L. Hoopes	150.00		.31
								24.30	6S	24E	1	SW¼ SW¼	"	Heber B. Bryce	145.80		.30
								7.00	6S	24E	1	NW¼ SE¼	"	" " "	42.00		.09
								28.70	6S	24E	2	SE¼ NE¼	"	Martha A. Merrill	172.20		.36
								9.20	6S	24E	2	NW¼ SE¼	"	E. E. Hancock	55.20		.11
								30.10	6S	25E	8	SW¼ SE¼	"	Simon Mathews	180.60		.39
								5.50	6S	25E	25	NE¼ SW¼	"	J. A. Foster	33.00		.07
								10.90	6S	25E	25	NW¼ SW¼	"	T. Hugh Talley	65.40		.14
								4.70	6S	25E	25	NW¼ SW¼	"	Van Talley	28.20		.06
								12.90	6S	25E	25	NW¼ SW¼	"	D. V. A. Talley	77.40		.16
								2.80	6S	25E	25	SW¼ SW¼	"	Van Talley	16.80		.04
								10.00	6S	25E	25	SW¼ SW¼	"	D. V. A. Talley	60.00		.1[illegible]
								10.00	6S	25E	25	SE¼ SW¼	"	" " " "	60.00		.1[illegible]
								15.50	6S	25E	26	NW¼ NW¼	"	S. D. Howard	93.00		.19

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
J. L. Henderson	1908	Right	6S	30E	1	NE¼ SE¼	Pumping Plant Direct	4.50	6S	30E	1	NW¼ SE¼	Greenlee	J. L. Henderson		27.00		.06
San Jose Canal Company	1908	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	13.40	7S	26E	28	NE¼ NE¼	Graham	Calvin Hocker		80.40		.17
York Canal Company	1908	Right	6S	31E	29	SW¼ NW¼	York Canal	121.70	Tracts described below:				Greenlee	Ownership data as below:		730.20		1.52
								5.20	6S	31E	8	SW¼ SW¼	"	N. C. Wright	31.20		.07	
								9.20	6S	31E	17	NW¼ NW¼	"	E. Day	55.20		.12	
								10.60	6S	31E	17	NW¼ NW¼	"	W. D. Tucker	63.60		.13	
								.80	6S	31E	17	SW¼ NW¼	"	" " "	4.80		.01	
								9.60	6S	31E	17	SW¼ NW¼	"	" " "	57.60		.12	
								19.40	6S	31E	18	NE¼ NE¼	"	E. Day	116.40		.23	
								16.40	6S	31E	18	NE¼ NE¼	"	W. D. Tucker	98.40		.21	
								4.10	6S	31E	18	NW¼ NE¼	"	E. Day	24.60		.05	
								3.10	6S	31E	18	SE¼ NE¼	"	W. D. Tucker	18.60		.04	
								17.00	6S	31E	19	NE¼ NE¼	"	Ypolita Cascarilla	102.00		.21	
								1.90	6S	31E	19	NW¼ NE¼	"	" "	11.40		.02	
								7.00	6S	31E	19	SW¼ NE¼	"	" "	42.00		.09	
								17.40	6S	31E	19	SE¼ NE¼	"	" "	104.40		.22	
Colmenero Canal Company	1908	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	26.30	Tracts described below:				Greenlee	Ownership data as below:		157.80		.32
								1.90	7S	31E	16	SW¼ SW¼	"	Theodore H. Moody	11.40		.02	
								22.40	7S	31E	16	SE¼ SW¼	"	" " "	134.40		.28	
								2.00	7S	31E	16	SW¼ SE¼	"	" " "	12.00		.02	
Black & McCleskey Canal Company	1908	Left	8S	32E	19	NE¼ SE¼	Black & McCleskey Canal	16.00	Tracts described below:				Greenlee	Ownership data as below:		96.00		.20
								13.60	8S	31E	13	NW¼ NW¼	"	R. F. Cloudt	81.60		.17	
								2.40	8S	31E	14	NE¼ NE¼	"	" " "	14.40		.03	
Valley Canal Company	1908	Right	19S	21W	4	NE¼ NW¼	Valley Canal	105.30	Tracts described below:				Greenlee	Ownership data as below:		631.80		1.31
								33.40	8S	32E	20	NW¼ NW¼	"	(Emma Spoon, Administratrix	200.40		.41	
								27.20	8S	32E	20	SW¼ NW¼	"	(of the Estate of J. H. Spoon	163.20		.34	
								5.30	8S	32E	20	SW¼ NW¼	"	(deceased	31.80		.07	
								7.40	8S	32E	28	NE¼ SW¼	"	(S. A. Foster & W. F. Foster,	44.40		.09	
								27.30	8S	32E	28	NW¼ SE¼	"	(and J. H. Merrian, Executor	163.80		.34	
								4.70	8S	32E	28	NW¼ SE¼	"	(of the Estate of Alice E.	28.20		.06	
														(Day, deceased.				
Moddle Canal Company	1908	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	46.60	Tracts described below:				Greenlee	Ownership data as below:		279.60		.59
								.20	8S	32E	28	SW¼ SE¼	"	(S. A. Foster & W. F. Foster,	1.20		.01	
								23.00	8S	32E	28	NW¼ SW¼	"	(and J. H. Merrian, Executor	138.00		.29	
								3.70	8S	32E	28	SW¼ SW¼	"	(of the Estate of Alice E.	22.20		.05	
								14.70	8S	32E	28	SE¼ SW¼	"	(Day, deceased	88.20		.18	
								5.00	8S	32E	28	NE¼ SW¼	"		30.00		.06	
Nevada Consolidated Copper Company	1908	Right	5S	15E	14	SE¼ SW¼ SW¼ SE¼	Pumps		Use of water for industrial municipal, domestic and related purposes.				Gila	For further definition of this right see Article IX.		918.00		1.91
			5S	15E	23	NE¼ NW¼												

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maxim[um] rate of d[iver]sion in [cu.] ft. per [sec.]: Individual
Nevada Consolidated Copper Company	1908	Left	5S	15E	23	NE¼ SW¼	Herring Ditch	93.00	Tracts described below:				Pinal	Ownership data as below:		558.00	
								8.00	5S	15E	15	SW¼ SW¼	"	(Nevada Consolidated	48.00		.10
								45.00	5S	15E	16	SE¼	"	(Copper Company	270.00		.56
								40.00	5S	15E	22	N½ NW¼, W½ NE¼	"	(	240.00		.50
United States	1909	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal	270.00	Tracts described below:				Pinal	Ownership data as below:		1620.00	
								20.00	5S	8E	9	W½ SE¼ NE¼	"	Elizabeth Shannon	120.00		.25
								35.90	5S	8E	9	N½ NE¼	"	"	215.40		.45
								4.10	5S	8E	9	N½ NE¼	"	" "	24.60		.05
								20.00	5S	8E	9	N½ NW¼ SW¼	"	Mary L. Shannon	120.00		.25
								40.00	5S	8E	9	SW¼ NE¼	"	" " "	240.00		.50
								40.00	5S	8E	9	SW¼ NW¼	"	Charles M. Shannon	240.00		.50
								10.00	5S	8E	9	NE¼ SE¼ NE¼	"	Theresa Hall Brown	60.00		.13
								10.00	5S	8E	9	SE¼ SE¼ NE¼	"	" " "	60.00		.13
								10.00	5S	8E	10	N½ S½ NE¼ SE¼	"	Charlotte Hall Brown	60.00		.13
								20.00	5S	8E	10	N½ NE¼ SE¼	"	" " "	120.00		.25
								10.00	5S	8E	10	S½ S½ SE¼ NE¼	"	" " "	60.00		.13
								50.00	5S	9E	29	S½ NE¼	"	Lissa J. Fulton	300.00		.60
Colvin-Jones Canal Company	1909	Right	4S	23E	26	SW¼ SW¼	Colvin-Jones Canal	75.50	Tracts described below:				Graham	Ownership data as below:		453.00	
								20.00	4S	23E	22	SW¼ SW¼	"	C. N. Higgins	120.00		.25
								35.80	4S	23E	27	NE¼ SE¼	"	Hugh C. Hamman	214.80		.45
								17.10	4S	23E	27	NW¼ NE¼	"	W. F. Bollinger	102.60		.21
								2.60	4S	23E	27	NW¼ SE¼	"	" " "	15.60		.03
Nevada Consolidated Copper Company	1909	Right	5S	15E	14	SE¼ SW¼, SW¼ SE¼	Pumps		Use of water for Industrial, Municipal, Domestic & Related purposes.				Gila	For further definition of this right see Article IX.		16,221.00	
			5S	15E	23	NE¼ NW¼											
Smithville Canal Company	1909	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	99.80	Tracts described below:				Graham	Ownership data as below:		598.80	
								15.00	6S	24E	10	NW¼ SE¼	"	Mrs. Chloe Matthews	90.00		.19
								6.00	6S	24E	10	NW¼ SE¼	"	C. E. Farley	36.00		.07
								.80	6S	24E	10	NE¼ SW¼	"	Mrs. Chloe Matthews	4.80		.01
								4.10	6S	24E	10	SE¼ SW¼	"	" " "	24.60		.05
								17.80	6S	24E	10	SW¼ SE¼	"	" " "	106.80		.22
								23.30	6S	24E	10	SE¼ SE¼	"	Ephriam Larson	139.80		.29
								18.30	6S	24E	11	SE¼ SW¼	"	H. L. Smith	109.80		.23
								5.70	6S	24E	11	SW¼ SW¼	"	Earl Larson	34.20		.07
								1.30	6S	24E	11	SE¼ SW¼	"	Ephriam Larson	7.80		.02
								7.50	6S	24E	15	NE¼ NE¼	"	" "	45.00		.09
Fort Thomas Consolidated Canal Company	1909	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	77.00	Tracts described below:				Graham	Ownership data as below:		462.00	
								2.30	4S	23E	18	NE¼ NW¼	"	Mrs. Henry Dial	13.80		.03
								17.30	4S	23E	28	NW¼ SW¼	"	Edgar H. Chesley	103.80		.22
								3.80	4S	23E	28	SW¼ SW¼	"	" " "	22.80		.05
								6.20	4S	23E	29	SE¼ NW¼	"	Mrs. S. J. Hunter	37.20		.08
								12.30	5S	23E	11	SW¼ NE¼	"	George W. Healy	73.80		.15
								35.10	5S	23E	11	SE¼ SE¼	"	W. H. Roach	210.60		.44

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location, referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
San Jose Canal Company	1909	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	70.00	Tracts described below:				Graham	Ownership data as below:		420.00		.87
								28.60	7S	26E	28	NW¼ NE¼	"	George Albert Morris	171.60		.36	
								30.40	7S	26E	28	NE¼ NW¼	"	Frank Morris	182.40		.38	
								5.00	7S	27E	20	NE¼ NE¼	"	Nora Floyd	30.00		.06	
								6.00	7S	27E	20	NE¼ NE¼	"	Etta G. Deller	36.00		.07	
Union Canal Company	1909	Left	7S	27E	18	SE¼ NW¼	Union Canal	5.80	6S	24E	25	SE¼ NW¼	Graham	Harriett Pulsipher		34.80		.07
York Cattle Company	1909	Left	6S	31E	19	SW¼ SE¼	Pumping Plant Direct	45.50	Tracts described below:				Greenlee	Ownership data as below:		273.00		.57
								3.50	6S	31E	18	NE¼ SE¼	"	York Cattle Company	21.00		.04	
								8.00	6S	31E	18	NW¼ SE¼	"	" " "	48.00		.10	
								.90	6S	31E	18	SW¼ SE¼	"	" " "	5.40		.01	
								9.30	6S	31E	18	SW¼ SE¼	"	" " "	55.80		.12	
								17.40	6S	31E	19	NW¼ NE¼	"	" " "	104.40		.22	
								1.40	6S	31E	19	SE¼ NE¼	"	" " "	8.40		.02	
								5.00	6S	31E	19	SW¼ NE¼	"	" " "	30.00		.06	
F. E. Ross	1909	Right	6S	31E	19	NW¼ NE¼	Pumping Plant Direct	11.60	6S	31E	19	SW¼ SE¼	Greenlee	F. E. Ross		69.60		.15
W. C. Craufurd	1909	Right	6S	31E	32	SW¼ SE¼	Pumping Plant Direct	33.00	Tracts described below:				Greenlee	Ownership data as below:		198.00		.42
								16.40	6S	31E	32	NW¼ SE¼	"	W. C. Craufurd	98.40		.21	
								16.20	6S	31E	32	SW¼ SE¼	"	" " "	97.20		.20	
								.40	6S	31E	32	SE¼ SE¼	"	" " "	2.40		.01	
Billingsley Extension Canal Company	1909	Right	7S	31E	16	NE¼ NW¼	Billingsley Extension Canal	14.00	Tracts described below:				Greenlee	Ownership data as below:		84.00		.18
								1.90	7S	31E	4	NW¼ SW¼	"	W. C. Craufurd	11.40		.0[illegible]	
								12.10	7S	31E	4	SW¼ NW¼	"	" " "	72.60		.15	
United States	1910	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal.	132.00	Tracts described below:				Pinal	Ownership data as below:		792.00		1.65
								15.00	4S	9E	35	W½ SW¼	"	George W. Smith	90.00		.19	
								34.00	4S	10E	21	SW¼ SW¼	"	Harry True	204.00		.42	
								3.00	4S	10E	31	SW¼ SW¼ SW¼	"	Mary A. Antenoll	18.00		.04	
								80.00	5S	8E	24	W½ NE¼	"	L. S. Nafziger	480.00		1.00	
Colvin-Jones Canal Company	1910	Right	4S	23E	26	SW¼ NW¼	Colvin-Jones Canal	17.50	4S	23E	27	NE¼ NW¼	Graham	George W. Healy		105.00		.22
Dodge-Nevada Canal Company	1910	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal.	10.60	5S	24E	30	SW¼ SE¼	Graham	L. A. Adams		63.60		.13
Smithville Canal Company	1910	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	483.00	Tracts described below:				Graham	Ownership data as below:		2898.00		6.01
								22.90	5S	24E	31	NE¼ SW¼	"	Edward Moody	137.40		.24	
								2.20	5S	24E	31	NW¼ SW¼	"	" "	13.20		.03	
								21.20	5S	24E	31	SW¼ SW¼	"	J. H. Mack	127.20		.27	
								35.10	5S	24E	31	SE¼ SW¼	"	" " "	210.60		.44	
								36.30	6S	24E	4	SW¼ SW¼	"	Benjamin Echols	217.80		.45	
								10.00	6S	24E	4	SE¼ SW¼	"	Lewis Allen	60.00		.13	

(continued)

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maxi rate of sion i ft. pe: Individual
Smithville Canal Company (continuation)	1910											(continuation)					
								20.60	6S	24E	5	SW¼ SE¼	Graham	P. A. Norton	123.60		.26
								20.60	6S	24E	5	SE¼ SE¼	"	F. R. Taylor	123.60		.26
								37.60	6S	24E	8	NE¼ NE¼	"	H. J. Anderson	225.60		.47
								8.50	6S	24E	8	NW¼ NE¼	"	" " "	51.00		.11
								16.20	6S	24E	8	NW¼ NW¼	"	Ben Blake	97.20		.20
								19.20	6S	24E	9	SW¼ NE¼	"	" "	115.20		.24
								38.30	6S	24E	9	NW¼ NW¼	"	Milton Lines	229.80		.48
								31.70	6S	24E	9	SW¼ NW¼	"	H. J. Anderson	190.20		.40
								14.00	6S	24E	9	SE¼ NW¼	"	" " "	84.00		.18
								11.60	6S	24E	9	NE¼ SW¼	"	" " "	69.60		.15
								22.20	6S	24E	9	NW¼ SW¼	"	" " "	133.20		.2[illegible]
								23.10	6S	24E	9	NE¼ NW¼	"	Lewis Allen	138.60		.29
								12.00	6S	24E	9	SW¼ SW¼	"	H. J. Anderson	72.00		.15
								.10	6S	24E	9	SE¼ SW¼	"	" " "	.60		.01
								20.60	6S	24E	16	NE¼ NW¼	"	Benjamin Echols	123.60		.26
								27.70	6S	24E	16	NW¼ NW¼	"	" "	166.20		.35
								7.80	6S	24E	16	SW¼ NW¼	"	" "	46.80		.10
								12.00	6S	24E	16	SE¼ NW¼	"	" "	72.00		.15
								11.50	6S	24E	16	NE¼ SW¼	"	" "	69.00		.14
Fort Thomas Consolidated Canal Company	1910	Left	6S	24E	9	NE¼ NW¼	Fort Thomas Consolidated Canal	49.70	Tracts described below:				Graham	Ownership data as below:		298.20	
								33.30	5S	23E	24	NE¼ NE¼	"	Charles F. Solomon	199.80		.42
								12.20	5S	23E	24	SE¼ NE¼	"	" " "	73.20		.15
								4.20	5S	23E	24	SE¼ NE¼	"	School District #7, County of Graham, State of Arizona	25.20		.05
Curtis Canal Company	1910	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	10.00	Tracts described below:				Graham	Ownership data as below:		60.00	
								.60	6S	24E	3	NE¼ NE¼	"	Jesse A. Hancock	3.60		.01
								9.40	6S	24E	3	SE¼ NE¼	"	" " "	56.40		.12
J. H. Brown	1910	Left	6S	31E	6	SW¼ SW¼	Pumping Plant Direct	25.60	Tracts described below:				Greenlee	Ownership data as below:		153.60	
								6.80	6S	30E	1	SW¼ SE¼	"	J. H. Brown	40.80		.08
								16.50	6S	30E	1	SE¼ SE¼	"	" " "	99.00		.2[illegible]
								2.30	6S	31E	6	SW¼ SW¼	"	" " "	13.80		.0[illegible]
Sexton Canal Company	9110	Left	7S	31E	21	SW¼ SE¼	Sexton Canal	9.50	Tracts described below:				Greenlee	Ownership data as below:		57.00	
								2.10	7S	31E	16	SW¼ SW¼	"	West White	12.60		.0[illegible]
								1.00	7S	31E	16	SE¼ SW¼	"	" "	6.00		.01
								5.30	7S	31E	21	NE¼ NW¼	"	" "	31.80		.0[illegible]
								1.10	7S	31E	21	NW¼ NW¼	"	" "	6.60		.01
Duncan Canal Company	1910	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	4.00	Tracts described below:				Greenlee	Ownership data as below:		24.00	
								1.30	8S	32E	19	NW¼ NE¼	"	Mrs. E. M. Simmons	7.80		.0[illegible]
								.50	8S	32E	19	SW¼ NE¼	"	" " " "	3.00		.0[illegible]
								1.80	8S	32E	19	NE¼ NW¼	"	" " " "	10.80		.0[illegible]
								.40	8S	32E	19	SE¼ NW¼	"	" " " "	2.40		.0[illegible]
York Canal Company	1910	Right	6S	31E	29	SW¼ NW¼	York Canal	6.30	Tracts described below:				Greenlee	Ownership data as below:		37.80	
								1.10	6S	31E	7	SE¼ NE¼	"	Richard Kirtland	6.60		.0[illegible]
								.80	6S	31E	7	NE¼ SE¼	"	" "	4.80		.0[illegible]
								2.60	6S	31E	8	SW¼ NW¼	"	" "	15.60		.0[illegible]
								1.80	6S	31E	8	NW¼ SW¼	"	" "	10.80		.0[illegible]

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac. ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Moddle Canal Company	1910	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	12.00	8S	32E	34	SW¼ SE¼	Greenlee	R. C. Moore		72.00		.1
United States	1911	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	160.00	5S	9E	19	SE¼	Pinal	Mark Twain Clemans		960.00		2.0
Fort Thomas Consolidated Canal Company	1911	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	33.00	Tracts described below:				Graham	Ownership data as below:		198.00		.4
								27.40	4S	23E	28	SW¼ NE¼	"	Leslie Montierth & Wendell Montierth	164.40		.34	
								5.60	4S	23E	28	SE¼ NE¼	"	George W. Healy	33.60		.07	
San Jose Canal Company	1911	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	46.80	Tracts described below:				Graham	Ownership data as below:		280.80		.5
								26.80	7S	26E	21	SW¼ SW¼	"	Oscar Olsen	160.80		.34	
								20.00	7S	26E	21	SE¼ SW¼	"	" "	120.00		.25	
Cooper & Windham Extension Canal Company, Under Contract whereby Cooper & Windham Canal Company makes actual diversion.	1911	Right	19S	21W	11	NW¼ SE¼	Cooper & Windham Canal & Cooper & Windham Extension Canal.	73.40	Tracts described below:				Greenlee	Ownership data as below:		440.40		.9
								25.80	7S	31E	5	SE¼ NE¼	"	B. F. Billingsley	154.80		.32	
								15.90	8S	32E	28	NE¼ NE¼	"	" " "	95.40		.20	
								25.40	8S	32E	28	SE¼ NE¼	"	" " "	152.40		.32	
								4.30	8S	32E	28	NE¼ SE¼	"	" " "	25.80		.05	
								2.00	8S	32E	27	NW¼ SW¼	"	School District #27, County of Greenlee, State of Arizona.	12.00		.03	
United States	1912	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal	140.00	Tracts described below:				Pinal	Ownership data as below:		840.00		1.7
								60.00	5S	9E	1	N½ SW¼	"	Chloren B. Shiflet	360.00		.75	
								80.00	5S	9E	30	W½ NE¼	"	Earl G. Clemans	480.00		1.00	
Colvin-Jones Canal Company	1912	Right	4S	23E	26	SW¼ SW¼	Colvin-Jones Canal	16.50	Tracts described below:				Graham	Ownership data as below:		99.00		.2
								1.60	4S	23E	21	SW¼ NE¼	"	C. N. Higgins	9.60		.02	
								4.80	4S	23E	21	SE¼ NE¼	"	" " "	28.80		.06	
								10.10	4S	23E	21	NE¼ SE¼	"	" " "	60.60		.13	
Fort Thomas Consolidated Canal Company	1912	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	28.90	Tracts described below:				Graham	Ownership data as below:		173.40		.3
								6.10	4S	23E	17	SE¼ SW¼	"	E. W. Black	36.60		.05	
								22.80	4S	23E	28	NW¼ NW¼	"	Alonzo Winsor	136.80		.25	
Graham Canal Company	1912	Right	7S	26E	9	NE¼ NW¼	Graham Canal	302.70	Tracts described below:				Graham	Ownership data as below:		1816.20		3.7
								28.50	6S	24E	1	SE¼ SE¼	"	John L. Hoopes	171.00		.36	
								10.00	6S	24E	12	NE¼ NW¼	"	Wilfred Peterson	60.00		.13	
								13.70	6S	24E	12	NW¼ NW¼	"	D. E. Adams	82.20		.17	
								32.00	6S	25E	6	SW¼ SW¼	"	John L. Hoopes	192.00		.40	
								1.50	6S	25E	7	NE¼ NW¼	"	" " "	9.00		.02	
								20.00	6S	25E	7	NW¼ NW¼	"	" " "	120.00		.25	
								12.70	6S	25E	7	SE¼ NW¼	"	Bell Kempton, Administratrix of the Estate of A. N. Bryce, deceased	76.20		.16	

(continued)

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in c. ft. per s.: Individual	Total
Graham Canal Company (continuation)	1912											(continuation)						
								6.60	6S	25E	7	SE¼ SE¼	"	John W. Mattice	39.60		.08	
								7.90	6S	25E	8	NW¼ SW¼	"	John C. Cooper	47.40		.10	
								6.00	6S	25E	8	NW¼ SW¼	"	J. P. Walker	36.00		.07	
								11.70	6S	25E	8	SW¼ SW¼	"	" " "	70.20		.15	
								8.80	6S	25E	8	SE¼ SE¼	"	William E. Bryce	52.80		.11	
								3.60	6S	25E	15	SW¼ SW¼	"	J. R. Moore	21.60		.05	
								24.90	6S	25E	16	NW¼ NW¼	"	S. N. Norton	149.40		.31	
								9.80	6S	25E	16	SW¼ NW¼	"	J. E. Chesley	58.80		.12	
								14.40	6S	25E	16	SW¼ NW¼	"	Mrs. A. W. Chesley	86.40		.18	
								7.40	6S	25E	16	NE¼ SW¼	"	A. J. Dodge	44.40		.09	
								17.10	6S	25E	16	NW¼ SW¼	"	William Wamslee	102.60		.21	
								22.00	6S	25E	17	SE¼ NE¼	"	Mrs. A. W. Chesley	132.00		.27	
								23.80	6S	25E	17	NE¼ SE¼	"	J. L. Foutz	142.80		.30	
								11.20	6S	25E	17	NW¼ SE¼	"	" " "	67.20		.14	
								4.10	6S	25E	18	NW¼ NE¼	"	G. A. Bryce	24.60		.05	
								5.00	6S	25E	21	NE¼ NE¼	"	Mattie Wamslee	30.00		.06	
Union Canal Company	1912	Left	7S	27E	1S	SE¼ NW¼	Union Canal	120.60	Tracts described below:				Graham	Ownership data as below:		723.60		
								7.50	6S	24E	14	NW¼ SE¼	"	Mrs. Sarah Bryce	45.00		.09	
								34.80	6S	24E	14	SW¼ SE¼	"	" " "	208.80		.43	
								18.10	6S	24E	14	SE¼ SE¼	"	" " "	108.60		.22	
								10.00	6S	24E	23	NE¼ NE¼	"	J. A. Mack	60.00		.12	
								2.00	6S	24E	23	NW¼ NE¼	"	" " "	12.00		.03	
								24.80	6S	24E	23	SE¼ NE¼	"	" " "	148.80		.31	
								18.80	6S	24E	24	SE¼ SE¼	"	E. C. Eyring	112.80		.24	
								4.60	6S	24E	25	NE¼ NE¼	"	" " "	27.60		.06	
Duncan Canal Company	1912	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	9.30	8S	32E	29	SE¼ NE¼	Greenlee	G. W. Collins		55.80		
Black & McCleskey Canal Company	1912	Left	8S	32E	19	NE¼ SE¼	Black & McCleskey Canal.	4.00	8S	31E	13	NE¼ NW¼	Greenlee	J. F. McGrath		24.00		
United States	1913	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal.	1210.00	Tracts described below:				Pinal	Ownership data as below:		7260.00		
								80.00	4S	10E	29	S½ SW¼	"	J. L. Mills	480.00		1.00	
								20.00	4S	10E	30	S½ SW¼ SW¼	"	Olive J. O'Connor & James W. O'Connor	120.00		.25	
													"	J. L. Mills	420.00		.87	
								70.00	4S	10E	32	N½ NW¼	"	Ed Lacy & Hazel A. Converse	480.00		1.00	
								80.00	5S	8E	35	S½ NW¼	"	W. J. Clemans, Jr.	960.00		2.00	
								160.00	5S	9E	19	NE¼	"	Winnefred W. Clemans	960.00		2.00	
								160.00	5S	9E	19	SW¼	"	Lillian C. Merchant	480.00		1.00	
								80.00	5S	9E	19	E½ NW¼	"	F. P. Jamieson	932.70		1.94	
								155.45	5S	9E	29	SW¼	"	United States	27.30		.06	
								4.55	5S	9E	29	SW¼	"	J. J. Fraser	960.00		2.00	
								160.00	5S	9E	30	SE¼	"	Ivey Marshall	932.70		1.94	
								155.45	5S	9E	31	NE¼	"	United States	27.30		.06	
								4.55	5S	9E	31	NE¼	"	C. D. Bradley	480.00		1.00	
								80.00	5S	9E	9	S½ SW¼						
Moddle Canal Company	1913	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	7.50	Tracts described below:				Greenlee	Ownership data as below:		45.00		
								6.60	8S	32E	29	SE¼ NW¼	"	Oscar Rainville	39.60		.07	
								.70	8S	32E	29	SE¼ NW¼	"	" "	4.20		.01	
								.20	8S	32E	29	NE¼ SW¼	"	" "	1.20		.01	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Colvin-Jones Canal Company	1913	Right	4S	23E	26	SW¼ SW¼	Colvin-Jones Canal	21.80	Tracts described below:				Graham	Ownership data as below:		130.80		.27
								12.50	4S	23E	21	SW¼ NE¼	"	C. N. Higgins	75.00		.16	
								7.50	4S	23E	21	SE¼ NW¼	"	" " "	43.80		.09	
								2.00	4S	23E	21	NW¼ SE¼	"		12.00		.02	
Fort Thomas Consolidated Canal Company	1913	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	35.20	Tracts described below:				Graham	Ownership data as below:		211.20		.44
								12.70	4S	23E	18	NE¼ SE¼	"	Norman J. Johnson	76.20		.16	
								8.00	4S	23E	18	NW¼ SE¼	"	" "	48.00		.10	
								7.90	4S	23E	18	SW¼ SE¼	"	E. W. Black	47.40		.10	
								1.40	4S	23E	35	NW¼ SW¼	"	W. O. Tuttle	8.40		.02	
								5.20	4S	23E	35	SW¼ SW¼	"	" " "	31.20		.06	
Dodge-Nevada Canal Company	1913	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	581.50	Tracts described below:				Graham	Ownership data as below:		3489.00		7.27
								37.00	5S	23E	14	SW¼ NE¼	"	E. P. Bryce	222.00		.46	
								37.00	5S	23E	14	NW¼ SE¼	"	Carrie B. Yett & E. D. Householder	222.00		.46	
								38.20	5S	23E	14	SW¼ SE¼	"	Sam Henry	229.20		.48	
								24.80	5S	23E	23	SW¼ NE¼	"	E. M. Plumb	148.80		.31	
								32.30	5S	23E	23	SE¼ NE¼	"	" " "	193.80		.40	
								38.80	5S	23E	24	NE¼ SW¼	"	John Carpenter	232.80		.49	
								32.20	5S	23E	24	NW¼ SW¼	"	" "	193.20		.40	
								32.20	5S	23E	24	SW¼ SW¼	"	" "	193.20		.40	
								39.10	5S	23E	24	SE¼ SW¼	"	" "	234.60		.49	
								8.10	5S	23E	24	SW¼ SE¼	"	Niels J. Roseberry	48.60		.10	
								37.70	5S	23E	24	SE¼ SE¼	"	" " "	226.20		.47	
								.30	5S	23E	25	NE¼ NE¼	"	George A. Mathews	1.80		.01	
								23.60	5S	23E	25	NE¼ NE¼	"	Asa Packer	141.60		.30	
								9.90	5S	23E	25	NW¼ NE¼	"	George A. Mathews	59.40		.12	
								24.90	5S	23E	25	SW¼ NE¼	"	George Clyde Mathews	149.40		.31	
								16.70	5S	23E	25	SE¼ NE¼	"	" " "	100.20		.21	
								19.70	5S	23E	25	SE¼ NE¼	"	George A. Mathews	118.20		.25	
								31.40	5S	24E	30	NW¼ NW¼	"	Asa Packer	188.40		.39	
								39.30	5S	24E	30	SW¼ NW¼	"	George A. Mathews	235.80		.49	
								36.90	5S	24E	30	SE¼ SW¼	"	L. A. Adams	221.40		.46	
								21.40	5S	24E	31	NE¼ NW¼	"	Mrs. J. E. Cluff	128.40		.27	
Smithville Canal Company	1913	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	8.40	Tract described below:				Graham	Ownership data as below:		50.40		.10
								1.80	6S	24E	9	NW¼ SE¼	"	William S. Mac	10.80		.02	
								2.40	6S	24E	9	NE¼ NE¼	"	" " "	14.40		.03	
								4.20	6S	24E	9	SE¼ NE¼	"	" " "	25.20		.05	
United States	1914	Left	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence Casa Grande Canal.	827.00	Tracts described below:				Pinal	Ownership data as below:		4962.00		10.34
								160.00	4S	9E	35	NE¼ & NW¼ SE¼	"	Willie K. Pearson	960.00		2.00	
								40.00	5S	8E	21	SE¼ SE¼	"	Inez H. Conrad	240.00		.50	
								20.00	5S	8E	21	S½ NE¼ SE¼	"	" " "	120.00		.25	
								160.00	5S	8E	25	SE¼	"	F. A. Urban	960.00		2.00	
								12.00	5S	9E	1	E½ NE¼ NW¼	"	Ernest W. McFarland	72.00		.15	
								25.00	5S	9E	11	NW¼ NE¼	"	Dugald Stewart	150.00		.31	
								150.00	5S	9E	32	NW¼	"	J. C. Jamieson	900.00		1.88	
								30.00	6S	6E	29	SE¼ SW¼	"	Amandus F. Peters, Jr. and Marie C. Peters	180.00		.37	
								160.00	6S	8E	1	Lots 9 & 10 S½ NE¼	"	Esther A. Brockway	960.00		2.00	
								70.00	6S	9E	6	Lots 2, 3 & 4	"	David I. Little	420.00		.88	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location, referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Max[imum] rate o[f diver]sion [in cu.] ft. p[er second]: Individual
Curtis Canal Company	1914	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	1.40	5S	24E	28	NW¼ NW¼	Graham	J. D. Busby		8.40	
Fort Thomas Consolidated Canal Company	1914	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	73.70	Tracts described below:				Graham	Ownership data as below:		442.20	
								4.50	4S	23E	35	NE¼ SW¼	"	William O. Tyler	27.00		.06
								.80	4S	23E	35	SW¼ SW¼	"	Pablo Barela	4.80		.01
								3.00	4S	23E	35	SW¼ SW¼	"	L. J. Brown, Jr.	18.00		.04
								1.50	4S	23E	35	SW¼ SW¼	"	Mrs. Clara Hinton	9.00		.02
								1.70	4S	23E	35	SW¼ SW¼	"	A. A. Smith	10.20		.03
								31.00	4S	23E	35	SE¼ SW¼	"	L. J. Brown, Jr.	186.00		.39
								7.10	4S	23E	35	SE¼ SE¼	"	Oscar Tyler	42.60		.09
								24.10	5S	24E	19	SW¼ NW¼	"	Charles M. Layton	144.60		.30
Dodge-Nevada Canal Company	1914	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	67.80	Tracts described below:				Graham	Ownership data as below:		406.80	
								16.10	5S	23E	11	NE¼ SW¼	"	W. H. Roach	96.60		.20
								38.60	5S	23E	23	NW¼ NE¼	"	Sam Henry	231.60		.49
								.20	5S	24E	30	NE¼ NW¼	"	A. E. Weech	1.20		.01
								12.90	5S	24E	30	SE¼ NW¼	"	" " "	77.40		.16
Graham Canal Company	1914	Right	7S	26E	9	NE¼ NW¼	Graham Canal	94.60	Tracts described below:				Graham	Ownership data as below:		567.60	
								6.10	6S	24E	2	NE¼ SW¼	"	Joseph Moyes	36.60		.09
								6.70	6S	24E	2	SE¼ SW¼	"	" "	40.20		.09
								33.60	6S	24E	2	SW¼ SE¼	"	Leslie W. Layton & Zeb Ison	201.00		.43
								8.10	6S	25E	16	SE¼ SW¼	"	A. O. Lamoreaux, Jr.	48.60		.10
								1.40	6S	25E	16	NE¼ SE¼	"	Wilfred Peterson	8.40		.02
								1.30	6S	25E	16	NW¼ SE¼	"	" "	7.80		.02
								8.80	6S	25E	16	NW¼ SE¼	"	George Sanders	52.80		.11
								28.70	6S	25E	16	SW¼ SE¼	"	Wilfred Peterson	172.20		.36
Union Canal Company	1914	Left	7S	26E	18	SE¼ NW¼	Union Canal	17.00	6S	25E	30	NW¼ NW¼	Graham	P. H. Teeple		102.00	
Albert Canal Company	1914						Albert Canal	8.80	Tracts described below:				Greenlee	Ownership data as below:		52.80	
								6.30	7S	31E	21	SE¼ NW¼	"	H. Albert & W. Bleinstein	37.80		.08
								2.50	7S	31E	21	NE¼ SW¼	"	" " " " "	15.00		.03
Valley Canal Company	1914	Right	19S	21W	4	NE¼ NW¼	Valley Canal	43.60	Tracts described below:				Greenlee	Ownership data as below:		261.60	
								3.90	8S	31E	11	SW¼ NE¼	"	J. L. T. Watters	23.40		.0
								7.70	8S	31E	11	NE¼ NW¼	"	" " " "	46.20		.10
								5.20	8S	31E	11	NW¼ SE¼	"	" " " "	31.20		.0
								6.70	8S	31E	12	SE¼ NW¼	"	W. V. McCarty	40.20		.0
								9.70	8S	31E	12	NE¼ SW¼	"	" " "	58.20		.1
								10.40	8S	31E	12	NW¼ SW¼	"	" " "	62.40		.1
Curtis Canal Company	1915	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	22.10	Tracts described below:				Graham	Ownership data as below:		132.60	
								10.00	5S	24E	20	NE¼ NW¼	"	C. E. Ferrin	60.00		.1
								8.90	5S	24E	28	SE¼ NW¼	"	B. O. Rapier	53.40		.1
								3.20	5S	24E	28	NE¼ SW¼	"	" " "	19.20		.0
Smithville Canal Company	1915	Left	6S	25E	35	SE¼ NE¼	Smithville Canal	184.80	Tracts described below:				Graham	Ownership data as below:		1108.80	
								15.90	6S	24E	5	SW¼ NE¼	"	C. J. McElroy	95.40		.2
								10.00	6S	24E	5	NE¼ NW¼	"	Mrs. Frank Curtis	60.00		.1
								33.90	6S	24E	5	NW¼ SE¼	"	C. J. McElroy	203.40		.4
								23.10	6S	24E	5	NE¼ SW¼	"	A. O. Mack	138.60		.2
								18.00	6S	24E	5	SE¼ SW¼	"	A. O. Mack	108.00		.2

(continued)

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Smithville Canal Company (continuation)	1915							39.30	6S	24E	6	(continuation) NW¼ NE¼	Graham	Henry H. Mack	235.80		.49	
								1.10	6S	24E	6	SW¼ NE¼	"	" " "	6.60		.01	
								5.80	6S	24E	6	NE¼ NW¼	"	" " "	34.80		.07	
								37.70	6S	24E	6	NE¼ NE¼	"	A. O. Mack	226.20		.47	
Fort Thomas Consolidated Canal Company	1915	Left	6S	24E	9	NW¼ NW¼	Fort Thomas Consolidated Canal	53.90	Tracts described below:				Graham	Ownership data as below:		323.40		.0
								5.50	4S	23E	20	NW¼ NW¼	"	C. N. Rose	33.00		.07	
								15.20	4S	23E	20	SW¼ NW¼	"	" " "	91.20		.19	
								8.30	5S	23E	2	NW¼ SE¼	"	H. L. Colvin	49.80		.10	
								8.90	5S	23E	2	NW¼ SE¼	"	L. W. Smith	53.40		.11	
								6.60	5S	23E	13	SE¼ NE¼	"	William Wamslee & Charles Wamslee	36.90		.08	
								9.40	5S	23E	13	SE¼ SW¼	"	M. D. Maloy	56.40		.12	
Dodge-Nevada Canal Company	1915	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	199.60	Tracts described below:				Graham	Ownership data as below:		1197.60		2.
								5.10	5S	23E	13	SE¼ SW¼	"	M. D. Maloy	30.60		.06	
								23.00	5S	23E	14	NE¼ NW¼	"	W. H. Roach	138.00		.29	
								20.60	5S	23E	14	SE¼ NW¼	"	G. J. Hatch	123.60		.26	
								21.40	5S	23E	14	NE¼ SW¼	"	" " "	128.40		.27	
								35.00	5S	23E	14	SE¼ SW¼	"	Sam Henry	210.00		.44	
								5.00	5S	23E	24	SW¼ NW¼	"	E. R. Naillon	30.00		.06	
								19.70	5S	23E	24	SE¼ NW¼	"	E. M. Plumb	118.20		.24	
								30.40	5S	23E	25	SE¼ SE¼	"	Charles P. Johns	182.40		.38	
								39.40	5S	24E	30	SW¼ SW¼	"	L. A. Adams	236.40		.49	
Graham Canal Company	1915	Right	7S	26E	9	NE¼ NW¼	Graham Canal	31.00	Tracts described below:				Graham	Ownership data as below:		186.00		.
								6.50	6S	24E	1	SW¼ NE¼	"	Heber B. Bryce	39.00		.08	
								24.50	6S	25E	16	SE¼ SE¼	"	W. F. Butler, Jr.	147.00		.30	
San Jose Canal Company	1915	Left	6S	27E	36	SW¼ SW¼	San Jose Canal	32.00	Tracts described below:				Graham	Ownership data as below:		192.00		.
								3.90	7S	26E	25	SW¼ NE¼	"	Braulio Ochoba	23.40		.05	
								13.70	7S	26E	25	SE¼ NE¼	"	Pedro Franco	82.20		.17	
								1.70	7S	27E	30	SW¼ NW¼	"	Emery Adelbert Curtis	10.20		.02	
								6.30	7S	27E	30	SE¼ NW¼	"	" " "	37.80		.08	
								3.00	7S	27E	30	NE¼ SW¼	"	" " "	18.00		.04	
								3.40	7S	27E	30	NW¼ SW¼	"	" " "	20.40		.04	
Colmenero Canal Company	1915	Right	8S	31E	11	NW¼ SW¼	Colmenero Canal	1.40	8S	31E	4	NE¼ NE¼	Greenlee	Charles Telles		8.40		.
Valley Canal Company	1915	Right	19S	21W	4	NE¼ NW¼	Valley Canal	30.90	Tracts described below:				Greenlee	Ownership data as below:		185.40		.
								15.00	8S	31E	12	SE¼ SE¼	"	G. I. Elmer	90.00		.18	
								13.40	8S	32E	20	SE¼ SE¼	"	H. J. Nunn & T. A. Nunn	80.40		.17	
								2.50	8S	32E	19	NE¼ NE¼	"	Alice H. Cooper	15.00		.03	
United States	1916	Both	4S	11E	8	NW¼	Ashurst-Hayden Diversion Dam & Florence-Casa Grande Canal and Sacaton Diversion Dam.	62,000	Lands of Florence-Casa Grande Project				Pinal	For full statement of this Right see Article VI (3)		372,000		775.
			4S	6E	12	SE¼												

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to S. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in ... ft. per ...: Individual	T
Nevada Consolidated Copper Company	1916	Left	5S	15E	16	SE¼ SE¼	Vann Ditch	70.00	Tracts described below:				Pinal	Ownership data as below:	60.00	420.00	.12	
								10.00	5S	15E	7	S½ SE¼	"	(Nevada Consolidated	180.00		.38	
								30.00	5S	15E	8	S½ SW¼	"	(Copper Company	180.00		.38	
								30.00	5S	15E	17	N½ NE¼, NE¼ NW¼		(				
Fort Thomas Consolidated Canal Company	1916	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	42.00	Tracts described below:				Graham	Ownership data as below:		252.00		
								3.00	4S	23E	19	SE¼ NE¼	"	J. N. Holyoak	18.00		.04	
								39.00	5S	24E	19	NW¼ NW¼	"	M. P. Tryon	234.00		.49	
Dodge-Nevada Canal Company	1916	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	74.30	Tracts described below:				Graham	Ownership data as below:		445.80		
								31.60	5S	24E	30	NE¼ SW¼	"	Dan Young	189.60		.39	
								40.00	5S	24E	30	NW¼ SW¼	"	L. A. Adams	240.00		.50	
								2.50	5S	24E	30	SE¼ SW¼	"	Dan Young	15.00		.03	
								.20	5S	24E	30	SW¼ SE¼	"	" "	1.20		.01	
								19.00	Tracts described below:				Graham	Ownership data as below:		114.00		
								12.50	6S	25E	26	SW¼ NW¼	"	Joseph Howard & J. M. Howard	75.00		.16	
								6.50	6S	25E	26	SE¼ NW¼	"	" " " " "	39.00		.05	
Graham Canal Company	1916	Right	7S	26E	9	NE¼ NW¼	Graham Canal	10.00	6S	25E	35	SW¼ NW¼	Graham	L. S. Branam		60.00		
Union Canal Company	1916	Left	7S	27E	18	SE¼ NW¼	Union Canal						Greenlee	Ownership data as below:		172.80		
Cosper & Windham Extension Canal Company. Under contract whereby Cosper & Windham Ditch makes actual diversion.	1916	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Ditch & Cosper & Windham Extension canal.	28.80	Tracts described below:				"	J. C. Burleson	120.60		.25	
								20.10	8S	32E	21	SE¼ SW¼	"	" " "	52.20		.11	
								8.70	8S	32E	21	SW¼ SE¼						
C. C. Hester	1916	Left	6S	31E	19	SW¼ SE¼	Pumping Plant Direct	4.30	Tracts described below:				Greenlee	Ownership data as below:		25.80		
								3.50	6S	31E	19	NW¼ SE¼	"	C. C. Hester	21.00		.04	
								.80	6S	31E	19	SW¼ SE¼	"	" " "	4.80		.01	
Union Canal Company	1917	Left	7S	27E	18	SE¼ NW¼	Union Canal	31.60	Tracts described below:				Graham	Ownership data as below:		189.60		
								2.00	6S	24E	14	SE¼ SW¼	"	H. G. Boyle	12.00		.03	
								10.10	6S	24E	23	SW¼ NE¼	"	F. H. Holiday	60.60		.13	
								18.00	6S	24E	23	NE¼ NW¼	"	H. G. Boyle	108.00		.22	
								1.50	6S	24E	24	SW¼ NW¼	"	G. B. Maloy	9.00		.02	
Dodge-Nevada Canal Company	1917	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	105.50	Tracts described below:				Graham	Ownership data as below:		633.00		
								32.40	5S	23E	11	SE¼ SW¼	"	W. H. Roach	194.40		.40	
								7.70	5S	23E	14	NE¼ NW¼	"	" " "	46.20		.16	
								27.20	5S	23E	23	NE¼ SE¼	"	W. A. Pitt	163.20		.34	
								11.20	5S	23E	24	NE¼ SE¼	"	Gilbert Richardson	67.20		.14	
								12.20	5S	23E	24	NW¼ SE¼	"	" "	73.20		.15	
								13.30	5S	24E	19	SW¼ SW¼	"	" "	79.80		.17	
								1.50	6S	24E	5	SE¼ NE¼	"	Martha McElroy	9.00		.02	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Fort Thomas Consolidated Canal Company	1917	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	46.50	Tracts described below:				Graham	Ownership data as below:		279.00		.58
								5.20	4S	23E	19	NE¼ SE¼	"	William H. Holyoak	31.20		.06	
								9.30	4S	23E	20	NW¼ SW¼	"	J. N. Holyoak	55.80		.12	
								6.50	4S	23E	20	NW¼ SW¼	"	William H. Holyoak	39.00		.03	
								6.80	4S	23E	28	NW¼ SW¼	"	Edgar H. Chesley	40.80		.09	
								6.30	4S	23E	29	NE¼ NE¼	"	School District #31, County of Graham, State of Arizona	37.80		.08	
								2.50	4S	23E	28	SW¼ SW¼	"	Edgar H. Chesley	15.00		.03	
								8.30	4S	23E	28	SE¼ SW¼	"	" " "	49.80		.10	
								1.60	4S	23E	35	NW¼ SW¼	"	Mrs. Clara Hinton	9.60		.02	
Montezuma Canal Company	1917	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	21.50	Tracts described below:				Graham	Ownership data as below:		129.00		.27
								1.50	7S	25E	11	SE¼ SW¼	"	(Sarah L. Richardson and (Rebecca J. Richardson (	9.00		.02	
								20.00	7S	25E	11	SW¼ SE¼	"	(	120.00		.25	
Smithville Canal Company	1917	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	2.00	6S	24E	10	NW¼ SE¼	Graham	Leo Keiffer		12.00		.02
Graham Canal Company	1917	Right	7S	26E	9	NE¼ NW¼	Graham Canal	133.40	Tracts described below:				Graham	Ownership data as below:		800.40		1.66
								29.50	6S	24E	2	SE¼ SE¼	"	D. Raper	177.00		.37	
								2.60	6S	24E	3	NE¼ NE¼	"	Jesse A. Hancock	15.60		.03	
								17.50	6S	24E	3	SE¼ NE¼	"	" " "	105.00		.22	
								8.20	6S	25E	7	SW¼ NE¼	"	Guy W. Lamoreaux	49.20		.10	
								16.00	6S	25E	22	NE¼ SE¼	"	E. D. Howard	96.00		.20	
								14.60	6S	25F	22	SE¼ SE¼	"	" " "	87.60		.18	
								2.80	6S	25E	26	SW¼ NE¼	"	Pratt Stewart	16.80		.03	
								2.20	6S	25E	26	SE¼ NW¼	"	John Nulton	13.20		.03	
								8.90	6S	25E	26	NE¼ SW¼	"	" "	53.40		.11	
								5.60	6S	25E	36	SW¼ NE¼	"	Jerome Walker	33.60		.07	
								4.10	6S	25E	36	NW¼ NW¼	"	W. H. Spafford	24.60		.05	
								4.60	6S	25E	36	SW¼ NW¼	"	" " "	27.60		.06	
								1.90	6S	25E	36	SW¼ NW¼	"	Alma Peterson	11.40		.02	
								7.70	6S	25E	36	SE¼ NW¼	"	" "	46.20		.10	
								7.20	6S	25E	36	SE¼ NW¼	"	Jerome Walker	43.20		.09	
Curtis Canal Company	1917	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	21.40	Tracts described below:				Graham	Ownership data as below:		128.40		.27
								17.80	5S	24E	7	NE¼ SE¼	"	M. P. McEuen	106.80		.22	
								3.60	5S	24E	33	NW¼ NE¼	"	Lee L. Palmer	21.60		.05	
T. D. Burton	1917	Right	4S	23E	26	SE¼ SW¼	Pumping Plant Direct	40.30	Tracts described below:				Graham	Ownership data as below:		241.80		.50
								6.60	4S	23E	20	NE¼ SW¼	"	T. D. Burton	39.60		.08	
								22.40	4S	23E	26	NW¼ SW¼	"	" " "	134.40		.28	
								.60	4S	23E	26	SW¼ SW¼	"	" " "	3.60		.01	
								10.70	4S	23E	26	SE¼ SW¼	"	" " "	64.20		.13	
Moddie Canal Company	1917	Left	19S	21W	11	NW¼ SE¼	Moddie Canal	6.60	Tracts described below:				Greenlee	Ownership data as below:		39.60		.83
								1.20	8S	32E	34	SW¼ SE¼	"	R. C. Moore	7.20		.15	
								1.10	9S	32E	3	NE¼ SW¼	"	Amos F. Fearin	6.60		.14	
								4.30	9S	32E	3	NW¼ SW¼	"	" " "	25.80		.54	
Valley Canal Company	1917	Right	19S	21W	4	NW¼ NW¼	Valley Canal	10.10	8S	31E	12	SW¼ SE¼	Greenlee	Nance E. Ragsdale & Margaret I. Ragsdale		60.60		.13

Party entitled to divert from the stream	Date of priority	Side of stream	Location Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Number of acres	Description Referred to G. & S. R. B. & M. or N. M. B. & M. Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	For irrigation season in ac.-ft. Indi-vid-ual	Total	Maximu rate of di sion in c ft. per s Indi-vid-ual	To
Colmenero Canal Company	1917	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal	9.10	Tracts described below:				Greenlee	Ownership data as below:		54.60		
								1.00	7S	31E	21	SE¼ NE¼	"	Roy D. Williams	6.00		.02	
								8.10	7S	31E	21	SE¼ NW¼	"	" " "	48.60		.10	
R. C. Gilliland	1917	Right	6S	30E	1	NE¼ SE¼	Pumping Plant direct	18.10	Tracts described below:				Greenleo	Ownership data as below		108.60		
								4.00	6S	30E	1	NE¼ SW¼	"	R. C. Gilliland	24.00		.05	
								14.10	6S	30E	1	NW¼ SE¼	"	" " "	84.60		.18	
J. W. Foote	1917	Right	6S	31E	7	N½ NW¼	Pumping Plant	6.20	6S	31E	6	SW¼ SW¼	Greenlee	J. W. Foote		37.20		
Sunset Canal Company	1917	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	250.20	Tracts described below:				Hidalgo	Ownership data as below:		1537.20		
								16.90	18S	21W	32	SW¼ NW¼	"	R. J. McLaren	101.40		.21	
								8.70	18S	21W	32	SE¼ NE¼	"	Hans Mortensen	52.20		.11	
								.80	18S	21W	32	NE¼ SE¼	"	" "	4.80		.01	
								7.70	18S	21W	32	NE¼ SE¼	"	M. M. Allred & W. J. Mabin	46.20		.10	
								12.30	18S	21W	32	NE¼ SE¼	"	Fenley F. Merrill	73.80		.15	
								7.50	18S	21W	32	SW¼ NE¼	"	B. Y. Whipple	45.00		.09	
								10.50	18S	21W	32	NW¼ SE¼	"	" " "	63.00		.13	
								8.80	18S	21W	32	NE¼ SW¼	"	" " "	52.80		.11	
								4.50	18S	21W	32	SW¼ NW¼	"	P. L. Lunt	27.00		.06	
								8.00	18S	21W	32	SW¼ NE¼	"	E. C. Payne	48.00		.10	
								12.70	18S	21W	32	SE¼ NW¼	"	" " "	76.20		.16	
								5.20	18S	21W	32	NE¼ SW¼	"	" " "	31.20		.06	
								9.90	18S	21W	32	NW¼ SE¼	"	" " "	59.40		.12	
								12.50	18S	21W	32	SW¼ NE¼	"	G. Q. Payne	75.00		.16	
								15.50	18S	21W	32	NW¼ SE¼	"	" " "	93.00		.19	
								1.70	18S	21W	32	SE¼ SE¼	"	Mrs. T. M. Williamson	10.20		.02	
								.30	18S	21W	82	NW¼ SE¼	"	Anna H. Lunt	1.80		.01	
								7.30	18S	21W	32	NE¼ SE¼	"	" " "	43.80		.09	
								8.40	18S	21W	33	NW¼ SW¼	"	John B. Jones	50.40		.11	
								9.20	18S	21W	33	SE¼ SE¼	"	Fenley F. Merrill	55.20		.11	
								12.00	18S	21W	33	NW¼ SW¼	"	" " "	72.00		.15	
								7.10	18S	21W	33	SW¼ NW¼	"	H. Grady	42.60		.09	
								27.90	18S	21W	33	SW¼ SW¼	"	G. V. Lunt	167.40		.35	
								18.60	18S	21W	33	NW¼ SW¼	"	Orson A. Merrill	111.60		.23	
								3.40	18S	21W	34	SW¼ SW¼	"	Church of Jesus Christ of Latter Day Saints, J. E. Payne, trustee	20.40		.04	
								1.40	19S	21W	32	SW¼ NE¼	"	Mary Jane Jones	8.40		.02	
								8.10	19S	21W	32	SE¼ NE¼	"	" " "	48.60		.10	
								1.60	19S	21W	32	NW¼ SE¼	"	" " "	9.60		.03	
								7.70	19S	21W	32	NE¼ SE¼	"	" " "	46.20		.10	
Cosper & Windham Canal Company	1917	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Canal	97.60	Tracts described below:				Hidalgo	Ownership data as below:		585.60		
								2.90	18S	21W	31	Lot 2	"	Randall Lunt, Administrator of the Estate of Jasper Gale, deceased	17.40		.04	
								13.10	18S	21W	32	NE¼ SW¼	"	R. W. Brooks	78.60		.16	
								17.30	18S	21W	32	SE¼ NW¼	"	" " "	103.80		.22	
								14.60	18S	21W	32	NW¼ SW¼	"	Peter Wahlloe	87.60		.18	
								1.70	18S	21W	32	SE¼ SE¼	"	A. C. Gruwell	10.20		.02	
								25.30	18S	21W	33	SW¼ SE¼	"	R. H. Lunt	151.80		.32	
								17.90	18S	21W	33	NW¼ SE¼	"	G. V. Lunt	107.40		.22	
								2.00	18S	21W	33	SE¼ SW¼	"	E. G. Davidson	12.00		.02	
								.40	18S	21W	33	SW¼ SW¼	"	A. C. Gruwell	2.40		.01	
								2.40	19S	21W	3	SW¼ NE¼	"	George H. Cosper, Jr., Administrator of the estate of George Cosper, deceased.	14.40		.03	

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Location (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description (Referred to G. & S. R. B. & M. or N. M. B. & M.): Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Union Canal Company	1918	Left	7S	27E	18	SE¼ NW¼	Union Canal	19.10	Tracts described below:				Graham	Ownership data as below:		114.60		.24
								15.10	6S	24E	14	SE¼ NW¼	"	W. A. Carter, Jr.	90.60		.18	
								4.00	6S	25E	30	SE¼ NE¼	"	C. M. Beal	24.00		.06	
Dodge-Nevada Canal Company	1918	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	12.00	Tracts described below:				Graham	Ownership data as below:		72.00		.15
								3.70	5S	23E	11	SW¼ SW¼	"	Forest Gilliland	22.20		.05	
								6.00	5S	23E	14	NW¼ NW¼	"	" "	36.00		.07	
								2.30	5S	23E	24	NE¼ NW¼	"	G. J. Hatch	13.80		.03	
Fort Thomas Consolidated Canal Company	1918	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	26.80	Tracts described below:				Graham	Ownership data as below:		160.80		.33
								24.80	5S	23E	2	NE¼ SE¼	"	L. W. Smith	148.80		.31	
								2.00	5S	23E	2	NW¼ SE¼	"	" " "	12.00		.02	
Graham Canal Company	1918	Right	7S	26E	9	NE¼ NW¼	Graham Canal	75.90	Tracts described below:				Graham	Ownership data as below:		455.40		.95
								12.80	6S	25E	7	SE¼ NE¼	"	Thomas McGuire	76.80		.16	
								12.10	6S	25E	7	NE¼ NW¼	"	John L. Hoopes	72.60		.15	
								5.90	6S	25E	7	NE¼ SE¼	"	George O. Peck.	35.40		.07	
								27.10	6S	25E	8	SW¼ NW¼	"	A. J. Bryce	162.60		.34	
								6.00	6S	25E	8	SW¼ NW¼	"	R. D. Lamoreaux	36.00		.08	
								4.00	6S	25E	8	SE¼ NW¼	"	John C. Cosper	24.00		.05	
								8.00	6S	25E	17	SW¼ NE¼	"	J. I. Palmer	48.00		.10	
Cosper & Windham Extension Canal Company. Under contract whereby Cosper & Windham Ditch makes actual diversion.	1918	Right	19S	21W	11	NW¼ SE¼	Cosper & Windham Ditch & Cosper & Windham Extension Canal.	62.00	Tracts described below:				Greenlee	Ownership data as below:		372.00		.78
								.20	8S	32E	27	SW¼ NW¼	"	J. M. Gilliland	1.20		.01	
								2.40	8S	32E	27	NE¼ SW¼	"	" " "	14.40		.03	
								16.70	8S	32E	27	NW¼ SW¼	"	" " "	100.20		.21	
								6.70	8S	32E	27	SW¼ SW¼	"	Edward Lunt	30.20		.08	
								5.00	8S	32E	27	SE¼ SW¼	"	" "	30.00		.06	
								13.00	8S	32E	28	NW¼ NE¼	"	Emil Girard	78.00		.16	
								10.80	8S	32E	28	SW¼ NE¼	"	" "	64.80		.14	
								7.20	8S	32E	28	NW¼ NE¼	"	" "	43.20		.09	
Valley Canal Company	1918	Right	19S	21W	4	NE¼ NW¼	Valley Canal	8.60	Tracts described below:				Greenlee	Ownership data as below:		51.60		.11
								5.80	8S	32E	28	NW¼ NE¼	"	Emil Girard	34.80		.07	
								2.80	8S	32E	28	SW¼ NE¼	"	" "	16.80		.04	
Moddle Canal Company	1918	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	4.00	Tracts described below:				Greenlee	Ownership data as below:		24.00		.05
								1.00	8S	32E	29	SW¼ SW¼	"	Nellie R. Hoch	6.00		.01	
								3.00	8S	32E	32	NW¼ SW¼	"	C. C. Passmore	18.00		.04	
J. W. Foote	1918	Right	6S	31E	7	N½ NW¼	Pumping Plant indirect	6.50	Tracts described below:				Greenlee	Ownership data as below:		39.00		.08
								3.60	6S	31E	7	NE¼ NW¼	"	J. W. Foote	21.60		.04	
								2.90	6S	31E	7	NW¼ NW¼	"	" " "	17.40		.04	
R. Sexton	1918	Right	7S	31E	16	NE¼ NW¼	Pumping Plant Direct	7.50	7S	31E	9	SE¼ SW¼	Greenlee	R. Sexton		45.00		.09

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maxi rate of sion in ft. per: Individual
Montezuma Canal Company	1919	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	80.80	Tracts described below:				Graham	Ownership data as below:		484.80	
								3.00	7S	25E	10	NE¼ NW¼	"	J. A. Farley	18.00		.04
								18.00	7S	25E	13	SE¼ SE¼	"	Elam Olsen	108.00		.22
								7.60	7S	25E	13	NE¼ SE¼	"	"	45.60		.10
								10.00	7S	26E	14	NE¼ NW¼	"	Edward M. Claridge	60.00		.13
								12.00	7S	26E	14	NW¼ NW¼	"	" " "	72.00		.14
								19.20	7S	26E	14	SW¼ NW¼	"	" " "	115.20		.24
								9.00	7S	26E	14	SE¼ NW¼	"	" " "	54.00		.11
								2.00	7S	26E	21	NW¼ SW¼	"	William Ellsworth	12.00		.03
Brown Canal Company	1919	Right	6S	28E	30	SE¼ SE¼	Brown Canal	23.80	Tracts described below:				Graham	Ownership data as below:		142.80	
								3.90	6S	28E	31	SW¼ NE¼	"	J. W. Earvin	23.40		.05
								19.90	6S	28E	31	SE¼ NE¼	"	" " "	119.40		.25
Union Canal Company	1919	Left	7S	27E	18	SE¼ NW¼	Union Canal	58.00	Tracts described below:				Graham	Ownership data as below:		348.00	
								12.00	7S	26E	15	NE¼ NE¼	"	(Charles M. Purnley & (Robert L. Nash	72.00		.15
								3.00	7S	26E	15	NW¼ NE¼	"	(	18.00		.04
								2.80	7S	26E	15	SW¼ NE¼	"	(	16.80		.03
								13.90	7S	26E	15	SE¼ NE¼	"	(	83.40		.17
								12.20	7S	26E	15	NE¼ NW¼	"	(	73.20		.15
								5.50	7S	26E	15	NW¼ NW¼	"	(	33.00		.07
								8.60	7S	26E	15	NW¼ NW¼	"	J. T. Owens, Jr.	51.60		.11
Smithville Canal Company	1919	Left	6S	25E	35	SW¼ NE¼	Smithville Canal	45.40	Tracts described below:				Graham	Ownership data as below:		272.40	
								8.40	6S	24E	11	SE¼ SW¼	"	P. A. Norton	50.40		.11
								4.40	6S	24E	14	NE¼ NW¼	"	" " "	26.40		.06
								6.60	6S	24E	14	NE¼ NW¼	"	Thomas Batty	39.60		.09
								26.00	6S	25E	27	NW¼ NW¼	"	R. William Bingham	156.00		.31
Dodge-Nevada Canal Company	1919	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal	104.30	Tracts described below:				Graham	Ownership data as below:		625.80	
								10.00	5S	23E	14	NW¼ NE¼	"	E. P. Bryce	60.00		.13
								6.30	5S	23E	23	NE¼ NW¼	"	J. L. Green	37.80		.08
								3.20	5S	23E	24	SW¼ NE¼	"	Angus Maloy	19.20		.04
								9.30	5S	23E	24	NE¼ SE¼	"	Forrest Gilliland	55.80		.12
								40.00	5S	23E	25	NE¼ SE¼	"	Charles P. Johns	240.00		.50
								30.60	5S	24E	31	NW¼ NW¼	"	Mrs. J. E. Cluff	183.60		.38
								4.90	5S	24E	31	SW¼ NW¼	"	" " " "	29.40		.05
Fort Thomas Consolidated Canal Company	1919	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal	62.00	Tracts described below:				Graham	Ownership data as below:		372.00	
								8.50	4S	23E	17	SW¼ SW¼	"	E. W. Black	51.00		.11
								3.00	4S	23E	18	SE¼ NE¼	"	J. E. Pulsipher	18.00		.04
								2.50	5S	23E	13	NE¼ NE¼	"	(William Wamslee &	15.00		.03
								18.00	5S	23E	13	SE¼ NE¼	"	(Charles Wamslee	108.00		.23
								30.00	5S	24E	19	NE¼ SW¼	"	David Rogers	180.00		.37
Graham Canal Company	1919	Right	7S	26E	9	NE¼ NW¼	Graham Canal	24.60	Tracts described below:				Graham	Ownership data as below:		147.60	
								5.60	6S	25E	7	SE¼ NW¼	"	William A. Peck	33.60		.07
								5.00	6S	25E	8	SE¼ SE¼	"	William E. Bryce	30.00		.06
								2.00	6S	25E	17	NE¼ SW¼	"	W. M. Blair	12.00		.03
								2.00	6S	25E	17	SE¼ SW¼	"	" "	12.00		.03
								10.00	6S	25E	21	NW¼ NE¼	"	A. T. West	60.00		.12

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maximum rate of diversion in cu. ft. per sec.: Individual	Total
Curtis Canal Company	1919	Right	6S	24E	12	NW¼ NW¼	Curtis Canal	19.60	Tracts described below:				Graham	Ownership data as below:		117.60		[illegible]
								2.20	5S	24E	28	SE¼ SW¼	"	E. Palmer	13.20		.03	
								9.00	5S	24E	32	SE¼ NW¼	"	Antone Christensen	54.00		.11	
								4.00	5S	24E	33	SE¼ NW¼	"	A. A. Wilkins	24.00		.05	
								4.40	5S	24E	33	NE¼ SW¼	"	" " "	26.40		.06	
Sexton Canal Company	1919	Left	7S	31E	21	SW¼ SE¼	Sexton Canal	25.40	Tracts described below:				Greenlee	Ownership data as below:		152.40		.3[illegible]
								13.20	7S	31E	16	SW¼ SW¼	"	West White	79.20		.17	
								.70	7S	31E	17	SE¼ SE¼	"	" "	4.20		.01	
								.90	7S	31E	20	NE¼ NE¼	"	" "	5.40		.01	
								10.60	7S	31E	21	NW¼ NW¼	"	" "	63.60		.13	
J. W. Foote	1919	Right	6S	31E	7	N½ NW¼	Pumping Plant indirect	5.60	6S	31E	7	NW¼ NW¼	Greenlee	J. W. Foote		33.60		.0[illegible]
Montezuma Canal Company	1920	Left	7S	27E	17	NE¼ NE¼	Montezuma Canal	10.00	7S	26E	13	SW¼ NE¼	Graham	Albert Gillespie		60.00		.1[illegible]
Union Canal Company	1920	Left	7S	27E	18	SE¼ NW¼	Union Canal	11.50	Tracts described below:				Graham	Ownership data as below:		69.00		.1[illegible]
								5.00	6S	24E	13	SE¼ SW¼	"	C. E. Ferrin	30.00		.06	
								3.50	6S	24E	24	NE¼ SE¼	"	Charles Rogers	21.00		.04	
								3.00	6S	25E	19	SW¼ SW¼	"	W. E. McBride	18.00		.04	
Dodge-Nevada Canal Company	1920	Left	6S	25E	20	NE¼ NW¼	Dodge-Nevada Canal.	78.30	Tracts described below:				Graham	Ownership data as below:		469.80		.9[illegible]
								14.00	5S	23E	23	NE¼ NW¼	"	J. L. Green	84.00		.18	
								10.00	5S	23E	24	SW¼ NW¼	"	J. R. Naillon	60.00		.12	
								10.00	5S	23E	24	NE¼ SE¼	"	Gilbert Richardson	60.00		.12	
								3.00	5S	23E	24	NW¼ SE¼	"	" "	18.00		.04	
								18.10	5S	24E	31	NE¼ NW¼	"	Mrs. J. E. Cliff	108.60		.23	
								8.90	5S	24E	31	NW¼ NW¼	"	" " " "	53.40		.11	
								4.00	5S	24E	31	SW¼ NW¼	"	" " " "	24.00		.05	
								10.30	5S	24E	31	SE¼ NW¼	"	" " " "	61.80		.13	
Fort Thomas Consolidated Canal Company	1920	Left	6S	24E	4	NE¼ NW¼	Fort Thomas Consolidated Canal.	52.70	Tracts described below:				Graham	Ownership data as below:		316.20		.6[illegible]
								2.00	4S	23E	19	NE¼ NE¼	"	E. W. Black	12.00		.03	
								.80	4S	23E	34	NW¼ NE¼	"	George P. Ballard	4.80		.01	
								5.90	4S	23E	34	NE¼ NW¼	"	" " "	35.40		.07	
								10.00	4S	23E	35	NW¼ NE¼	"	William O. Tyler	60.00		.13	
								34.00	4S	23E	35	SW¼ NE¼	"	" " "	204.00		.42	
Graham Canal Company	1920	Right	7S	26E	9	NE¼ NW¼	Graham Canal	11.50	Tracts described below:				Graham	Ownership data as below:		69.00		.1[illegible]
								1.50	6S	25E	21	SE¼ NE¼	"	Brigham Stowell	9.00		.02	
								10.00	6S	25E	22	NW¼ SE¼	"	Charles Watson	60.00		.12	
Duncan Canal Company	1920	Left	8S	32E	28	NE¼ SW¼	Duncan Canal	5.80	Tracts described below:				Greenlee	Ownership data as below:		34.80		.0[illegible]
								5.00	8S	32E	19	SE¼ NE¼	"	J. L. T. Watters	30.00		.06	
								.80	8S	32E	19	NE¼ SE¼	"	" " " "	4.80		.01	
Grady L. Herring	1920	Left	5S	15E	24	SE¼ NW¼	Pumping Plant Direct.	26.00	5S	15E	24	S½ NW¼ & N½ SW¼	Pinal	Grady L. Herring		156.36		.33[illegible]

Party entitled to divert from the stream	Date of priority	Point of diversion: Side of stream	Point of diversion: Location, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	Name of diverting and/or carrying structure	Lands for which right acquired: Number of acres	Description, Referred to G. & S. R. B. & M. or N. M. B. & M.: Twp.	Rge.	Sec.	Subdivision	County	Parties owning said lands when jurisdiction acquired herein	Diversion right: For irrigation season in ac.-ft.: Individual	Total	Maxi rate of sion i ft. pe: Individual
Black & McCleskey Canal Company	1920	Left	8S	32E	19	NE¼ SE¼	Black & McCleskey Canal.	4.00	8S	31E	13	SE¼ NE¼	Greenlee	W. W. Brooks		24.00	
Colmenero Canal Company	1921	Right	8S	31E	11	NW¼ SE¼	Colmenero Canal.	3.90	7S	31E	21	SW¼ SE¼	Greenlee	Albert L. Barber		23.40	
Moddle Canal Company	1921	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	6.30	19S	21W	3	NW¼ SW¼	Hidalgo	G. W. Johnson		37.80	
United States	1924	Both	4S 4S	11E 6E	8 12	NW¼ SE¼	Ashurst-Hayden Diversion Dam and Florence-Casa Grande Canal, and Sacaton diversion dam.	100,546	Lands of San Carlos Project				Pinal	For full statement of this right see Article VI (4).		603,276	1
United States	1924	Channel	3S	18E	17	On San Carlos Indian Reservation.	Coolidge Dam across channel and San Carlos Storage reservoir.	100,546	Lands of San Carlos Project				Pinal	For full statement of this right see Article VI (5)	—1,285,000 capacity—		
Sunset Canal Company	1925	Right	19S	20W	21	SW¼ NW¼	Sunset Canal	2.30	18S	21W	34	SW¼ SW¼	Hidalgo	Orson A. Merrill.		13.80	
Sunset Canal Company	1926	Right	19S	20W	21	SW¼ NW¼.	Sunset Canal	4.30	18S	21W	34	SE¼ SW¼	Hidalgo	E. C. Payne		28.00	
Nevada Consolidated Copper Company	1926	Left	5S	15E	16	SE¼ SE¼	Vann Ditch	20.00	5S	15E	17	N½ NE¼, NE¼ NW¼	Pinal	Nevada Consolidated Copper Company		120.00	
Moddle Canal Company	1929	Left	19S	21W	11	NW¼ SE¼	Moddle Canal	34.94 17.06 17.88	Tracts described below: 19S 19S	 21W 21W	 4 5	 Lot 4 Lot 1	Hidalgo " "	Ownership data as below: Amanda Nations " "	 102.36 107.28	209.64	 .22 .22

... affected by priorities antedating 1905

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
4.0	7S	25E	3	SE¼ SW¼	Mrs. Nisia Lindsey
6.7	7S	25E	3	SE¼ SW¼	J. A. Farley
8.7	7S	25E	10	NE¼ NE¼	Town of Thatcher
11.4	7S	25E	10	NE¼ NE¼	Roy A. Layton
28.8	7S	25E	10	NW¼ NE¼	A. A. Allred
4.2	7S	25E	10	SW¼ NE¼	" " "
16.0	7S	25E	10	SE¼ NE¼	Town of Thatcher
4.5	7S	25E	10	SE¼ NE¼	(Frank V. Beers, Administrator of the Estate of R. H. Beers, deceased.
30.0	7S	25E	11	SW¼ NE¼	Town of Thatcher
39.0	7S	25E	11	SE¼ NE¼	" " "
20.0	7S	25E	11	NW¼ NW¼	" " "
30.0	7S	25E	11	SE¼ NW¼	" " "
5.0	7S	25E	11	NW¼ SW¼	" " "
3.9	7S	25E	11	NE¼ SE¼	Evans Coleman
1.7	7S	25E	11	NE¼ SE¼	Arizona Eastern Railroad Company.
16.0	7S	25E	11	NW¼ SE¼	Town of Thatcher
2.1	7S	25E	11	NW¼ SE¼	Evans Coleman
8.2	7S	25E	11	NW¼ SE¼	Spence C. Heywood
3.1	7S	25E	11	NW¼ SE¼	Guy W. Lamoreaux
10.6	7S	25E	11	SE¼ SE¼	Evans Coleman
1.4	7S	25E	11	SE¼ SE¼	Kimbal Maxham
0.4	7S	25E	11	SE¼ SE¼	Davidsel Ellsworth
1.2	7S	25E	12	NW¼ NW¼	Edward M. Claridge
9.5	7S	25E	12	NW¼ NW¼	Town of Thatcher
19.0	7S	25E	12	SW¼ NW¼	" " "
7.6	7S	25E	12	SW¼ NW¼	Mrs. Sarah S. Elmer
5.9	7S	25E	12	SW¼ NW¼	Edward M. Claridge
3.3	7S	25E	12	SW¼ NW¼	S. V. Pollock
6.2	7S	25E	12	SE¼ NW¼	C. N. Motes
36.9	7S	25E	12	NE¼ SW¼	Mrs. Isabelle Pace
21.9	7S	25E	12	NW¼ SW¼	S. L. Johns & D. L. Johns
9.8	7S	25E	12	NW¼ SW¼	Town of Thatcher
2.0	7S	25E	12	SW¼ SW¼	Arizona Eastern Railroad Company.
2.7	7S	25E	12	SW¼ SW¼	S. L. Johns & D. L. Johns
1.5	7S	25E	12	SW¼ SW¼	Mrs. Isabelle Pace
4.5	7S	25E	12	SW¼ SW¼	M. Mortensen
15.2	7S	25E	12	SW¼ SW¼	Evans Coleman
11.0	7S	25E	12	SW¼ SW¼	Davidsel Ellsworth
15.3	7S	25E	12	SE¼ SW¼	Mrs. Isabelle Pace
6.4	7S	25E	12	SE¼ SW¼	M. Mortensen
5.4	7S	25E	12	NW¼ SE¼	Mrs. Isabelle Pace
2.4	7S	25E	12	SW¼ SE¼	" " "
17.8	7S	25E	12	SW¼ SE¼	Davidsel Ellsworth
27.9	7S	25E	13	NE¼ NE¼	R. G. Layton, Jr.
25.9	7S	25E	13	NW¼ NE¼	J. D. Lee
12.0	7S	25E	13	SW¼ NE¼	W. H. Clifford
22.0	7S	25E	13	SW¼ NE¼	L. B. Scarlett
23.8	7S	25E	13	SE¼ NE¼	R. L. Freestone
7.7	7S	25E	13	SE¼ NE¼	W. H. Clifford
19.2	7S	25E	13	NE¼ NW¼	George Killian
18.9	7S	25E	13	NE¼ NW¼	J. D. Lee

Table No. 1 (Continued)

Montezuma Canal—Lands and parties affected by priorities antedating 1905

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
28.6	7S	25E	13	NW¼ NW¼	Marion Lee
7.0	7S	25E	13	NW¼ NW¼	W. W. Wild
18.9	7S	25E	13	SW¼ NW¼	Alex Layton
16.5	7S	25E	13	SE¼ NW¼	J. D. Lee
12.0	7S	25E	13	SE¼ NW¼	George Killian
2.2	7S	25E	13	NE¼ SW¼	" "
14.1	7S	25E	13	NE¼ SE¼	J. L. Freeman
4.8	7S	25E	13	NE¼ SE¼	Mrs. Belle Morris
1.3	7S	25E	13	NE¼ SE¼	Elam Olsen
4.1	7S	25E	13	NW¼ SE¼	" "
15.1	7S	25E	13	NW¼ SE¼	Aeshel Clifford
1.1	7S	25E	14	SE¼ NE¼	Alex Layton
13.5	7S	26E	13	SW¼ NE¼	Albert Gillespie
4.9	7S	26E	13	SW¼ NW¼	William H. Gillespie
16.7	7S	26E	13	SE¼ NW¼	James Gillespie
9.0	7S	26E	13	SE¼ NW¼	Shell Gillespie
25.0	7S	26E	13	NE¼ SW¼	James Gillespie
15.0	7S	26E	13	NE¼ SW¼	Shell Gillespie
20.9	7S	26E	13	NW¼ SW¼	" "
19.1	7S	26E	13	NW¼ SW¼	William H. Gillespie
30.4	7S	26E	13	SW¼ SW¼	Charles Boots
12.8	7S	26E	13	SE¼ SW¼	James Gillespie
14.6	7S	26E	13	SE¼ SW¼	Shell Gillespie
30.9	7S	26E	13	NE¼ SE¼	Edward L. Gillespie
4.2	7S	26E	13	NW¼ SE¼	" " "
20.3	7S	26E	13	NW¼ SE¼	Albert Gillespie
33.7	7S	26E	13	SW¼ SE¼	" "
5.1	7S	26E	13	SW¼ SE¼	Edward L. Gillespie
24.8	7S	26E	13	SE¼ SE¼	" " "
13.7	7S	26E	14	NE¼ NE¼	Edward M. Claridge
13.0	7S	26E	14	NW¼ NE¼	" " "
40.0	7S	26E	14	SW¼ NE¼	" " "
30.0	7S	26E	14	SE¼ NE¼	" " "
2.5	7S	26E	14	NE¼ NW¼	" " "
19.8	7S	26E	14	SW¼ NW¼	" " "
31.0	7S	26E	14	SE¼ NW¼	" " "
38.7	7S	26E	14	NE¼ SW¼	" " "
34.2	7S	26E	14	NW¼ SW¼	" " "
37.0	7S	26E	14	SW¼ SW¼	" " "
38.2	7S	26E	14	SE¼ SW¼	" " "
35.6	7S	26E	14	NE¼ SE¼	" " "
38.1	7S	26E	14	SW¼ SE¼	" " "
31.2	7S	26E	14	SE¼ SE¼	" " "
30.0	7S	26E	15	NE¼ SW¼	W. A. Johns & L. A. Johns
37.3	7S	26E	15	NW¼ SW¼	" " " " " "
29.2	7S	26E	15	SE¼ SW¼	" " " " " "
24.8	7S	26E	15	NW¼ SE¼	Charles M. Pursley and Robert L. Nash
37.7	7S	26E	15	SW¼ SE¼	N. W. Stevenson
23.1	7S	26E	15	SE¼ SE¼	" " "
7.6	7S	26E	16	SW¼ NE¼	John W. Morris
11.2	7S	26E	16	SE¼ NE¼	J. T. Owens, Jr.
31.2	7S	26E	16	SW¼ NW¼	Lawrence Fuller
4.1	7S	26E	16	SE¼ NW¼	P. Chendilla
2.9	7S	26E	16	SE¼ NW¼	Tom Aranda

Table No. 1 (Continued)

Montezuma Canal—Lands and parties affected by priorities antedating 1905

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
17.0	7S	26E	16	SE¼ NW¼	Lawrence Fuller
26.5	7S	26E	16	NE¼ SW¼	L. A. Nelson
5.0	7S	26E	16	NE¼ SW¼	Lawrence Fuller
36.8	7S	26E	16	NW¼ SW¼	" "
37.6	7S	26E	16	SW¼ SW¼	Henry Clifford, Sr.
7.9	7S	26E	16	SE¼ SW¼	" " "
2.5	7S	26E	16	SE¼ SW¼	L. A. Nelson
23.8	7S	26E	16	SE¼ SW¼	Mrs. Thomas Blake
29.1	7S	26E	16	NE¼ SE¼	O. E. Owens
14.4	7S	26E	16	NW¼ SE¼	" " "
7.0	7S	26E	16	NW¼ SE¼	Hugh Foster
3.3	7S	26E	16	NW¼ SE¼	L. A. Nelson
1.9	7S	26E	16	SW¼ SE¼	" " "
33.8	7S	26E	16	SW¼ SE¼	Hugh Foster
11.0	7S	26E	16	SE¼ SE¼	Ramon Gauna
1.4	7S	26E	16	SE¼ SE¼	Pedro Ruiz
15.9	7S	26E	16	SE¼ SE¼	Joaquin Padilla
1.1	7S	26E	17	NE¼ NE¼	Austin Evans
29.5	7S	26E	17	SW¼ NE¼	C. S. Conway, Administrator of the Estate of F. W. Hays, deceased.
21.2	7S	26E	17	SE¼ NE¼	Austin Evans
7.9	7S	26E	17	NE¼ NW¼	Town of Safford
8.1	7S	26E	17	NW¼ NW¼	" " "
10.0	7S	26E	17	SW¼ NW¼	" " "
11.5	7S	26E	17	SW¼ NW¼	George P. Jacobson
1.7	7S	26E	17	SW¼ NW¼	Ira N. Kempton
0.7	7S	26E	17	SW¼ NW¼	Cora Kruger
3.2	7S	26E	17	SW¼ NW¼	J. M. Wilson
2.0	7S	26E	17	SW¼ NW¼	Clarence Scarlett
2.0	7S	26E	17	SW¼ NW¼	George Van Gausig
10.0	7S	26E	17	SE¼ NW¼	Town of Safford
0.3	7S	26E	17	SE¼ NW¼	H. S. Clarke
3.3	7S	26E	17	SE¼ NW¼	Ben T. Platt
0.9	7S	26E	17	SE¼ NW¼	Mrs. V. M. Baker
1.8	7S	26E	17	SE¼ NW¼	W. F. Scarlett
3.5	7S	26E	17	SE¼ NW¼	Elam Olsen
0.7	7S	26E	17	SE¼ NW¼	M. S. Freeman
2.1	7S	25E	17	SE¼ NW¼	J. R. Gillmore
0.7	7S	26E	17	SE¼ NW¼	A. T. West
0.4	7S	26E	17	SE¼ NW¼	Spencer Kimball
2.0	7S	26E	17	SE¼ NW¼	William Morris
2.0	7S	26E	17	SE¼ NW¼	Layton Corporation of the Church of Jesus Christ of Latter Day Saints
1.2	7S	26E	17	NE¼ SW¼	J. C. Anglin
1.5	7S	26E	17	NE¼ SW¼	I. P. Robinson
0.8	7S	26E	17	NE¼ SW¼	Jesse B. Quinn
0.1	7S	26E	17	NE¼ SW¼	T. F. Boggs
1.8	7S	26E	17	NE¼ SW¼	R. A. Smith, Sr.
1.1	7S	26E	17	NE¼ SW¼	Mrs. J. B. Smithson
0.5	7S	26E	17	NE¼ SW¼	Warren Bingham
0.6	7S	26E	17	NE¼ SW¼	J. A. Walker
1.0	7S	26E	17	NE¼ SW¼	Orson F. Foote

Number of acres	Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein
	Lands — Description — Referred to G. & S. R. B. & M.				
0.7	7S	26E	17	NE¼ SW¼	G. L. Crawford
2.2	7S	26E	17	NE¼ SW¼	John West
1.8	7S	26E	17	NE¼ SW¼	H. P. Rogers
0.8	7S	26E	17	NE¼ SW¼	C. D. Welker
2.0	7S	26E	17	NE¼ SW¼	Adam Welker
1.1	7S	26E	17	NE¼ SW¼	Gratz D. Brown
1.2	7S	26E	17	NE¼ SW¼	George Burrell
1.1	7S	26E	17	NE¼ SW¼	Ephriam Larson
1.2	7S	26E	17	NE¼ SW¼	Safford School District #1, County of Graham, State of Arizona.
1.9	7S	26E	17	NE¼ SW¼	Lee N. Stratton, Administrator of the Estate of Mrs. N. A. Bell, deceased.
1.1	7S	26E	17	NE¼ SW¼	Nephi Williams
1.1	7S	26E	17	NE¼ SW¼	Charles Burrell
1.1	7S	26E	17	NE¼ SW¼	J. W. Greenhalgh
1.3	7S	26E	17	NW¼ SW¼	John West
1.4	7S	26E	17	NW¼ SW¼	E. P. Stuermer
0.8	7S	26E	17	NW¼ SW¼	Dan Williams
1.1	7S	26E	17	NW¼ SW¼	Fannie Bailey
1.1	7S	26E	17	NW¼ SW¼	R. L. McAllister
1.1	7S	26E	17	NW¼ SW¼	J. W. N. Scarlett
1.8	7S	26E	17	NW¼ SW¼	C. B. Sale
4.1	7S	26E	17	NW¼ SW¼	J. F. Rhinehart
1.2	7S	26E	17	NW¼ SW¼	Sarah E. Reed
3.7	7S	26E	17	NW¼ SW¼	S. E. D. Sears
4.4	7S	26E	17	NW¼ SW¼	Austin Evans
1.1	7S	26E	17	NW¼ SW¼	John Bilby
6.7	7S	26E	17	NW¼ SW¼	J. A. Chapman
4.4	7S	26E	17	NW¼ SW¼	W. A. Bennett
17.0	7S	26E	17	SW¼ SW¼	Austin Evans
2.5	7S	26E	17	SE¼ SW¼	Mrs. Virginia Curtis
2.5	7S	26E	17	SE¼ SW¼	L. B. Scarlett
1.9	7S	26E	17	SE¼ SW¼	S. A. Sowell
14.2	7S	26E	17	SE¼ SW¼	Calista B. Peel
7.9	7S	26E	17	NE¼ SE¼	W. D. Cluff & Fred M. Mitchell
30.0	7S	26E	17	NE¼ SE¼	J. W. Greenhalgh
6.0	7S	26E	17	NW¼ SE¼	William Brunson
4.2	7S	26E	17	NW¼ SE¼	John W. Morris
1.0	7S	26E	17	NW¼ SE¼	R. H. Greenhalgh
8.0	7S	26E	17	NW¼ SE¼	George Foote
5.2	7S	26E	17	NW¼ SE¼	W. A. Bennett
2.2	7S	26E	17	NW¼ SE¼	W. D. Spear
18.2	7S	26E	17	SW¼ SE¼	George Foote
2.5	7S	26E	17	SW¼ SE¼	Mrs. Nancy Palmer
1.5	7S	26E	17	SW¼ SE¼	Elam Olsen
4.3	7S	26E	17	SW¼ SE¼	Mrs. H. E. Warner
2.0	7S	26E	17	SW¼ SE¼	Francis Ellsworth
4.4	7S	26E	17	SW¼ SE¼	Jesse B. Quinn
26.7	7S	26E	17	SE¼ SE¼	C. M. Mack
13.0	7S	26E	18	NE¼ NE¼	Town of Safford
4.1	7S	26E	18	NW¼ NE¼	Donald Kennedy
5.5	7S	26E	18	NW¼ NE¼	Myron J. Allred
2.8	7S	26E	18	NW¼ NE¼	William N. Beebe
6.4	7S	26E	18	NW¼ NE¼	Mrs. Francis Goodman

Number of acres	Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein
	Lands — Description — Referred to G. & S. R. B. & M.				
1.0	7S	26E	18	NW¼ NE¼	Mrs. G. R. Young and David L. Ridgeway.
13.4	7S	26E	18	SW¼ NE¼	William N. Beebe
1.8	7S	26E	18	SW¼ NE¼	D. W. Cheney
4.7	7S	26E	18	SW¼ NE¼	J. W. Greenhalgh
13.0	7S	26E	18	SW¼ NE¼	County of Graham, State of Arizona.
2.4	7S	26E	18	SW¼ NE¼	Martin Jacobson
10.0	7S	26E	18	SE¼ NE¼	Town of Safford
2.0	7S	26E	18	SE¼ NE¼	Mrs. Martha Skinner
4.1	7S	26E	18	SE¼ NE¼	J. H. Bingham
4.1	7S	26E	18	SE¼ NE¼	J. Bingham
1.6	7S	26E	18	SE¼ NE¼	Lester Bingham
2.7	7S	26E	18	SE¼ NE¼	Martin Jacobson
9.0	7S	26E	18	NE¼ NW¼	Mary Lorraine Birdno
9.0	7S	26E	18	NE¼ NW¼	Mildred B. Larson
19.2	7S	26E	18	NW¼ NW¼	C. O. Larson
25.6	7S	26E	18	SW¼ NW¼	Elam Olsen
15.9	7S	26E	18	SE¼ NW¼	Charles E. Freestone
8.7	7S	26E	18	SE¼ NW¼	M. G. Montierth
17.9	7S	26E	18	NE¼ SW¼	Aeshel Clifford
19.8	7S	26E	18	NE¼ SW¼	M. G. Montierth
30.8	7S	26E	18	NW¼ SW¼	" "
1.1	7S	26E	18	SW¼ SW¼	J. W. N. Scarlett
13.1	7S	26E	18	SE¼ SW¼	" " "
12.5	7S	26E	18	NE¼ SE¼	Hyrum Bingham
2.7	7S	26E	18	NE¼ SE¼	P. J. Jacobson
18.8	7S	26E	18	NE¼ SE¼	Mrs. W. R. Reed
3.9	7S	26E	18	NW¼ SE¼	James Corder
7.5	7S	26E	18	NW¼ SE¼	J. W. Greenhalgh
1.9	7S	26E	18	NW¼ SE¼	J. H. Bingham
9.5	7S	26E	18	NW¼ SE¼	Mrs. W. R. Reed
8.0	7S	26E	18	NW¼ SE¼	W. H. Clifford
3.7	7S	26E	18	SW¼ SE¼	Mrs. W. R. Reed
1.8	7S	26E	18	SW¼ SE¼	W. H. Clifford
6.2	7S	26E	18	SW¼ SE¼	F. E. Kirkpatrick
12.3	7S	26E	18	SE¼ SE¼	Hart D. Empie
9.5	7S	26E	20	NE¼ NE¼	C. M. Mack
22.0	7S	26E	20	NE¼ NE¼	William Ellsworth
15.8	7S	26E	20	NW¼ NE¼	C. M. Mack
1.8	7S	26E	20	NW¼ NE¼	Henry Crabbe
3.6	7S	26E	20	NW¼ NE¼	Mrs. C. F. Stanley
8.1	7S	26E	20	NW¼ NE¼	John R. Davidson
5.1	7S	26E	20	SW¼ NE¼	" " "
2.6	7S	26E	20	SW¼ NE¼	William Ellsworth
2.4	7S	26E	20	SE¼ NE¼	John R. Davidson
23.0	7S	26E	20	NE¼ SE¼	Mrs. W. R. Smith
10.2	7S	26E	21	NE¼ NE¼	Victoriano Garcia
25.6	7S	26E	21	NE¼ NE¼	Elijah Clifford
7.8	7S	26E	21	NW¼ NE¼	" "
14.2	7S	26E	21	NW¼ NE¼	Henry Clifford, Sr.
1.4	7S	26E	21	NW¼ NE¼	Mrs. Nancy Palmer
3.1	7S	26E	21	SW¼ NE¼	Elijah Clifford
5.3	7S	26E	21	SW¼ NE¼	Henry Clifford, Sr.
7.1	7S	26E	21	SW¼ NE¼	Mrs. Nancy Palmer
17.8	7S	26E	21	SE¼ NE¼	Elijah Clifford

Number of acres	Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands des in the preceding column jurisdiction acquired here
	Lands — Description — Referred to G. & S. R. B. & M.				
13.3	7S	26E	21	NE¼ NW¼	Mrs. Nancy Palmer
16.6	7S	26E	21	NE¼ NW¼	Oscar Olsen
25.2	7S	26E	21	SE¼ NW¼	William Ellsworth
34.7	7S	26E	21	NW¼ SW¼	" "
30.4	7S	26E	22	NE¼ NE¼	W. L. Nelson
29.4	7S	26E	22	NW¼ NE¼	" " "
7.1	7S	26E	22	NW¼ NE¼	William Ellsworth
35.4	7S	26E	22	SW¼ NE¼	" "
36.1	7S	26E	22	SE¼ NE¼	" "
30.0	7S	26E	22	NE¼ NW¼	W. L. Nelson
30.3	7S	26E	22	NW¼ NW¼	Fred H. Wiemer
1.9	7S	26E	22	SW¼ NW¼	" " "
27.6	7S	26E	22	SW¼ NW¼	E. E. Montierth
7.7	7S	26E	22	SE¼ NW¼	Elijah Clifford
16.5	7S	26E	22	SE¼ NW¼	L. A. Clifford
36.1	7S	26E	22	NE¼ SW¼	William Ellsworth
6.2	7S	26E	22	NW¼ SW¼	E. E. Montierth
4.2	7S	26E	22	SE¼ SW¼	William Ellsworth
37.7	7S	26E	22	NE¼ SE¼	" "
39.1	7S	26E	22	NW¼ SE¼	" "
10.7	7S	26E	22	SW¼ NE¼	" "
1.5	7S	26E	22	SE¼ SE¼	" "
26.6	7S	26E	23	NE¼ NE¼	Ben Mauer
32.6	7S	26E	23	NW¼ NE¼	Maroni Larson
21.7	7S	26E	23	SW¼ NE¼	S. A. Merrill
9.0	7S	26E	23	SE¼ NE¼	Ben Mauer
19.3	7S	26E	23	NE¼ NW¼	S. A. Merrill
19.4	7S	26E	23	NE¼ NW¼	Mrs. Margaret R. Kempto
30.2	7S	26E	23	NW¼ NW¼	W. T. Barney
29.5	7S	26E	23	SW¼ NW¼	" " "
20.9	7S	26E	23	SE¼ NW¼	S. A. Merrill
12.8	7S	26E	23	SE¼ NW¼	Mrs. Margaret R. Kempto
1.9	7S	26E	23	NE¼ SW¼	S. A. Merrill
1.6	7S	26E	23	NE¼ SW¼	W. T. Barney
24.2	7S	26E	23	NW¼ SW¼	" " "
2.5	7S	26E	24	NE¼ NE¼	W. S. Baker
0.5	7S	26E	24	NW¼ NE¼	Arthur Welker
12.6	7S	26E	24	NW¼ NE¼	Isaac Williamson
1.4	7S	26E	24	NE¼ NW¼	" "
26.1	7S	26E	24	NE¼ NW¼	Arthur Welker
35.5	7S	26E	24	NW¼ NW¼	Ernest Motes
5.1	7S	26E	24	SW¼ NW¼	" "
11.5	7S	27E	18	NE¼ SW¼	J. M. Grijalva
21.8	7S	27E	18	NW¼ SW¼	H. M. Merrill
34.4	7S	27E	18	SW¼ SW¼	" " "
7.4	7S	27E	18	SE¼ SW¼	" " "
13.4	7S	27E	18	SE¼ SW¼	J. M. Grijalva
1.4	7S	27E	19	NW¼ NW¼	H. M. Merrill

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
10.0	7S	26E	21	SE¼ NW¼	Robert Morris
30.0	7S	26E	21	NE¼ SW¼	" "
8.9	7S	26E	21	NE¼ SW¼	William Ellsworth
37.0	7S	26E	21	SE¼ SE¼	Asa Packer
2.7	7S	26E	22	SW¼ NW¼	E. E. Montierth
1.3	7S	26E	22	NE¼ SW¼	William Ellsworth
30.2	7S	26E	22	NW¼ SW¼	E. E. Montierth
37.3	7S	26E	22	SW¼ SW¼	Asa Packer
33.0	7S	26E	22	SE¼ SW¼	William Ellsworth
24.0	7S	26E	22	SW¼ SE¼	" "
35.4	7S	26E	22	SE¼ SE¼	" "
2.3	7S	26E	23	SW¼ NE¼	J. C. Johns
17.2	7S	26E	23	SE¼ NE¼	Ben Mauer
5.5	7S	26E	23	SE¼ NE¼	Leslie W. Layton
23.9	7S	26E	23	NE¼ SW¼	W. T. Barney
4.5	7S	26E	23	NW¼ SW¼	" " "
37.9	7S	26E	23	SW¼ SW¼	George Foote
38.0	7S	26E	23	SE¼ SW¼	"
36.3	7S	26E	23	NE¼ SE¼	Leslie W. Layton
35.7	7S	26E	23	NW¼ SE¼	J. C. Johns
37.0	7S	26E	23	SW¼ SE¼	" " "
32.3	7S	26E	23	SE¼ SE¼	Leslie W. Layton
4.6	7S	26E	24	NE¼ NE¼	W. S. Baker
3.7	7S	26E	24	NE¼ NE¼	Edward L. Gillespie
2.0	7S	26E	24	NW¼ NE¼	William H. Taylor
1.6	7S	26E	24	NW¼ NE¼	John Tidwell and E. L. Tidwell Jr., Administrators of the Estate of E. L. Tidwell, deceased.
1.0	7S	26E	24	NW¼ NE¼	Charles F. Solomon
2.5	7S	26E	24	NW¼ NE¼	Mrs. Marcelina Padilla
5.2	7S	26E	24	NW¼ NE¼	Leslie W. Layton
9.2	7S	26E	24	NW¼ NE¼	Mrs. J. S. Miles
36.8	7S	26E	24	SW¼ NE¼	Albert Stephens
1.5	7S	26E	24	SW¼ NE¼	Mrs. J. S. Miles
30.3	7S	26E	24	SE¼ NE¼	" " " "
2.3	7S	26E	24	SE¼ NE¼	Mrs. Belle Epley
5.2	7S	26E	24	SE¼ NE¼	Albert Stephens
4.8	7S	26E	24	NE¼ NW¼	Mrs. W. A. Wilson
20.5	7S	26E	24	SW¼ NW¼	" " " "
35.5	7S	26E	24	SE¼ NW¼	" " " "
39.5	7S	26E	24	NE¼ SW¼	" " " "
26.5	7S	26E	24	NW¼ SW¼	" " " "
4.0	7S	26E	24	NW¼ SW¼	J. C. Johns
6.0	7S	26E	24	SW¼ SW¼	Mrs. W. A. Wilson
25.7	7S	26E	24	SW¼ SW¼	J. C. Johns
0.7	7S	26E	24	SE¼ SW¼	" " "
33.3	7S	26E	24	SE¼ SW¼	Mrs. W. A. Wilson
37.9	7S	26E	24	NE¼ SE¼	Mrs. J. S. Miles
1.5	7S	26E	24	NW¼ SE¼	" " " "
37.3	7S	26E	24	NW¼ SE¼	Albert Stephens
38.0	7S	26E	24	SW¼ SE¼	Leslie W. Layton
35.8	7S	26E	24	SE¼ SE¼	" " "
36.2	7S	26E	25	NE¼ NE¼	P. H. Freudenthal
12.8	7S	26E	25	NW¼ NE¼	" "
10.2	7S	26E	25	SE¼ NE¼	" "

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
27.9	7S	26E	25	NE¼ NW¼	Henry Clifford, Sr.
25.4	7S	26E	25	NW¼ NW¼	" " "
7.9	7S	26E	26	NE¼ NE¼	" " "
15.0	7S	26E	26	NE¼ NW¼	George Foote
5.1	7S	26E	26	NE¼ NW¼	Mrs. Margaret R. Kempton
20.0	7S	26E	26	NW¼ NW¼	" " " "
13.7	7S	26E	27	NE¼ NE¼	William Ellsworth
23.6	7S	26E	27	NW¼ NE¼	" "
22.3	7S	26E	27	NE¼ NW¼	" "
15.5	7S	26E	27	NW¼ NW¼	" "
15.0	7S	26E	28	NE¼ NE¼	Calvin Hocker
24.8	7S	27E	9	NE¼ SE¼	S. N. Holman
0.7	7S	27E	9	NW¼ SE¼	" " "
34.2	7S	27E	9	SW¼ SE¼	" " "
38.9	7S	27E	9	SE¼ SE¼	" " "
1.4	7S	27E	10	NE¼ NW¼	Ammon Curtis
18.7	7S	27E	10	SW¼ NW¼	(Ammon Curtis & Thomas
5.9	7S	27E	10	SE¼ NW¼	(Gardner
22.3	7S	27E	10	NW¼ SW¼	(
25.4	7S	27E	10	SW¼ SW¼	(
2.7	7S	27E	15	NW¼ NW¼	Ammon Curtis
1.3	7S	27E	16	NE¼ NE¼	Felix Berada
4.3	7S	27E	16	NE¼ NE¼	Elias Flores
22.4	7S	27E	16	NE¼ NE¼	Casimiro Garcia
0.5	7S	27E	16	NE¼ NE¼	Innocente Bartolda
15.5	7S	27E	16	NW¼ NE¼	Casimiro Garcia
22.9	7S	27E	16	NW¼ NE¼	Innocente Bartolda
0.2	7S	27E	16	NW¼ NE¼	Severa Bartolda
8.7	7S	27E	16	SW¼ NE¼	Innocente Bartolda
6.4	7S	27E	16	SW¼ NE¼	Severa Bartolda
5.1	7S	27E	16	SW¼ NE¼	Jesus Montez
1.4	7S	27E	16	NE¼ NW¼	S. N. Holman
15.6	7S	27E	16	NE¼ NW¼	Innocente Bartolda
11.4	7S	27E	16	NE¼ NW¼	Severa Bartolda
10.0	7S	27E	16	NE¼ NW¼	Jesus Montez
4.0	7S	27E	16	NW¼ NW¼	S. N. Holman
0.2	7S	27E	16	NW¼ NW¼	Severa Bartolda
7.8	7S	27E	16	NW¼ NW¼	Jesus Montez
8.4	7S	27E	16	NW¼ NW¼	Sesario Alvillar
3.8	7S	27E	16	NW¼ NW¼	Casimiro Garcia
2.4	7S	27E	16	NW¼ NW¼	Tomas Garcia
1.9	7S	27E	16	SW¼ NW¼	Sesario Alvillar
22.6	7S	27E	16	SW¼ NW¼	Casimiro Garcia
13.4	7S	27E	16	SW¼ NW¼	Tomas Garcia
1.0	7S	27E	16	SE¼ NW¼	Severa Bartolda
15.6	7S	27E	16	SE¼ NW¼	Jesus Montez
15.8	7S	27E	16	SE¼ NW¼	Sesario Alvillar
0.7	7S	27E	16	SE¼ NW¼	Augustin Franco
0.1	7S	27E	16	SE¼ NW¼	Anastacio Quiros
4.3	7S	27E	16	SE¼ NW¼	Casimiro Garcia
0.7	7S	27E	16	SE¼ NW¼	Jose B. Garica
2.3	7S	27E	16	NE¼ SW¼	" " "
2.0	7S	27E	16	NE¼ SW¼	Sesario Alvillar
1.1	7S	27E	16	NE¼ SW¼	Mrs. S. C. Gonzales
3.3	7S	27E	16	NE¼ SW¼	Francisco Montoz
1.2	7S	27E	16	NE¼ SW¼	Rafael Garcia

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
6.8	7S	27E	16	NW¼ SW¼	Casimiro Garcia
0.2	7S	27E	16	NW¼ SW¼	Rafael Garcia
14.4	7S	27E	16	NW¼ SW¼	Tomas Garcia
1.8	7S	27E	16	NW¼ SW¼	Juan Garcia
1.5	7S	27E	17	NE¼ NE¼	Maroni Larson
32.0	7S	27E	17	SW¼ NE¼	Ida Tidwell
36.3	7S	27E	17	SE¼ NE¼	Maroni Larson
19.4	7S	27E	17	SE¼ NW¼	Tomas Garcia
35.8	7S	27E	17	NE¼ SW¼	William H. Gillespie
24.5	7S	27E	17	NW¼ SW¼	Mrs. Jesus Carrasco
7.3	7S	27E	17	NW¼ SW¼	G. A. Bryce
37.3	7S	27E	17	SW¼ SW¼	" " "
2.7	7S	27E	17	SW¼ SW¼	Mrs. Jesus Carrasco
6.9	7S	27E	17	SE¼ SW¼	William H. Gillespie
31.8	7S	27E	17	SE¼ SW¼	A. T. Pollock
36.7	7S	27E	17	NE¼ SE¼	Maroni Larson
37.3	7S	27E	17	NW¼ SE¼	Ida Tidwell
1.0	7S	27E	17	SW¼ SE¼	Marajilda Garcia
39.0	7S	27E	17	SW¼ SE¼	Jesus Garica
9.2	7S	27E	17	SE¼ SE¼	" "
3.1	7S	27E	17	SE¼ SE¼	Marajilda Garcia
20.7	7S	27E	17	SE¼ SE¼	Fernando Gervantez
4.7	7S	27E	18	SW¼ NE¼	George C. Evans
7.8	7S	27E	18	SE¼ NE¼	Mrs. Jesus Carrasco
15.0	7S	27E	18	SE¼ SW¼	F. M. Woodward
12.1	7S	27E	18	NE¼ SE¼	George C. Evans
20.9	7S	27E	18	NE¼ SE¼	Mrs. Jesus Carrasco
37.6	7S	27E	18	NW¼ SE¼	George C. Evans
37.3	7S	27E	18	SW¼ SE¼	" " "
12.2	7S	27E	18	SE¼ SE¼	" " "
26.3	7S	27E	18	SE¼ SE¼	Mrs. Jesus Carrasco
39.3	7S	27E	19	NE¼ NE¼	George L. Hatch
10.1	7S	27E	19	NW¼ NE¼	" " "
12.0	7S	27E	19	NW¼ NE¼	W. W. Chapman
7.0	7S	27E	19	NW¼ NE¼	George C. Evans
7.0	7S	27E	19	NW¼ NE¼	Luther Farley
1.9	7S	27E	19	NW¼ NE¼	F. M. Woodward
36.5	7S	27E	19	SW¼ NE¼	John W. Mattice
38.0	7S	27E	19	SE¼ NE¼	P. H. Freudenthal
10.1	7S	27E	19	NE¼ NW¼	F. M. Woodward
6.5	7S	27E	19	NE¼ NW¼	Luther Farley
9.7	7S	27E	19	NE¼ NW¼	Juan Martinez
15.0	7S	27E	19	NE¼ NW¼	Pedro Bartolda
20.0	7S	27E	19	NW¼ NW¼	" "
0.3	7S	27E	19	SW¼ NW¼	Pablo Chavarria
0.6	7S	27E	19	SW¼ NW¼	Epitacio Granillo
0.6	7S	27E	19	SW¼ NW¼	Reinoldo Elias
0.6	7S	27E	19	SW¼ NW¼	Victorino Olivas
0.6	7S	27E	19	SW¼ NW¼	Manuel Mendez
0.6	7S	27E	19	SW¼ NW¼	Miguel Encinas
0.6	7S	27E	19	SW¼ NW¼	S. Marcus
0.9	7S	27E	19	SW¼ NW¼	Mrs. M. Michelena
0.3	7S	27E	19	SW¼ NW¼	Jose Villareal
2.1	7S	27E	19	SW¼ NW¼	Lito Rios
1.0	7S	27E	19	SW¼ NW¼	Jose Figuerroa
10.0	7S	27E	19	SW¼ NW¼	[illegible]

San Jose Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
1.3	7S	27E	19	SW¼ NW¼	W. G. Richards
3.1	7S	27E	19	SW¼ NW¼	Louis Michelena
8.2	7S	27E	19	SW¼ NW¼	Mrs. L. A. Massey & J. T. Massey
28.1	7S	27E	19	SE¼ NW¼	John C. Epley
39.7	7S	27E	19	NE¼ SW¼	" " "
37.4	7S	27E	19	NW¼ SW¼	(Mrs. L. A. Massey & J. T.
35.0	7S	27E	19	SW¼ SW¼	(Massey
26.4	7S	27E	19	SE¼ SW¼	John C. Epley
28.9	7S	27E	19	NE¼ SE¼	P. H. Freudenthal
39.0	7S	27E	19	NW¼ SE¼	John W. Mattice
10.1	7S	27E	19	SW¼ SE¼	" " "
1.3	7S	27E	20	NE¼ NE¼	G. Garcia
8.9	7S	27E	20	NE¼ NE¼	Ed Blake
38.6	7S	27E	20	NW¼ NE¼	" "
16.4	7S	27E	20	SW¼ NE¼	W. G. Richards
38.0	7S	27E	20	NE¼ NW¼	A. T. Pollock
36.3	7S	27E	20	NW¼ NW¼	G. A. Bryce
18.1	7S	27E	20	SW¼ NW¼	W. G. Richards
36.8	7S	27E	20	SE¼ NW¼	" " "
7.2	7S	27E	20	NE¼ SW¼	Mathews Stuart
11.0	7S	27E	20	NW¼ SW¼	W. G. Richards
8.8	7S	27E	30	NE¼ NW¼	Emery Adelbert Curtis
11.1	7S	27E	30	NW¼ NW¼	H. L. Alexander
25.5	7S	27E	30	NW¼ NW¼	Archie Fuller
4.3	7S	27E	30	SW¼ NW¼	" "
20.0	7S	27E	30	SW¼ NW¼	H. L. Alexander
9.1	7S	27E	30	SE¼ NW¼	Emery Adelbert Curtis

TABLE No. 3

Tidwell Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
0.5	7S	26E	12	SE¼ SE¼	(John Tidwell & E. L.
1.1	7S	26E	13	NE¼ NE¼	(Tidwell, Jr., Administra-
0.6	7S	27E	7	NE¼ SW¼	(tors of the Estate of
30.2	7S	27E	7	SW¼ SW¼	(E. L. Tidwell, deceased.
39.9	7S	27E	7	SE¼ SW¼	(
0.2	7S	27E	7	NW¼ SE¼	(
36.5	7S	27E	7	SW¼ SE¼	(
27.7	7S	27E	7	SE¼ SE¼	(
0.5	7S	27E	8	SW¼ NE¼	(
16.1	7S	27E	8	SE¼ NE¼	(
7.0	7S	27E	8	SW¼ SW¼	(
5.2	7S	27E	8	SE¼ SW¼	(
37.4	7S	27E	8	NE¼ SE¼	(
24.4	7S	27E	8	NW¼ SE¼	(
27.2	7S	27E	8	SW¼ SE¼	(
27.1	7S	27E	8	SE¼ SE¼	(
7.0	7S	27E	17	NW¼ NE¼	Rafael Garcia
15.3	7S	27E	17	NE¼ NW¼	" "
8.3	7S	27E	17	NW¼ NW¼	" "
0.5	7S	27E	17	NW¼ NW¼	(John Tidwell & E. L.
27.1	7S	27E	18	NE¼ NE¼	(Tidwell, Jr., Administra-
34.0	7S	27E	18	NW¼ NE¼	(tors of the Estate of
38.6	7S	27E	18	NE¼ NW¼	(E. L. Tidwell, deceased.
37.6	7S	27E	18	NW¼ NW¼	(

TABLE No. 4

Union Canal—Lands and parties affected by priorities antedating

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands d… in the preceding colum… jurisdiction acquired h…
5.0	6S	24E	13	SW¼ SE¼	I. B. Blake
6.3	6S	24E	13	SE¼ SE¼	Niels J. Roseberry
2.6	6S	24E	13	SE¼ SE¼	A. Harper
1.5	6S	24E	13	SE¼ SE¼	H. J. Anderson
10.0	6S	24E	24	NE¼ NE¼	Milton Lines
9.5	6S	24E	24	SE¼ NE¼	Reece D. Green
8.2	6S	24E	24	SE¼ NE¼	Charles Kerby
4.0	6S	24E	24	NE¼ SE¼	Charles Rogers
5.0	6S	24E	24	NE¼ SE¼	P. C. Merrill
10.3	6S	25E	19	NW¼ NW¼	W. A. Lines
7.9	6S	25E	20	SW¼ SW¼	William Larson
2.0	6S	25E	20	SW¼ SW¼	G. W. Miller
2.5	6S	25E	20	SW¼ SW¼	Mrs. Layman Dodge
3.5	6S	25E	20	SW¼ SW¼	M. M. Curtis
5.4	6S	25E	26	SW¼ SE¼	George A. Hoopes
1.1	6S	25E	27	SW¼ NE¼	E. C. Phillips
12.7	6S	25E	27	NW¼ SE¼	Thomas S. Kimball
30.8	6S	25E	27	SW¼ SE¼	" " "
24.2	6S	25E	27	SE¼ SE¼	Orvil Larson
4.2	6S	25E	28	NE¼ SW¼	J. D. Kennison
2.5	6S	25E	28	NW¼ SW¼	" " "
17.4	6S	25E	28	SW¼ SW¼	H. L. Norton, Sr.
10.0	6S	25E	28	SW¼ SW¼	J. E. Norton
12.6	6S	25E	28	SW¼ SW¼	William R. Norton
11.4	6S	25E	28	SE¼ SW¼	J. E. Norton
5.8	6S	25E	28	SE¼ SW¼	William R. Norton
18.2	6S	25E	28	SE¼ SW¼	Lorenzo Watson
3.9	6S	25E	28	SW¼ SE¼	J. N. Allred
7.7	6S	25E	28	SW¼ SE¼	William Bigler
11.8	6S	25E	28	SW¼ SE¼	B. F. Whitmer, Jr.
2.7	6S	25E	28	SE¼ SE¼	D. T. Adams
12.7	6S	25E	29	NW¼ NE¼	P. C. Merrill, Administr… of the estate of Joe Pensyl, deceased.
37.8	6S	25E	29	SW¼ NE¼	Joseph Alder
7.1	6S	25E	29	SE¼ NE¼	(P. C. Merrill, Administra…
24.7	6S	25E	29	NE¼ NW¼	(tor of the estate of Joe (Pensyl, deceased.
4.7	6S	25E	29	NE¼ NW¼	C. J. Ferrington
2.6	6S	25E	29	NE¼ NW¼	Mrs. J. S. Beals
1.7	6S	25E	29	NE¼ NW¼	Arizona Eastern Railroa… Company
2.5	6S	25E	29	NE¼ NW¼	Joseph Alder
6.7	6S	25E	29	NW¼ NW¼	Charles Luster
6.3	6S	25E	29	NW¼ NW¼	Mrs. Nisia Lindsey
21.1	6S	25E	29	NW¼ NW¼	Joseph Alder
13.2	6S	25E	29	SW¼ NW¼	" "
9.5	6S	25E	29	SW¼ NW¼	Mrs. Nisia Lindsey
8.6	6S	25E	29	SE¼ NW¼	P. C. Merrill, Administr… of the estate of Joe Pensyl, deceased.
27.2	6S	25E	29	SE¼ NW¼	Joseph Alder
30.6	6S	25E	29	NE¼ SW¼	" "
11.7	6S	25E	29	NE¼ SE¼	" "
36.9	6S	25E	29	NW¼ SE¼	" "
26.0	6S	25E	29	SW¼ SE¼	" "

Number of acres	Lands				Ownership
	Description				Parties owning lands described in the preceding column when jurisdiction acquired herein.
	Referred to G. & S. R. B. & M.				
	Twp.	Rge.	Sec.	Subdivision	
6.3	6S	25E	29	SE¼ SE¼	J. E. Norton
22.3	6S	25E	29	SE¼ SE¼	William R. Norton
6.3	6S	25E	29	SE¼ SE¼	H. L. Norton, Sr.
14.1	6S	25E	30	NE¼ NE¼	Ethlon Saline
9.2	6S	25E	30	NE¼ NE¼	Joseph Alder
5.1	6S	25E	30	SE¼ NE¼	" "
1.0	6S	25E	30	NE¼ NW¼	John Cluff
50.0	6S	25E	30	and 19	Town of Pima
37.9	6S	25E	32	NE¼ NE¼	S. B. Tenny, Jr.
3.7	6S	25E	32	NW¼ NE¼	Joseph Alder
22.1	6S	25E	32	SE¼ NE¼	H. W. Layton
11.6	6S	25E	32	NE¼ SE¼	L. A. Adams
2.5	6S	25E	33	NE¼ NE¼	B. F. Cluff
16.5	6S	25E	33	NE¼ NE¼	J. D. Webb
9.5	6S	25E	33	NE¼ NE¼	H. M. Tate
7.8	6S	25E	33	NE¼ NE¼	Mrs. J. E. Cluff
4.5	6S	25E	33	NW¼ NE¼	Mrs. Mildred Whitmer
4.4	6S	25E	33	NW¼ NE¼	William Bigler
8.2	6S	25E	33	NW¼ NE¼	B. F. Whitmer, Sr.
19.2	6S	25E	33	NW¼ NE¼	George A. Bigler
7.6	6S	25E	33	SW¼ NE¼	J. W. Sowell
2.1	6S	25E	33	SW¼ NE¼	S. P. Jenkins
1.7	6S	25E	33	SW¼ NE¼	School District #12, County of Graham, State of Arizona.
3.7	6S	25E	33	SW¼ NE¼	S. L. Jenkins
5.1	6S	25E	33	SW¼ NE¼	George Coombs
2.2	6S	25E	33	SW¼ NE¼	Benjamin F. Cluff, Administrator of the estates of Joseph Cluff, deceased and Phoebe Cluff, deceased.
1.8	6S	25E	33	SW¼ NE¼	Mrs. J. E. Cluff
5.8	6S	25E	33	SW¼ NE¼	L. A. Adams
5.0	6S	25E	33	SE¼ NE¼	B. F. Cluff
13.8	6S	25E	33	SE¼ NE¼	Benjamin F. Cluff, Administrator of the estate of Joseph Cluff, deceased.
7.7	6S	25E	33	SE¼ NE¼	Mrs. D. E. Smith
3.3	6S	25E	33	SE¼ NE¼	Mrs. W. E. Craig
4.6	6S	25E	33	SE¼ NE¼	J. M. Smith
2.2	6S	25E	33	NE¼ NW¼	C. L. Coombs
16.9	6S	25E	33	NE¼ NW¼	William Coombs
1.7	6S	25E	33	NE¼ NW¼	H. L. Norton, Jr.
10.1	6S	25E	33	NE¼ NW¼	George R. Shurtz
3.1	6S	25E	33	NE¼ NW¼	J. E. Schurtz
3.9	6S	25E	33	NE¼ NW¼	S. V. Porter
2.2	6S	25E	33	NW¼ NW¼	J. E. Norton
14.9	6S	25E	33	NW¼ NW¼	George R. Shurtz
15.9	6S	25E	33	NW¼ NW¼	Lloyd Norton
29.[illegible]	6S	25E	33	SW¼ NW¼	Isaac Coombs
0.6	6S	25E	33	SE¼ NW¼	S. V. Porter
4.4	6S	25E	33	SE¼ NW¼	A. J. Shifflet
4.4	6S	25E	33	SE¼ NW¼	E. M. Allred
1.1	6S	25E	33	SE¼ NW¼	J. S. Shifflet
1.0	6S	25E	33	SE¼ NW¼	Clarence Martin
0.6	6S	25E	33	SE¼ NW¼	Mrs. Charlotte F. Elmer

Number of acres	Lands				Ownership
	Description				Parties owning lands described in the preceding column when jurisdiction acquired herein.
	Referred to G. & S. R. B. & M.				
	Twp.	Rge.	Sec.	Subdivision	
2.1	6S	25E	33	SE¼ NW¼	J. N. Allred
12.2	6S	25E	33	SE¼ NW¼	William Coombs
10.8	6S	25E	33	NE¼ SW¼	Millard Fyffe
4.9	6S	25E	33	NE¼ SW¼	M. M. Layton
11.3	6S	25E	33	NE¼ SW¼	William Coombs
10.1	6S	25E	33	NE¼ SW¼	H. W. Layton
31.8	6S	25E	33	NW¼ SW¼	" " "
10.7	6S	25E	33	SW¼ SW¼	" " "
25.8	6S	25E	33	SE¼ SW¼	" " "
14.3	6S	25E	33	SE¼ SW¼	William Coombs
1.7	6S	25E	33	NE¼ SE¼	H. L. Norton, Sr.
16.6	6S	25E	33	NE¼ SE¼	E. D. Smith
19.3	6S	25E	33	NE¼ SE¼	David Dodge
26.1	6S	25E	33	NW¼ SE¼	M. P. Ferguson
7.7	6S	25E	33	NW¼ SE¼	N. E. Coombs
0.4	6S	25E	33	SW¼ SE¼	" " "
37.2	6S	25E	33	SW¼ SE¼	F. A. Webster
1.5	6S	25E	33	SW¼ SE¼	M. P. Ferguson
36.4	6S	25E	33	SE¼ SE¼	H. L. Norton, Sr.
20.3	6S	25E	34	NE¼ NE¼	L. C. Cutler
19.7	6S	25E	34	NE¼ NE¼	Roy A. Layton
20.6	6S	25E	34	NW¼ NE¼	L. C. Cutler
29.7	6S	25E	34	SW¼ NE¼	A. O. Lamoreaux
37.8	6S	25E	34	SE¼ NE¼	D. C. Johnson
7.0	6S	25E	34	NE¼ NW¼	J. B. Martin
21.1	6S	25E	34	NW¼ NW¼	J. D. Webb
5.0	6S	25E	34	SW¼ NW¼	B. F. Cluff
14.9	6S	25E	34	SW¼ NW¼	Benjamin F. Cluff, Administrator of the estates of Joseph Cluff, deceased and Phoebe Cluff, deceased.
20.2	6S	25E	34	SW¼ NW¼	Mrs. W. F. Martin
33.9	6S	25E	34	SE¼ NW¼	J. B. Martin
6.7	6S	25E	34	SE¼ NW¼	J. S. Martin
26.6	6S	25E	34	NE¼ SW¼	" " "
13.1	6S	25E	34	NE¼ SW¼	J. M. Smith
39.8	6S	25E	34	NW¼ SW¼	" " "
38.6	6S	25E	34	SW¼ SW¼	E. M. Lambson
12.9	6S	25E	34	SE¼ SW¼	" " "
26.5	6S	25E	34	SE¼ SW¼	Oscar G. Layton
40.0	6S	25E	34	NE¼ SE¼	Roy A. Layton
36.6	6S	25E	34	NW¼ SE¼	M. M. Smith
24.6	6S	25E	34	SW¼ SE¼	W. Ollerton
39.2	6S	25E	34	SE¼ SE¼	Roy A. Layton
6.9	6S	25E	35	SW¼ NE¼	Willis K. Daly
6.7	6S	25E	35	NE¼ NW¼	Antonio Vasquez
24.6	6S	25E	35	NW¼ NW¼	Mrs. Artie Branam
0.3	6S	25E	35	SW¼ NW¼	" " "
10.8	6S	25E	35	SW¼ NW¼	L. S. Branam
0.6	6S	25E	35	SE¼ NW¼	Antonio Vasquez
33.3	6S	25E	35	SE¼ NW¼	James H. Porter
19.0	6S	25E	35	NE¼ SW¼	" " "
19.8	6S	25E	35	NE¼ SW¼	W. R. Chambers
6.3	6S	25E	35	NW¼ SW¼	James H. Porter
3.1	6S	25E	35	NW¼ SW¼	W. R. Chambers
23.0	6S	25E	35	NW¼ SW¼	W. E. Platt
11.0	6S	25E	35	SW¼ SW¼	" " "

Number of acres	Lands				Ownership
	Description				Parties owning lands described in the preceding column when jurisdiction acquired herein.
	Referred to G. & S. R. B. & M.				
	Twp.	Rge.	Sec.	Subdivision	
22.1	6S	25E	35	SW¼ SW¼	Mrs. Lilly Duke
1.0	6S	25E	35	SE¼ SW¼	Antone Carreon
2.6	6S	25E	35	SE¼ SW¼	Miguel Mena
5.0	6S	25E	35	SE¼ SW¼	Damesio O. Meraz
9.7	6S	25E	35	SE¼ SW¼	Manuel Burrell
2.0	6S	25E	35	SE¼ SW¼	W. E. Platt
17.5	6S	25E	35	SE¼ SW¼	Rudger Phillips
21.4	6S	25E	35	NE¼ SE¼	Frank N. Tyler
36.5	6S	25E	35	NW¼ SE¼	Willis K. Daly
19.3	6S	25E	35	SW¼ SE¼	Mrs. Julia Daly
19.4	6S	25E	35	SW¼ SE¼	Seth P. Fletcher
38.9	6S	25E	35	SE¼ SE¼	" " "
0.4	6S	25E	36	NW¼ SW¼	Ephriam J. Allen
12.7	6S	25E	36	SW¼ SW¼	" " "
20.0	7S	25E	1	SW¼ NE¼	W. R. Chambers
20.0	7S	25E	1	NE¼ NW¼	Seth P. Fletcher
39.9	7S	25E	1	NW¼ NW¼	" " "
4.4	7S	25E	1	SW¼ NW¼	" " "
9.0	7S	25E	1	SW¼ NW¼	Town of Thatcher
24.3	7S	25E	1	SW¼ NW¼	Mrs. C. R. Pace
35.6	7S	25E	1	SE¼ NW¼	" " " "
4.4	7S	25E	1	SE¼ NW¼	Seth P. Fletcher
40.0	7S	25E	1	NE¼ SW¼	Bert Hoopes
18.0	7S	25E	1	NW¼ SW¼	Town of Thatcher
20.0	7S	25E	1	NW¼ SW¼	Sarah A. Hunt
18.1	7S	25E	1	SW¼ SW¼	" " "
18.0	7S	25E	1	SW¼ SW¼	Town of Thatcher
38.5	7S	25E	1	SE¼ SW¼	Bert Hoopes
21.0	7S	25E	1	NE¼ SE¼	W. R. Chambers
24.4	7S	25E	1	NW¼ SE¼	" " "
11.5	7S	25E	1	NW¼ SE¼	Bert Hoopes
8.0	7S	25E	1	SW¼ SE¼	" "
20.2	7S	25E	1	SW¼ SE¼	D. C. Johnson
1.3	7S	25E	1	SW¼ SE¼	W. R. Chambers
7.6	7S	25E	1	SW¼ SE¼	A. C. Hunt
31.0	7S	25E	1	SE¼ SE¼	" " "
6.4	7S	25E	1	SE¼ SE¼	W. R. Chambers
39.5	7S	25E	2	NE¼ NE¼	Frank N. Tyler
39.2	7S	25E	2	NW¼ NE¼	Orlando Jolly
19.3	7S	25E	2	SW¼ NE¼	" "
19.5	7S	25E	2	SW¼ NE¼	Town of Thatcher
19.5	7S	25E	2	SE¼ NE¼	Frank N. Tyler
19.5	7S	25E	2	SE¼ NE¼	Town of Thatcher
8.4	7S	25E	2	NE¼ NW¼	James H. Porter
0.3	7S	25E	2	NE¼ NW¼	Rudger Phillips
9.7	7S	25E	2	NE¼ NW¼	J. M. Moody
9.6	7S	25E	2	NE¼ NW¼	A. O. Lamoreaux
9.9	7S	25E	2	NE¼ NW¼	W. E. Platt
9.8	7S	25E	2	NW¼ NW¼	" " "
14.4	7S	25E	2	NW¼ NW¼	George A. Hoopes
14.9	7S	25E	2	NW¼ NW¼	Roy A. Layton
14.1	7S	25E	2	SW¼ NW¼	" " "
4.5	7S	25E	2	SW¼ NW¼	W. E. Platt
0.2	7S	25E	2	SW¼ NW¼	George A. Hoopes
19.5	7S	25E	2	SW¼ NW¼	Town of Thatcher

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
4.8	7S	25E	2	SE¼ NW¼	W. E. Platt
4.7	7S	25E	2	SE¼ NW¼	A. O. Lamoreaux
4.8	7S	25E	2	SE¼ NW¼	J. M. Moody
4.3	7S	25E	2	SE¼ NW¼	James H. Porter
19.5	7S	25E	2	SE¼ NW¼	Town of Thatcher
10.0	7S	25E	2	NE¼ SW¼	" " "
10.0	7S	25E	2	NW¼ SW¼	" " "
6.0	7S	25E	2	SW¼ SW¼	" " "
5.0	7S	25E	2	SE¼ SW¼	" " "
10.0	7S	25E	2	NE¼ SE¼	" " "
10.0	7S	25E	2	NW¼ SE¼	" " "
10.0	7S	25E	2	SW¼ SE¼	" " "
10.0	7S	25E	2	SE¼ SE¼	" " "
37.4	7S	25E	3	NE¼ NE¼	Miles Reay
19.8	7S	25E	3	NW¼ NE¼	Mable Perkins
20.0	7S	25E	3	NW¼ NE¼	Oscar G. Layton
18.2	7S	25E	3	SW¼ NE¼	Joanna Smith
1.5	7S	25E	3	SW¼ NE¼	Oscar G. Layton
13.1	7S	25E	3	SW¼ NE¼	Citizens Bank
19.8	7S	25E	3	SE¼ NE¼	Mrs. Hester Damron
9.1	7S	25E	3	SE¼ NE¼	Miles Reay
9.0	7S	25E	3	SE¼ NE¼	Town of Thatcher
19.4	7S	25E	3	NE¼ NW¼	W. W. Pace
20.2	7S	25E	3	NE¼ NW¼	Mrs. J. E. Cluff
36.3	7S	25E	3	NW¼ NW¼	F. A. Webster
11.1	7S	25E	3	SW¼ NW¼	S. V. Pollock
24.6	7S	25E	3	SW¼ NW¼	W. W. Pace
18.8	7S	25E	3	SE¼ NW¼	I. J. Palmer
3.2	7S	25E	3	SE¼ NW¼	W. W. Pace
15.5	7S	25E	3	SE¼ NW¼	Rudger Phillips
18.7	7S	25E	3	NE¼ SW¼	Oscar G. Layton
20.0	7S	25E	3	NE¼ SW¼	I. J. Palmer
36.8	7S	25E	3	NW¼ SW¼	W. W. Pace
7.8	7S	25E	3	SW¼ SW¼	" " "
1.3	7S	25E	3	SE¼ SW¼	I. J. Palmer
7.7	7S	25E	3	SE¼ SW¼	Mrs. Nisia Lindsey
1.3	7S	25E	3	SE¼ SW¼	Oscar G. Layton
4.5	7S	25E	3	SE¼ SW¼	Elsie L. Overly
3.5	7S	25E	3	SE¼ SW¼	J. A. Farley
18.0	7S	25E	3	NE¼ SE¼	Town of Thatcher
19.8	7S	25E	3	NE¼ SE¼	A. V. Tate
18.9	7S	25E	3	NW¼ SE¼	Maranda Perkins
14.9	7S	25E	3	NW¼ SE¼	Citizens Bank
3.5	7S	25E	3	NW¼ SE¼	Jesse C. Phillips
1.2	7S	25E	3	SW¼ SE¼	" " "
1.0	7S	25E	3	SW¼ SE¼	Maranda Perkins
6.3	7S	25E	3	SW¼ SE¼	C. M. Hendricks
25.1	7S	25E	3	SW¼ SE¼	I. J. Palmer
0.8	7S	25E	3	SW¼ SE¼	Mrs. Sophia Barney
16.0	7S	25E	3	SE¼ SE¼	Town of Thatcher
1.2	7S	25E	3	SE¼ SE¼	A. V. Tate
4.8	7S	25E	3	SE¼ SE¼	W. A. Posy, Administrator of the estate of Orson Elliott, deceased.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
2.3	7S	25E	3	SE¼ SE¼	W. A. Posy
10.2	7S	25E	3	SE¼ SE¼	" " "
27.5	7S	25E	4	NE¼ NE¼	F. A. Webster
9.3	7S	25E	4	NE¼ NE¼	O. F. Webster
39.2	7S	25E	4	NW¼ NE¼	(O. F. Webster, Administrator of the estate of Thomas G. Webster, deceased.
32.0	7S	25E	4	SW¼ NE¼	
32.8	7S	25E	4	SE¼ NE¼	O. F. Webster
4.7	7S	25E	4	SE¼ NE¼	O. F. Webster, Administrator of the Estate of Thomas G. Webster, deceased.
23.7	7S	25E	4	NE¼ NW¼	M. M. Layton
2.2	7S	25E	4	SE¼ NW¼	" " "
15.3	7S	25E	4	NE¼ SE¼	William Webster
4.8	7S	25E	10	NE¼ NE¼	W. A. Posy
12.0	7S	25E	11	NE¼ NE¼	Town of Thatcher
22.7	7S	25E	12	NE¼ NE¼	D. C. Johnson
17.8	7S	25E	12	NE¼ NE¼	George Montierth
37.7	7S	25E	12	NW¼ NE¼	Mrs. William Johns
0.5	7S	25E	12	NW¼ NE¼	Edsil Blain
11.6	7S	25E	12	SW¼ NE¼	Mrs. William Johns
12.8	7S	25E	12	SW¼ NE¼	Edsil Blain
3.4	7S	25E	12	SW¼ NE¼	P. J. Jacobson
8.2	7S	25E	12	SW¼ NE¼	R. G. Layton, Jr.
0.4	7S	25E	12	SE¼ NE¼	D. C. Johnson
24.2	7S	25E	12	SE¼ NE¼	George Montierth
12.3	7S	25E	12	SE¼ NE¼	George A. Gourley
1.8	7S	25E	12	SE¼ NE¼	R. G. Layton, Jr.
10.1	7S	25E	12	NE¼ NW¼	David Johns
1.3	7S	25E	12	NE¼ NW¼	A. C. Hunt
18.7	7S	25E	12	NE¼ NW¼	Mrs. Arthusa Hoopes
7.8	7S	25E	12	NE¼ NW¼	Mrs. Sarah S. Elmer
1.7	7S	25E	12	NW¼ NW¼	" " " "
3.0	7S	25E	12	NW¼ NW¼	H. B. Harms
12.9	7S	25E	12	NW¼ NW¼	Ruth Allred, Della Allred, Phoebe Allred, Elden Allred and Edith M. Allred
9.5	7S	25E	12	NW¼ NW¼	Town of Thatcher
0.2	7S	25E	12	SW¼ NW¼	Mrs. Sarah S. Elmer
29.3	7S	25F	12	SE¼ NW¼	C. N. Motes
3.4	7S	25E	12	NE¼ SW¼	Mrs. Isabelle Pace
8.5	7S	25E	12	NE¼ SE¼	George A. Gourley
28.9	7S	25E	12	NE¼ SE¼	R. G. Layton, Jr.
27.9	7S	25E	12	NW¼ SE¼	" " " "
6.6	7S	25E	12	NW¼ SE¼	P. J. Jacobson
8.6	7S	25E	12	SW¼ SE¼	R. G. Layton, Jr.
38.2	7S	25E	12	SE¼ SE¼	" " " "
3.0	7S	25E	13	NE¼ NE¼	J. D. Lee
2.2	7S	25E	13	NE¼ NE¼	R. G. Layton, Jr.
0.9	7S	25E	13	NW¼ NE¼	J. D. Lee
23.4	7S	26E	7	NE¼ NW¼	H. E. Hoopes & John L. Hoopes
21.6	7S	26E	7	NW¼ NW¼	Charles P. Johns
14.1	7S	26E	7	NW¼ NW¼	P. Estrado
14.1	7S	26E	7	SW¼ NW¼	" "
21.3	7S	26E	7	SW¼ NW¼	Charles P. Johns

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands d[escribed] in the preceding colum[n when] jurisdiction acquired h[erein.]
39.7	7S	26E	7	SE¼ NW¼	H. E. Hoopes & John L.
37.5	7S	26E	7	NE¼ SW¼	" " " " " "
22.1	7S	26E	7	NW¼ SW¼	Charles P. Johns
11.1	7S	26E	7	NW¼ SW¼	P. Estrado
35.5	7S	26E	7	SW¼ SW¼	Charles P. Johns
38.5	7S	26E	7	SE¼ SW¼	H. E. Hoopes & John L.
38.0	7S	26E	7	NE¼ SE¼	Town of Safford
18.6	7S	26E	7	NW¼ SE¼	P. J. Jacobson
18.9	7S	26E	7	NW¼ SE¼	G. E. Crandall
7.8	7S	26E	7	SW¼ SE¼	W. E. Platt
1.0	7S	26E	7	SW¼ SE¼	Heber M. Higgins
1.9	7S	26E	7	SW¼ SE¼	Mattie Graham
7.4	7S	26E	7	SW¼ SE¼	E. D. Barry
17.4	7S	26E	7	SW¼ SE¼	D. W. Birdno
2.0	7S	26E	7	SW¼ SE¼	Charles Kruger
21.3	7S	26E	7	SE¼ SE¼	Town of Safford
8.0	7S	26E	8	NE¼ SW¼	" " "
13.5	7S	26E	8	NW¼ SW¼	" " "
23.3	7S	26E	8	SW¼ SW¼	" " "
22.0	7S	26E	8	SE¼ SW¼	" " "
27.2	7S	26E	8	NE¼ SE¼	Henry Clifford, Sr.
9.5	7S	26E	8	NW¼ SE¼	" " "
5.1	7S	26E	8	NW¼ SE¼	C. S. Conway
7.7	7S	26E	8	NW¼ SE¼	Mrs. J. C. Wamslee
0.8	7S	26E	8	SW¼ SE¼	" " " "
20.6	7S	26E	8	SW¼ SE¼	Henry Clifford, Sr.
10.0	7S	26E	8	SW¼ SE¼	C. S. Conway
6.4	7S	26E	8	SW¼ SE¼	Town of Safford
36.7	7S	26E	8	SE¼ SE¼	Henry Clifford, Sr.
5.4	7S	26E	9	SW¼ NE¼	Charles M. Pursley and Robert L. Nash
40.0	7S	26E	9	SW¼ NW¼	R. D. Crandall
29.8	7S	26E	9	SE¼ NW¼	" " "
16.0	7S	26E	9	NE¼ SW¼	Charles Gietz
20.3	7S	26E	9	NE¼ SW¼	Fred Waughtal
36.7	7S	26E	9	NW¼ SW¼	Charles M. Layton
32.1	7S	26E	9	SW¼ SW¼	" " "
4.7	7S	26E	9	SW¼ SW¼	Mrs. Laura McCullom
17.4	7S	26E	9	SE¼ SW¼	Charles Gietz
19.5	7S	26E	9	SE¼ SW¼	Fred Waughtal
9.1	7S	26E	9	NW¼ SE¼	Charles M. Pursley & Robert L. Nash
22.8	7S	26E	9	SW¼ SE¼	
3.0	7S	26E	9	SE¼ SE¼	
11.3	7S	26E	15	NW¼ NE¼	
37.2	7S	26E	15	SW¼ NE¼	
24.1	7S	26E	15	SE¼ NE¼	
17.8	7S	26E	15	NE¼ NW¼	
7.5	7S	26E	15	NW¼ NW¼	
8.4	7S	26E	15	NW¼ NW¼	J. T. Owens, Jr.
8.8	7S	26E	15	SW¼ NW¼	" " " "
27.4	7S	26E	15	SW¼ NW¼	Charles M. Pursley & Robert L. Nash
36.6	7S	26E	15	SE¼ NW¼	
3.2	7S	26E	15	NE¼ SW¼	
28.2	7S	26E	15	NE¼ SE¼	

Number of acres	Lands — Description — Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein
4.4	5S	24E	32	NE¼ SE¼	E. E. Hancock
9.2	5S	24E	33	NE¼ NW¼	" " "
14.1	5S	24E	33	SE¼ NW¼	" " "
10.0	6S	24E	1	NW¼ NW¼	James A. McBride
13.3	6S	24E	1	SW¼ NW¼	John L. Hoopes
39.9	6S	24E	1	NE¼ SW¼	Heber B. Bryce
30.0	6S	24E	1	NW¼ SW¼	John L. Hoopes
15.0	6S	24E	1	SW¼ SW¼	Heber B. Bryce
12.0	6S	24E	1	SE¼ SW¼	" " "
19.6	6S	24E	1	SE¼ SW¼	John L. Hoopes
24.5	6S	24E	1	NE¼ SE¼	Bell Kempton, Administratrix of the Estate of A. N. Bryce, deceased.
33.1	6S	24E	1	NW¼ SE¼	Heber B. Bryce
20.7	6S	24E	1	SW¼ SE¼	John L. Hoopes
10.0	6S	24E	1	SE¼ SE¼	" " "
8.4	6S	24E	2	SE¼ NE¼	Martha A. Merrill
14.1	6S	24E	2	NW¼ SW¼	Miles Messinger
39.3	6S	24E	2	NE¼ SE¼	E. E. Hancock
23.7	6S	24E	11	NE¼ NE¼	Leslie W. Layton & Zeb Ison
10.2	6S	24E	11	NW¼ NE¼	" " " " " "
8.7	6S	24E	12	NE¼ NE¼	R. A. Bryce
2.5	6S	24E	12	NE¼ NE¼	Heber B. Bryce
19.3	6S	24E	12	NE¼ NE¼	" " "
9.5	6S	24E	12	NW¼ NE¼	" " "
10.1	6S	24E	12	NW¼ NE¼	John Billingsley
19.5	6S	24E	12	NW¼ NE¼	J. W. Bryce
4.6	6S	24E	12	SW¼ NE¼	" " "
25.8	6S	24E	12	SW¼ NE¼	H. R. Chlarson
12.5	6S	24E	12	SE¼ NE¼	" " "
4.6	6S	24E	12	SE¼ NE¼	J. W. Bryce
17.5	6S	24E	12	SE¼ NE¼	R. D. Lamoreaux
1.5	6S	24E	12	SE¼ NE¼	Guy Dixon
20.0	6S	24E	12	NE¼ NW¼	D. E. Adams
16.3	6S	24E	12	NW¼ NW¼	Leslie W. Layton & Zeb Ison
2.8	6S	24E	12	SE¼ NW¼	J. W. Bryce
3.2	6S	25E	7	SW¼ NW¼	" " "
16.5	6S	25E	7	SW¼ NW¼	George O. Peck
18.5	6S	25E	7	SW¼ NW¼	R. D. Lamoreaux
10.6	6S	25E	7	SE¼ NW¼	William A. Peck
6.2	6S	25E	7	NE¼ SW¼	Bell Kempton, Administratrix of the Estate of A. N. Bryce, deceased.
14.6	6S	25E	7	NE¼ SW¼	G. A. Bryce
11.4	6S	25E	7	NE¼ SW¼	R. A. Bryce
14.8	6S	25E	7	NW¼ SW¼	Bell Kempton, Administratrix of the Estate of A. N. Bryce, deceased.
24.5	6S	25E	7	NE¼ SE¼	George O. Peck
23.6	6S	25E	7	NW¼ SE¼	" " "
7.0	6S	25E	7	NW¼ SE¼	G. A. Bryce
35.4	6S	25E	7	SW¼ SE¼	J. H. Nuttall
18.5	6S	25E	7	SE¼ SE¼	" " "
14.9	6S	25E	7	SE¼ SE¼	John W. Mattice
20.0	6S	25E	8	NE¼ SW¼	Simon Mathews

... affected by priorities antedating 1905

Number of acres	Lands — Description — Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein
1.7	7S	20E	6	SE¼ SE¼	R. G. Layton, Jr.
6.4	7S	26E	6	SE¼ SE¼	S. N. Holman
0.1	7S	26E	6	SW¼ SE¼	" " "
39.8	7S	26E	7	NE¼ NE¼	R. G. Layton, Jr.
20.0	7S	26E	7	NW¼ NE¼	R. A. Smith, Sr.
18.6	7S	26E	7	NW¼ NE¼	P. J. Jacobson
20.5	7S	26E	7	SW¼ NE¼	" " "
18.7	7S	26E	7	SW¼ NE¼	R. G. Layton, Jr.
39.8	7S	26E	7	SE¼ NE¼	" " " "
8.0	7S	26E	8	SW¼ NE¼	Charles M. Layton
22.0	7S	26E	8	SW¼ NE¼	Z. B. Decker
25.4	7S	26E	8	SE¼ NE¼	Charles M. Layton
32.9	7S	26E	8	NE¼ NW¼	Mrs. Mattie Prina
30.8	7S	26E	8	NW¼ NW¼	" " "
38.7	7S	26E	8	SW¼ NW¼	" " "
36.1	7S	26E	8	SE¼ NW¼	" " "
14.2	7S	26E	8	NE¼ SW¼	" " "
10.1	7S	26E	8	NE¼ SE¼	Charles M. Layton
8.0	7S	26E	8	NW¼ SE¼	" " "
8.2	7S	26E	8	NW¼ SE¼	Z. B. Decker

Number of acres	Lands — Description — Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein
14.6	7S	26E	15	NW¼ SE¼	Charles M. Pursley & Robert L. Nash
36.5	7S	26E	16	NE¼ NE¼	J. T. Owens, Jr.
14.7	7S	26E	16	NE¼ NE¼	E. M. Morris
20.0	7S	26E	16	NW¼ NE¼	Jesse B. Quinn
4.0	7S	26E	16	NW¼ NE¼	John W. Morris
14.9	7S	26E	16	SW¼ NE¼	" " "
3.7	7S	26E	16	SW¼ NE¼	E. M. Morris
11.6	7S	26E	16	SW¼ NE¼	E. Gallego
23.5	7S	26E	16	SE¼ NE¼	J. T. Owens, Jr.
20.6	7S	26E	16	NE¼ NE¼	O. E. Owens
13.2	7S	26E	16	NE¼ NW¼	Austin Evans
32.1	7S	26E	16	NW¼ NW¼	R. A. Welker
4.6	7S	26E	16	SE¼ NW¼	J. M. Dominges
3.1	7S	26E	16	SE¼ NW¼	N. Ortiz
35.4	7S	26E	17	NE¼ NE¼	Austin Evans
30.0	7S	26E	17	NW¼ NE¼	Robert Morris
7.0	7S	26E	17	NW¼ NE¼	Town of Safford
3.6	7S	26E	17	SE¼ NE¼	Austin Evans
10.0	7S	26E	17	NE¼ NW¼	Town of Safford
5.0	7S	26E	17	NW¼ NW¼	" " "
3.9	7S	26E	18	NW¼ NE¼	Arizona Eastern Railroad Company
7.5	7S	26E	18	NW¼ NE¼	P. J. Jacobson
7.8	7S	26E	18	NE¼ NW¼	Mary Lorraine Birdno
7.5	7S	26E	18	NE¼ NW¼	Mildred B. Larson
5.0	7S	26E	18	NW¼ NW¼	C. O. Larson
3.3	7S	26E	18	NW¼ NW¼	Mrs. W. A. Lewis

Number of acres	Lands: Description: Referred to G. & S. R. B. & M.				Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
	Twp.	Rge.	Sec.	Subdivision	
7.8	6S	25E	8	NW¼ SW¼	John C. Cooper
10.0	6S	25E	8	NW¼ SW¼	J. P. Walker
25.0	6S	25E	8	SW¼ SW¼	" " "
19.5	6S	25E	8	SE¼ SW¼	Simon Mathews
7.0	6S	25E	8	SW¼ SE¼	" "
15.0	6S	25E	8	SE¼ SE¼	William E. Bryce
14.0	6S	25E	16	NW¼ NW¼	S. N. Norton
3.7	6S	25E	16	SW¼ NW¼	J. E. Chesley
2.3	6S	26E	16	SW¼ NW¼	Mrs. A. W. Chesley
20.0	6S	25E	16	NW¼ SW¼	William Wamslee
39.0	6S	25E	16	SW¼ SW¼	G. A. Bryce
29.9	6S	25E	16	SE¼ SW¼	A. O. Lamoreaux, Jr.
11.0	6S	25E	16	SW¼ SE¼	Wilfred Peterson
21.0	6S	25E	17	NE¼ NE¼	Mrs. A. W. Chesley
20.0	6S	25E	17	NW¼ NE¼	" " " "
16.1	6S	25E	17	SW¼ NE¼	J. I. Palmer
17.0	6S	25E	17	SE¼ NE¼	Mrs. A. W. Chesley
40.0	6S	25E	17	NE¼ NW¼	S. S. Marshall
40.0	6S	25E	17	NW¼ NW¼	" " "
30.5	6S	25E	17	SW¼ NW¼	" " "
35.5	6S	25E	17	SE¼ NW¼	" " "
20.6	6S	25E	17	NE¼ SW¼	" " "
8.5	6S	25E	17	NE¼ SW¼	Carlyle Reynolds
4.7	6S	25E	17	NE¼ SW¼	Almera Hubbard
2.1	6S	25E	17	NE¼ SW¼	W. M. Blair
6.6	6S	25E	17	NW¼ SW¼	S. S. Marshall
5.1	6S	25E	17	NW¼ SW¼	Carlyle Reynolds
2.1	6S	25E	17	NW¼ SW¼	W. M. Blair
0.6	6S	25E	17	SW¼ SW¼	" " "
10.6	6S	25E	17	SE¼ SW¼	Almera Hubbard
2.6	6S	25E	17	SE¼ SW¼	W. M. Blair
7.7	6S	25E	17	NW¼ SE¼	J. L. Foutz
18.7	6S	25E	17	NW¼ SE¼	Almera Hubbard
20.4	6S	25E	17	SW¼ SE¼	Mrs. A. W. Chesley
36.4	6S	25E	17	SE¼ SE¼	J. W. Felshaw
12.5	6S	25E	18	NE¼ NE¼	John W. Mattice
10.4	6S	25E	20	NE¼ NE¼	J. W. Felshaw
0.7	6S	25E	21	NE¼ NE¼	Pima Corporation of the Church of Jesus Christ of Latter Day Saints.
26.7	6S	25E	21	NW¼ NE¼	A. T. West
35.0	6S	25E	21	SW¼ NE¼	" " "
16.1	6S	25E	21	SE¼ NE¼	Brigham Stowell
16.9	6S	25E	21	SE¼ NE¼	C. M. Mack
38.8	6S	26E	21	NE¼ NW¼	A. T. West
35.3	6S	25E	21	NW¼ NW¼	" " "
15.3	6S	25E	22	NE¼ NW¼	W. F. Butler, Jr.
12.9	6S	25E	22	NW¼ NW¼	" " " "
11.3	6S	25E	22	SW¼ NW¼	Mary Butler
16.6	6S	25E	22	SE¼ NW¼	" "
23.0	6S	25E	22	NE¼ SW¼	D. W. Sanders
17.1	6S	25E	22	NW¼ SW¼	" " "
22.2	6S	25E	22	NW¼ SE¼	Charles Watson
13.5	6S	25E	22	SW¼ SE¼	" "
12.0	6S	25E	22	SE¼ SE¼	" "
8.4	6S	25E	22	SE¼ SE¼	E. D. Howard
13.5	6S	25E	23	SW¼ SW¼	E. D. Howard
1.3	6S	25E	23	SE¼ SW¼	J. M. Howard
18.6	6S	25E	25	SW¼ SW¼	D. V. A. Talley
21.6	6S	25E	25	SE¼ SW¼	" " " "
5.5	6S	25E	25	SW¼ SE¼	" " " "
0.1	6S	25E	26	NW¼ NE¼	Pratt Stewart
17.8	6S	25E	26	NE¼ NW¼	J. M. Howard
16.6	6S	25E	26	NE¼ NW¼	Pratt Stewart
24.0	6S	25E	26	NW¼ NW¼	S. D. Howard
6.6	6S	25E	26	SW¼ NW¼	Joseph Howard & J. M. Howard
2.7	6S	25E	26	SE¼ NW¼	" " " " " "
18.0	6S	25E	26	SE¼ NW¼	Pratt Stewart
3.6	6S	25E	26	SE¼ NW¼	John Nulton
11.4	6S	25E	26	NE¼ SW¼	" "
3.0	6S	25E	26	NE¼ SW¼	Joseph Howard & J. M. Howard
16.3	6S	25E	26	NE¼ SE¼	Robert E. Reed
2.7	6S	25E	26	NE¼ SE¼	K. V. B. Talley
10.8	6S	25E	26	NW¼ SE¼	" " " "
8.9	6S	25E	26	SW¼ SE¼	" " " "
15.5	6S	25E	26	SE¼ SE¼	" " " "
24.7	6S	25E	26	SE¼ SE¼	Robert E. Reed
19.9	6S	25E	27	NE¼ NE¼	E. D. Howard
5.7	6S	25E	27	NE¼ NE¼	Charles Watson
17.5	6S	25E	35	NE¼ NE¼	K. V. B. Talley
0.6	6S	25E	35	NW¼ NE¼	" " " "
0.5	6S	25E	36	NE¼ NE¼	D. W. Sanders
0.4	6S	25E	36	NE¼ NE¼	J. T. Talley
2.0	6S	25E	36	NW¼ NE¼	School District #8, County of Graham, State of Arizona.
21.3	6S	25E	36	NW¼ NE¼	Jerome Walker
1.3	6S	25E	36	NW¼ NE¼	J. T. Talley
23.0	6S	25E	36	SW¼ NE¼	" " "
7.8	6S	25E	36	SW¼ NE¼	Jerome Walker
3.9	6S	25E	36	SE¼ NE¼	J. T. Talley
16.8	6S	35E	36	SE¼ NE¼	D. W. Sanders
7.7	6S	25E	36	SE¼ NE¼	Maroni Skinner
0.2	6S	25E	36	NE¼ NW¼	Jerome Walker
25.3	6S	25E	36	NE¼ NW¼	Alma Peterson
14.0	6S	25E	36	NE¼ NW¼	W. H. Spafford
33.6	6S	25E	36	NW¼ NW¼	" " "
0.1	6S	25E	36	NW¼ NW¼	Alma Peterson
4.0	6S	25E	36	SE¼ NW¼	" "
0.9	6S	25E	36	SE¼ NW¼	Jerome Walker
1.3	6S	25E	36	NE¼ SW¼	" "
0.6	6S	25E	36	NE¼ SW¼	J. T. Talley
30.0	6S	25E	36	NE¼ SE¼	Maroni Skinner
6.4	6S	25E	36	NE¼ SE¼	D. W. Sanders
2.9	6S	25E	36	NE¼ SE¼	Francis M. Skinner
3.6	6S	25E	36	NW¼ SE¼	D. W. Sanders
0.8	6S	25E	36	NW¼ SE¼	Francis M. Skinner
8.0	6S	25E	36	NW¼ SE¼	Maroni Skinner
21.7	6S	25E	36	NW¼ SE¼	J. T. Talley
0.8	6S	25E	36	SW¼ SE¼	" " "
4.2	6S	25E	36	SW¼ SE¼	Maroni Skinner
0.7	6S	25E	36	SW¼ SE¼	Francis M. Skinner
21.7	6S	25E	36	SE¼ SE¼	Francis M. Skinner
5.6	6S	25E	36	SE¼ SE¼	Maroni Skinner
18.1	6S	26E	31	NW¼ SW¼	" "
5.4	6S	26E	31	NW¼ SW¼	James M. Talley
39.4	6S	26E	31	SW¼ SW¼	Francis M. Skinner
1.6	6S	26E	31	SE¼ SW¼	" " "
20.0	7S	25E	1	NE¼ NE¼	James M. Talley
23.4	7S	26E	5	SW¼ NW¼	William Wamslee
17.3	7S	26E	5	NW¼ SW¼	" "
3.7	7S	26E	6	NE¼ NE¼	R. A. Smith, Sr.
2.6	7S	26E	6	NW¼ NE¼	" " " "
36.1	7S	26E	6	SW¼ NE¼	" " " "
2.7	7S	26E	6	SW¼ NE¼	J. R. Golding
17.1	7S	26E	6	SE¼ NE¼	" " "
20.4	7S	26E	6	SE¼ NE¼	R. A. Smith, Sr.
21.2	7S	26E	6	NE¼ NW¼	P. O. Peterson
19.3	7S	26E	6	NW¼ NW¼	" " "
19.0	7S	26E	6	NW¼ NW¼	James M. Talley
5.2	7S	26E	6	SW¼ NW¼	P. O. Peterson
18.0	7S	26E	6	SE¼ NW¼	" " "
7.3	7S	26E	6	SE¼ NW¼	" " "
25.0	7S	26E	6	NE¼ SE¼	J. R. Golding
10.8	7S	26E	6	NW¼ SE¼	" " "

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein
6.5	4S	23E	17	SW¼ NW¼	J. E. Pulsipher
6.0	4S	23E	17	NW¼ SW¼	" " "
3.1	4S	23E	17	SW¼ SE¼	L. M. Taylor
0.4	4S	23E	17	SE¼ SE¼	" " "
16.6	4S	23E	18	NW¼ NE¼	Mrs. Henry Dial
12.1	4S	23E	18	SW¼ NE¼	" " "
25.8	4S	23E	18	SE¼ NE¼	J. E. Pulsipher
2.1	4S	23E	18	NE¼ SE¼	" " "
24.5	4S	23E	19	NE¼ NE¼	E. W. Black
13.2	4S	23E	20	NE¼ NE¼	L. M. Taylor
1.0	4S	23E	20	NW¼ NE¼	" " "
1.2	4S	23E	20	SW¼ NE¼	C. J. Grover
1.5	4S	23E	20	SE¼ NE¼	L. M. Taylor
9.0	4S	23E	20	NE¼ NW¼	C. N. Rose
14.6	4S	23E	20	NW¼ NW¼	" " "
6.9	4S	23E	20	NW¼ NW¼	" " "
16.6	4S	23E	20	SE¼ NW¼	" " "
28.8	4S	23E	20	NE¼ SW¼	P. L. Motes & D. T. Motes
3.9	4S	23E	20	NE¼ SW¼	C. J. Grover
28.7	4S	23E	20	SW¼ SW¼	William H. Holyoak
20.1	4S	23E	20	SE¼ SW¼	P. L. Motes & D. T. Motes
5.7	4S	23E	20	SE¼ SW¼	Grady Coppedge
2.6	4S	23E	20	SE¼ SW¼	C. J. Grover
18.3	4S	23E	20	NW¼ SE¼	" " "
4.5	4S	23E	20	NW¼ SE¼	P. L. Motes & D. T. Motes
1.1	4S	23E	20	NW¼ SE¼	C. J. Grover
2.1	4S	23E	20	SW¼ SE¼	Grady Coppedge
18.5	4S	23E	20	SW¼ SE¼	C. J. Grover
15.5	4S	23E	20	SW¼ SE¼	Jacob Peters
27.3	4S	23E	21	SW¼ SW¼	Alonzo Winsor
13.5	4S	23E	21	SE¼ SW¼	" "
15.6	4S	23E	28	NW¼ NE¼	(Leslie Montierth & Wendell Montierth.
21.2	4S	23E	28	NE¼ NW¼	(
9.2	4S	23E	28	NW¼ NW¼	Alonzo Winsor
36.5	4S	23E	28	SE¼ NW¼	(Leslie Montierth & Wendell Montierth
2.6	4S	23E	28	NE¼ SW¼	(
33.1	4S	23E	29	NW¼ NE¼	Mrs. S. J. Hunter
16.9	4S	23E	29	SW¼ NE¼	" " " "
18.9	4S	23E	29	SW¼ NE¼	Charles E. Dallas
29.1	4S	23E	29	SE¼ NE¼	" " "
16.6	4S	23E	29	NE¼ NW¼	J. H. Elmer
6.1	4S	23E	29	NE¼ NW¼	James E. Jones
19.8	4S	23E	34	NW¼ NE¼	George P. Ballard
30.0	4S	23E	34	SW¼ NE¼	George W. Healy
8.9	4S	23E	34	NE¼ NW¼	George P. Ballard
5.1	4S	23E	35	SW¼ NE¼	William O. Tyler
17.3	4S	23E	35	SE¼ NW¼	Robert Ferrin
22.8	4S	23E	35	SW¼ NW¼	T. J. Rex
7.6	4S	23E	35	NW¼ SW¼	Charles S. Clark
7.3	4S	23E	35	NW¼ SW¼	Juan Garcia
17.2	4S	23E	35	NE¼ SW¼	Robert Ferrin
34.3	4S	23E	35	NW¼ SE¼	William O. Tyler
9.1	5S	23E	1	NE¼ SW¼	W. O. Tuttle
31.1	5S	23E	1	NW¼ SW¼	Claude M. Lee
4.3	5S	23E	1	NW¼ SW¼	W. E. Platt
27.3	5S	23E	1	SW¼ SW¼	" " "
39.2	5S	23E	1	SE¼ SW¼	W. O. Tuttle
24.2	5S	23E	1	SW¼ SE¼	" " "
3.7	5S	23E	2	NE¼ NE¼	J. Y. Lee
11.7	5S	23E	2	NW¼ NE¼	" " "
28.5	5S	23E	2	NW¼ NE¼	Oscar Tyler
29.7	5S	23E	2	SW¼ NE¼	J. Y. Lee
24.9	5S	23E	2	SE¼ NE¼	" " "
9.9	5S	23E	2	NE¼ SE¼	George W. Healy
6.7	5S	23E	2	NW¼ SE¼	" " "
13.7	5S	23E	2	SW¼ SE¼	" " "
37.7	5S	23E	2	SE¼ SE¼	" " "
0.6	5S	23E	11	NE¼ NE¼	P. M. Merrill
1.9	5S	23E	11	NW¼ NE¼	" " "
14.9	5S	23E	12	NE¼ NE¼	F. A. Webster
38.8	5S	23E	12	NW¼ NE¼	" " "
6.4	5S	23E	12	SW¼ NE¼	" " "
33.6	5S	23E	12	SW¼ NE¼	C. M. Layton, Jr.
5.5	5S	23E	12	SE¼ NE¼	F. A. Webster
34.0	5S	23E	12	SE¼ NE¼	C. M. Layton, Jr.
39.8	5S	23E	12	NE¼ NW¼	P. M. Merrill
37.2	5S	23E	12	NW¼ NW¼	W. O. Tuttle
38.4	5S	23E	12	SW¼ NW¼	George A. Todd
39.6	5S	23E	12	SE¼ NW¼	P. M. Merrill
9.4	5S	23E	12	NE¼ SW¼	E. P. Bryce
6.3	5S	23E	12	NW¼ SW¼	Emma B. Mellinger
32.0	5S	23E	12	SW¼ SW¼	W. H. Roach
37.9	5S	23E	12	SE¼ SW¼	George A. Todd
40.0	5S	23E	12	NE¼ SE¼	Eugene Curtis
40.0	5S	23E	12	NW¼ SE¼	C. M. Layton, Jr.
39.5	5S	23E	12	SW¼ SE¼	" " " "
39.0	5S	23E	12	SE¼ SE¼	Eugene Curtis
18.5	5S	23E	13	NE¼ NE¼	(William Wamslee & Charles Wamslee
30.5	5S	23E	13	NW¼ NE¼	(
10.0	5S	23E	13	NW¼ NE¼	George A. Todd
38.3	5S	23E	13	SW¼ NE¼	E. K. Packer
36.0	5S	23E	13	NE¼ NW¼	W. C. Bryce
2.1	5S	23E	13	NW¼ NW¼	" " "
24.6	5S	23E	13	NW¼ NW¼	David J. Bryce
24.4	5S	23E	13	SW¼ NW¼	E. P. Bryce
31.0	5S	23E	13	SE¼ NW¼	" " "
30.0	5S	23E	13	NE¼ SW¼	M. D. Maloy
4.5	5S	23E	13	NW¼ SW¼	" " "
15.5	5S	23E	13	NE¼ SE¼	W. R. Summers
14.2	5S	23E	13	NE¼ SE¼	A. B. Decker
37.8	5S	23E	13	NW¼ SE¼	Mrs. John J. Birdno
17.3	5S	23E	13	SW¼ SE¼	George F. Richards
11.6	5S	23E	13	SE¼ SE¼	" " "
4.7	5S	23E	14	NE¼ NE¼	David J. Bryce
15.3	5S	24E	7	NW¼ SW¼	Eugene Curtis
10.8	5S	24E	7	SW¼ SW¼	" "
0.1	5S	24E	18	NW¼ NW¼	E. K. Packer
6.3	5S	24E	18	SW¼ NW¼	" " "
3.2	5S	24E	19	NW¼ NE¼	Thomas H. Bell
30.5	5S	24E	19	SW¼ NE¼	Thomas H. Bell
36.8	5S	24E	19	NE¼ NW¼	" " "
40.0	5S	24E	19	SE¼ NW¼	" " "
38.4	5S	24E	19	NW¼ SE¼	R. H. Kempton
39.0	5S	24E	19	SW¼ SE¼	" " "
8.5	5S	24E	19	SE¼ SE¼	" " "
13.8	5S	24E	30	NE¼ NE¼	Thomas H. Hundley
26.4	5S	24E	30	SE¼ NE¼	" " "
15.6	5S	24E	30	NE¼ SE¼	" " "

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...priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
0.1	6S	27E	34	SW¼ SE¼	Ezra Curtis
6.2	6S	27E	34	SE¼ SE¼	L. B. Head
7.6	6S	27E	35	SW¼ NE¼	Manuel Sanchez
4.7	6S	27E	35	SE¼ NE¼	" "
23.1	6S	27E	35	SE¼ NE¼	Adiel Sanchez
3.7	6S	27E	35	SE¼ NE¼	Espedion Sadilla
9.7	6S	27E	35	NE¼ SW¼	Harry Van Order, Administrator of the Estate of Harry Van Order, deceased
10.7	6S	27E	35	SW¼ SW¼	L. B. Head
2.2	6S	27E	35	SE¼ SW¼	Harry Van Order, Administrator of the Estate of Harry Van Order, deceased.
5.9	6S	27E	35	NE¼ SE¼	Espedion Sadilla
13.7	6S	27E	35	NE¼ SE¼	Adiel Sanchez
0.5	6S	27E	35	NE¼ SE¼	Manuel Sanchez
3.9	6S	27E	35	NE¼ SE¼	Amadeo Fajardo
7.2	6S	27E	35	NW¼ SE¼	
9.8	6S	27E	35	NW¼ SE¼	Manuel Sanchez
3.0	6S	27E	35	NW¼ SE¼	Harry Van Order, Administrator of the Estate of Harry Van Order, deceased.
4.3	6S	27E	36	SW¼ NW¼	Santos Serna
3.6	6S	27E	36	SW¼ NW¼	Isias Sanchez
2.1	6S	27E	36	SW¼ NW¼	Catalina Entzminger
3.2	6S	27E	36	SW¼ NW¼	Eliseo Sanchez
2.0	6S	27E	36	SW¼ NW¼	Espedion Sadilla
2.1	6S	27E	36	SE¼ NW¼	Santes Serna
5.6	6S	27E	36	SE¼ NW¼	Abel Sanchez
8.1	6S	27E	36	NE¼ SW¼	Daniel Sanchez
25.0	6S	27E	36	NE¼ SW¼	Abel Sanchez
0.8	6S	26E	36	NE¼ SW¼	Santos Serna
8.9	6S	27E	36	NW¼ SW¼	" "
1.0	6S	27E	36	NW¼ SW¼	Abel Sanchez
7.6	6S	27E	36	NW¼ SW¼	Isias Sanchez
4.1	6S	27E	36	NW¼ SW¼	Catalina Entzminger
3.7	6S	27E	36	NW¼ SW¼	Eliseo Sanchez
2.8	6S	27E	36	NW¼ SW¼	Espedion Sadilla
1.4	6S	27E	36	NE¼ SE¼	Juvenal Perolas, Administrator of the Estate of Damos De Leon, deceased.
5.8	6S	27E	36	NE¼ SE¼	John T. Traylor
2.3	6S	27E	36	NW¼ SE¼	" "
26.7	6S	27E	36	NW¼ SE¼	Daniel Sanchez
1.6	6S	27E	36	SW¼ SE¼	" "
0.9	6S	27E	36	SW¼ SE¼	John T. Traylor
2.7	6S	27E	36	SE¼ SE¼	" " "
7.8	6S	27E	36	SE¼ SE¼	Juvenal Perolas, Administrator of the Estate of Damos DeLeon, deceased.
7.4	6S	28E	31	NE¼ SW¼	P. Johnson

Brown Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
13.1	6S	28E	31	SW¼ SW¼	P. Johnson
13.5	6S	28E	31	SE¼ SW¼	" "
13.0	6S	28E	31	NE¼ SE¼	" "
31.6	6S	28E	31	NW¼ SE¼	" "
16.0	6S	28E	31	SW¼ SE¼	" "
0.8	6S	28E	31	SE¼ SE¼	" "
5.4	7S	27E	2	NW¼ NW¼	Emula Viala
20.3	7S	27E	3	NE¼ NE¼	Ezra Curtis
36.8	7S	27E	3	NW¼ NE¼	" "
11.6	7S	27E	3	SW¼ NE¼	L. B. Head
11.0	7S	27E	3	NE¼ NW¼	Claro Dominques
2.9	7S	27E	3	NW¼ NW¼	" "
25.2	7S	27E	3	SW¼ NW¼	Edward Carpenter
36.5	7S	27E	3	SE¼ NW¼	Edwin Moody
33.0	7S	27E	3	NE¼ SW¼	" "
35.8	7S	27E	3	NW¼ SW¼	Edward Carpenter
34.5	7S	27E	3	SW¼ SW¼	" "
7.1	7S	27E	3	SE¼ SW¼	Edwin Moody
12.9	7S	27E	4	NE¼ SE¼	H. C. Usher
6.3	7S	27E	4	SW¼ SE¼	W. R. Chambers
38.0	7S	27E	4	SE¼ SE¼	" " "
23.6	7S	27E	9	NE¼ NE¼	" " "
36.8	7S	27E	9	NW¼ NE¼	" " "
15.0	7S	27E	9	SW¼ NE¼	" " "
19.5	7S	27E	9	NE¼ NW¼	Abran Madrid
2.5	7S	27E	9	NE¼ NW¼	T. J. Steward
0.6	7S	27E	9	NW¼ NW¼	" "
25.7	7S	27E	9	SW¼ NW¼	" " "
9.6	7S	27E	9	SE¼ NW¼	" "
27.9	7S	27E	9	SE¼ NW¼	Abran Madrid

Dodge-Nevada Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
9.6	5S	24E	19	NW¼ SW¼	Gilbert Richardson
17.4	5S	24E	19	SW¼ SW¼	" "
2.9	5S	24E	30	NE¼ SW¼	C. J. Farrington
27.3	5S	24E	30	NW¼ SE¼	" "
5.5	5S	24E	30	SW¼ SE¼	" "
14.4	5S	24E	30	SW¼ SE¼	Thomas H. Hundley
6.8	5S	24E	30	SE¼ SE¼	" "
5.3	5S	24E	31	NE¼ NE¼	Art Lee
0.3	5S	24E	31	NW¼ NE¼	" "
24.4	5S	24E	31	NW¼ NE¼	" "
30.4	5S	24E	31	SW¼ NE¼	" "
6.1	5S	24E	31	SE¼ NE¼	" "
8.8	5S	24E	31	SE¼ NE¼	William Boren
16.5	5S	24E	31	SE¼ NW¼	Mrs. J. E. Cluff
24.4	5S	24E	31	NE¼ SE¼	William Boren
8.0	5S	24E	32	NW¼ SW¼	R. R. Shipp
0.3	5S	24E	32	SW¼ SW¼	" " "
11.4	5S	24E	32	SE¼ SW¼	" " "
0.6	5S	24E	32	SW¼ SE¼	" " "
3.1	6S	24E	3	NE¼ SW¼	A. C. Hunt
9.6	6S	24E	3	NE¼ SW¼	F. A. Farrell & A. T. West
1.0	6S	24E	3	SW¼ SW¼	A. J. Curtis
5.1	6S	24E	3	SW¼ SW¼	D. H. Matthews
20.0	6S	24E	3	SW¼ SW¼	F. A. Farrell & A. T. West
19.5	6S	24E	3	SE¼ SW¼	" " " " " "
19.9	6S	24E	3	SE¼ SW¼	A. C. Hunt
1.4	6S	24E	3	NW¼ SE¼	" " "
5.1	6S	24E	3	SW¼ SE¼	" " "
25.4	6S	24E	3	SW¼ SE¼	F. A. Farrell & A. T. West
10.0	6S	24E	3	SE¼ SE¼	John Hicks
21.1	6S	24E	4	NW¼ NW¼	A. O. Mack
39.6	6S	24E	4	SW¼ NW¼	Joseph E. Follett
4.4	6S	24E	4	SE¼ NW¼	" " "
1.2	6S	24E	4	NE¼ SW¼	" " "
18.3	6S	24E	4	NW¼ SW¼	" " "
8.0	6S	24E	4	SE¼ SW¼	F. Sanchez
20.8	6S	24E	4	SW¼ SE¼	Benjamin Echols
5.4	6S	24E	4	SE¼ SE¼	A. J. Curtis
3.2	6S	24E	4	SE¼ SE¼	" " "
29.7	6S	24E	5	NE¼ NE¼	A. O. Mack
10.0	6S	24E	5	SE¼ NE¼	Martha McElroy
5.3	6S	24E	9	NE¼ NE¼	A. J. Curtis
29.8	6S	24E	10	NE¼ NE¼	C. A. Matthews
3.0	6S	24E	10	NW¼ NE¼	" " "
16.4	6S	24E	10	NW¼ NE¼	Eliza Matthews
20.2	6S	24E	10	NW¼ NE¼	A. C. Hunt
19.8	6S	24E	10	SW¼ NE¼	" " "
1.7	6S	24E	10	SW¼ NE¼	C. A. Matthews
15.3	6S	24E	10	SW¼ NE¼	Eliza Matthews
33.2	6S	24E	10	SE¼ NE¼	C. A. Matthews
28.9	6S	24E	10	NE¼ NW¼	D. H. Matthews
9.2	6S	24E	10	NE¼ NW¼	F. A. Farrell & A. T. West

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
19.9	6S	24E	10	NW¼ NW¼	F. A. Farrell & A. T. West
4.5	6S	24E	10	NW¼ NW¼	A. J. Curtis
2.1	6S	24E	10	NW¼ NW¼	D. H. Matthews
1.2	6S	24E	10	SW¼ NW¼	F. A. Farrell & A. T. West
0.4	6S	24E	10	SE¼ NW¼	" " " " " " "
4.5	6S	24E	10	SE¼ NW¼	D. H. Matthews
1.6	6S	24E	10	NW¼ SE¼	Leo Keiffer
4.0	6S	24E	11	SW¼ NE¼	J. A. Mack
28.5	6S	24E	11	SW¼ NW¼	Lehi Larson, Sr.
8.1	6S	24E	11	SW¼ NW¼	H. B. Elledge
11.6	6S	24E	11	SE¼ NW¼	" " "
7.4	6S	24E	11	NW¼ SW¼	Earl Larson
1.7	6S	24E	11	NW¼ SW¼	H. B. Elledge
19.9	6S	24E	11	NE¼ SW¼	" " "
3.7	6S	24E	11	SE¼ SW¼	P. A. Norton
8.2	6S	24E	11	NE¼ SE¼	Alof P. Carter
13.4	6S	24E	11	NE¼ SE¼	Alof P. Carter, Administrator of the Estate of E. L. Carter, deceased.
24.7	6S	24E	11	NW¼ SE¼	J. A. Mack
15.6	6S	24E	11	NW¼ SE¼	P. A. Norton
15.7	6S	24E	11	SW¼ SE¼	" " "
3.6	6S	24E	11	SW¼ SE¼	J. A. Mack
5.7	6S	24E	11	SW¼ SE¼	Lehi Larson, Sr.
7.7	6S	24E	11	SW¼ SE¼	Mrs. Olivea Larson
11.5	6S	24E	11	SE¼ SE¼	Alof P. Carter
12.5	6S	24E	11	SE¼ SE¼	Alof P. Carter, Administrator of the Estate of E. L. Carter, deceased.
8.6	6S	24E	11	SE¼ SE¼	James M. Larson
6.3	6S	24E	11	SE¼ SE¼	W. A. Carter, Sr.
1.6	6S	24E	12	NW¼ SW¼	Mrs. Sarah Barney
36.3	6S	24E	12	SW¼ SW¼	P. H. McBride
0.5	6S	24E	12	SW¼ SW¼	John H. Foster
5.2	6S	24E	12	SE¼ SW¼	I. A. Follett
6.3	6S	24E	12	SE¼ SW¼	John H. Foster
1.2	6S	24E	12	SE¼ SW¼	Roy Saline
0.3	6S	24E	12	SW¼ SE¼	J. H. Mack
2.4	6S	24E	12	SW¼ SE¼	H. J. Anderson
16.2	6S	24E	12	SE¼ SE¼	" " "
30.7	6S	24E	13	NE¼ NE¼	" " "
2.6	6S	24E	13	NW¼ NE¼	" " "
35.9	6S	24E	13	NW¼ NE¼	J. H. Mack
7.9	6S	24E	13	SW¼ NE¼	" " "
15.2	6S	24E	13	SE¼ NE¼	H. J. Anderson
18.3	6S	24E	13	NE¼ NW¼	Roy Saline
13.4	6S	24E	13	NE¼ NW¼	John H. Foster
0.9	6S	34E	13	NW¼ NW¼	" " "
27.0	6S	24E	13	NW¼ NW¼	P. H. McBride, Jr.
7.5	6S	24E	14	NE¼ NE¼	W. A. Carter, Sr.
6.9	6S	24E	14	NE¼ NE¼	James M. Larson
1.5	6S	24E	14	NE¼ NE¼	Mrs. Charlotte Wilkins

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
7.0	6S	24E	14	NE¼ NE¼	Alof P. Carter, Administrator of the estate of E. L. Carter, deceased.
4.3	6S	24E	14	NW¼ NE¼	Mrs. Olivea Larson
2.3	6S	24E	14	NW¼ NE¼	Lehi Larson, Sr.
3.7	6S	24E	14	NW¼ NE¼	C. B. Boren
2.4	6S	25E	18	SE¼ NW¼	W. A. Lines
19.8	6S	25E	18	SW¼ NW¼	H. J. Anderson
10.3	6S	25E	18	NE¼ SW¼	W. A. Lines
1.9	6S	25E	18	NE¼ SE¼	Lewis P. Mattice
12.6	6S	25E	18	NW¼ SE¼	" " "

Number of acres	Lands: Description, Referred to G. & S. R. B. & M.: Twp.	Rge.	Sec.	Subdivision	Ownership: Parties owning lands described in the preceding column when jurisdiction acquired herein.
10.7	6S	24E	11	NE¼ SW¼	H. B. Elledge
4.1	6S	24E	11	SE¼ SW¼	" " "
25.7	6S	24E	13	SW¼ NE¼	J. H. Mack
4.4	6S	24E	13	SW¼ NE¼	J. A. Mack
38.0	6S	24E	13	NE¼ SE¼	H. J. Anderson.
26.2	6S	24E	13	NW¼ SE¼	Karl Foster
11.1	6S	24E	13	SW¼ SE¼	" "
8.6	6S	24E	13	SE¼ SE¼	Niels J. Roseberry
18.8	6S	24E	13	SE¼ SE¼	H. J. Anderson
1.3	6S	24E	24	NE¼ NE¼	" " "
7.0	6S	25E	17	SW¼ SW¼	John W. Mattice
1.7	6S	25E	18	SW¼ NW¼	H. J. Anderson
10.2	6S	25E	18	NE¼ SW¼	W. A. Lines
27.2	6S	25E	18	NW¼ SW¼	" " "
29.5	6S	25E	18	SW¼ SW¼	" " "
11.7	6S	25E	18	SE¼ SW¼	" " "
4.5	6S	25E	18	SE¼ SW¼	John W. Mattice
1.2	6S	25E	18	NW¼ SE¼	Lewis P. Mattice
11.5	6S	25E	18	SW¼ SE¼	W. E. McBride
15.7	6S	25E	18	SW¼ SE¼	D. C. McBride
8.7	6S	25E	18	SW¼ SE¼	William C. Taylor
3.0	6S	25E	18	SW¼ SE¼	Thomas Dodge
28.1	6S	25E	18	SE¼ SE¼	Jane L. Mattice
5.1	6S	25E	18	SE¼ SE¼	John W. Mattice
27.4	6S	25E	19	NE¼ NE¼	" " "
5.6	6S	25E	19	NE¼ NE¼	W. W. Crockett
4.9	6S	25E	19	NE¼ NE¼	H. W. Crockett
13.0	6S	25E	19	NW¼ NE¼	" " "
12.1	6S	25E	19	NW¼ NE¼	W. W. Crockett
4.2	6S	25E	19	NW¼ NE¼	John W. Mattice
10.0	6S	25E	19	SW¼ NE¼	H. W. Crockett
9.0	6S	25E	19	SW¼ NE¼	S. S. Marshall
11.7	6S	25E	19	SE¼ NE¼	W. W. Crockett
? 19.7	6S	25E	19	SE¼ NE¼	H. W. Crockett
15.7	6S	25E	19	SE¼ NE¼	S. S. Marshall
10.9	6S	25E	19	NE¼ SE¼	Charles Rogers
3.9	6S	25E	19	NE¼ SE¼	Mrs. John Shields
13.3	6S	25E	19	NE¼ SE¼	Joseph H. Lines
9.2	6S	25E	19	NE¼ NW¼	W. A. Lines
21.3	6S	25E	19	NW¼ NW¼	" " "
130.00	6S	25E	19	and 30	Town of Pima
25.5	6S	25E	20	NW¼ NW¼	John W. Mattice
9.8	6S	25E	20	NW¼ NW¼	Henry Lines
18.4	6S	25E	20	SW¼ NW¼	Al Lines
9.6	6S	25E	20	SW¼ NW¼	W. E. McBride
7.3	6S	25E	20	SW¼ NW¼	Charles Kerby
2.6	6S	25E	20	SE¼ NW¼	Al Lines
18.2	6S	25E	20	NE¼ SW¼	S. O. Williams
2.4	6S	25E	20	NE¼ SW¼	Mrs. Maude Allred
7.0	6S	25E	20	NE¼ SW¼	George Reynolds
10.9	6S	25E	20	NE¼ SW¼	John E. Taylor
14.9	6S	25E	20	NW¼ SW¼	W. A. Clark
25.4	6S	25E	20	NW¼ SW¼	John Saline
11.5	6S	25E	20	SW¼ SW¼	" "
3.2	6S	25E	20	SW¼ SW¼	S. O. Williams
3.1	6S	25E	20	SW¼ SW¼	John E. Taylor
1.0	6S	25E	20	SW¼ SW¼	W. I. Follett

Table No. 10 (Continued)
Smithville Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
13.8	6S	25E	20	SE¼ SW¼	Charles S. Larson
22.8	6S	25E	20	SE¼ SW¼	Mrs. Maude Allred
16.3	6S	25E	20	NE¼ SE¼	W. L. Follett
40.0	6S	25E	20	NW¼ SE¼	S. O. Williams
12.6	6S	25E	20	SW¼ SE¼	Joe Larson
17.7	6S	25E	20	SW¼ SE¼	Mrs. Nancy Reynolds
7.6	6S	25E	20	SW¼ SE¼	Beatrice Larson
20.4	6S	25E	20	SE¼ SE¼	Charles S. Larson
6.0	6S	25E	20	SE¼ SE¼	Joe Larson
10.6	6S	25E	21	SW¼ SW¼	Charles S. Larson
7.8	6S	25E	27	NE¼ NW¼	Gerald Merrill
6.2	6S	25E	27	NW¼ NW¼	W. R. Bingham
19.2	6S	25E	27	SW¼ NW¼	" "
9.6	6S	25E	27	SW¼ NW¼	A. M. Farner
8.2	6S	25E	27	SE¼ NW¼	Gerald Merrill
22.0	6S	25E	27	SE¼ NW¼	Winford Moody
35.6	6S	25E	27	NE¼ SW¼	E. C. Phillips
1.2	6S	25E	27	NW¼ SW¼	W. R. Bingham
1.0	6S	25E	27	NW¼ SW¼	A. M. Farner
36.1	6S	25E	27	NW¼ SW¼	Lorenzo Watson
37.6	6S	25E	27	SW¼ SW¼	" "
37.1	6S	25E	27	SE¼ SW¼	E. C. Phillips
35.3	6S	25E	28	SW¼ NE¼	J. E. Schurtz
38.0	6S	25E	28	SE¼ NE¼	Clarence Martin
19.6	6S	25E	28	NW¼ NW¼	S. O. Williams
20.1	6S	25E	28	NW¼ NW¼	P. C. Merrill, Administrator of the Estate of Joe Pensyl, deceased.
19.5	6S	25E	28	SW¼ NW¼	J. E. Norton
19.7	6S	25E	28	SW¼ NW¼	J. D. Kennison
10.1	6S	25E	28	SE¼ NW¼	J. E. Norton
14.4	6S	25E	28	SE¼ NW¼	H. L. Norton, Jr.
14.0	6S	25E	28	SE¼ NW¼	" " " , Sr.
34.2	6S	25E	28	NE¼ SW¼	J. D. Kennison
36.8	6S	25E	28	NW¼ SW¼	" " "
0.2	6S	25E	28	SE¼ SW¼	" " "
39.1	6S	25E	28	NE¼ SE¼	Victor Christenson
17.5	6S	25E	28	NW¼ SE¼	E. M. Allred
21.9	6S	25E	28	NW¼ SE¼	J. N. Allred
14.3	6S	25E	28	SW¼ SE¼	D. T. Adams
35.7	6S	25E	28	SE¼ SE¼	" " "
39.5	6S	25E	29	NE¼ NE¼	(P. C. Merrill, Administrator
26.7	6S	25E	29	NW¼ NE¼	(of the Estate of Joe
31.5	6S	25E	29	SE¼ NE¼	(Pensyl, deceased.
1.0	6S	25E	29	NE¼ NW¼	(
21.4	6S	25E	29	NE¼ SE¼	Joseph Alder
17.6	6S	25E	34	NE¼ NW¼	A. J. Shifflet
13.6	6S	25E	34	NE¼ NW¼	J. W. Sowell
17.4	6S	25E	34	NW¼ NW¼	B. F. Cluff

Table No. 11 (Continued)
Curtis Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
1.4	5S	24E	7	NW¼ SE¼	E. W. McEuen
19.5	5S	24E	7	SW¼ SE¼	" " "
5.5	5S	24E	17	SW¼ NW¼	F. M. Ferrell
15.7	5S	24E	17	SW¼ NW¼	" " "
10.6	5S	24E	17	SE¼ NW¼	" " "
2.4	5S	24E	17	NE¼ SW¼	" " "
33.0	5S	24E	17	NW¼ SW¼	" " "
15.7	5S	24E	17	SW¼ SW¼	" " "
27.0	5S	24E	18	NE¼ NE¼	A. F. McEuen
9.5	5S	24E	18	NW¼ NE¼	" " "
12.9	5S	24E	18	SW¼ NE¼	" " "
20.9	5S	24E	18	SE¼ NE¼	" " "
20.3	5S	24E	18	SE¼ SE¼	Virgil R. McEuen
13.2	5S	24E	20	NW¼ NW¼	Scott Holladay
29.3	5S	24E	20	SW¼ NW¼	E. G. Bullard
40.0	5S	24E	20	NE¼ SW¼	Jaared T. Brown
22.0	5S	24E	20	NW¼ SW¼	" " "
13.4	5S	24E	20	SW¼ SW¼	Van D. Palmer
15.6	5S	24E	20	SE¼ SW¼	" " "
24.6	5S	24E	20	SE¼ SW¼	W. G. Marshall
15.8	5S	24E	20	NW¼ SE¼	Jaared T. Brown
10.7	5S	24E	20	SW¼ SE¼	W. G. Marshall
30.1	5S	24E	20	SW¼ SE¼	L. M. Thatcher
11.9	5S	24E	20	SE¼ SE¼	" " "
9.2	5S	24E	20	SE¼ SE¼	W. G. Marshall
1.5	5S	24E	21	SW¼ SW¼	Heber C. Kimball
14.5	5S	24E	28	NW¼ NW¼	Adelaide M. Bryce
23.1	5S	24E	28	SW¼ NW¼	" " "
9.4	5S	24E	28	SW¼ NW¼	Asa B. Kempton
4.2	5S	24E	28	SW¼ NW¼	Calvin I. Kempton
0.7	5S	24E	28	SE¼ NW¼	B. O. Rapier
1.0	5S	24E	28	SE¼ NW¼	Calvin I. Kempton
5.7	5S	24E	28	NW¼ SW¼	" " "
7.3	5S	24E	28	NW¼ SW¼	B. O. Rapier
10.9	5S	24E	28	NW¼ SW¼	Henry A. Waters
2.9	5S	24E	28	SW¼ SW¼	Antone Christensen
1.5	5S	24E	28	SW¼ SW¼	Heber Kempton
1.1	5S	24E	28	SW¼ SW¼	Thomas F. Fuller
1.0	5S	24E	28	SW¼ SW¼	Henry E. Plumb
0.9-	5S	24E	28	SW¼ SW¼	E. Palmer
2.5	5S	24E	28	SE¼ SW¼	Calvin I. Kempton
2.5	5S	24E	28	SE¼ SW¼	Adelaide M. Bryce
10.9	5S	24E	28	SE¼ SW¼	Lee L. Palmer
4.7	5S	24E	28	SE¼ SW¼	E. Palmer
4.0	5S	24E	28	SE¼ SW¼	Mrs. Elizabeth Curtis
1.7	5S	24E	28	SE¼ SW¼	Roy Palmer
19.2	5S	24E	29	NE¼ NE¼	W. G. Marshall
19.2	5S	24E	29	NE¼ NE¼	John Saline
20.0	5S	24E	29	NW¼ NE¼	W. G. Marshall
20.0	5S	24E	29	NW¼ NE¼	John Saline
38.9	5S	24E	29	SW¼ NE¼	Asa B. Kempton

Table No. 11 (Continued)
Curtis Canal—Lands and parties affected by priorities antedating 1

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands de in the preceding colum jurisdiction acquired he
38.7	5S	24E	29	SE¼ NE¼	John D. Colvin
38.0	5S	24E	29	NE¼ NW¼	John Saline
0.4	5S	24E	29	NW¼ NW¼	" "
22.6	5S	24E	29	SE¼ NW¼	Asa B. Kempton
5.8	5S	24E	29	NE¼ SW¼	" " "
15.0	5S	24E	29	NE¼ SW¼	A. J. Kempton
25.4	5S	24E	29	SE¼ SW¼	Calvin I. Kempton and Heber Kempton
38.5	5S	24E	29	NE¼ SE¼	John Saline
40.0	5S	24E	29	NW¼ SE¼	" "
9.8	5S	24E	29	SW¼ SE¼	A. J. Kempton
25.7	5S	24E	29	SW¼ SE¼	Asa B. Kempton
9.9	5S	24E	29	SE¼ SE¼	A. J. Kempton
4.7	5S	24E	29	SE¼ SE¼	Asa B. Kempton
22.3	5S	24E	29	SE¼ SE¼	" " "
18.7	5S	24E	32	NE¼ NE¼	John D. Colvin
19.0	5S	24E	32	NE¼ NE¼	Calvin I. Kempton and Heber Kempton
28.2	5S	24E	32	NW¼ NE¼	Claude M. Lee
9.0	5S	24E	32	NW¼ NE¼	A. J. Kempton
9.8	5S	24E	32	SW¼ NE¼	" " "
17.6	5S	24E	32	SW¼ NE¼	Antone Christensen
7.8	5S	24E	32	SW¼ NE¼	A. A. Wilkins
19.2	5S	24E	32	SE¼ NE¼	Calvin I. Kempton and Heber Kempton
19.3	5S	24E	32	SE¼ NE¼	John D. Colvin
29.2	5S	24E	32	NE¼ NW¼	Henry E. Plumb
9.1	5S	24E	32	NE¼ NW¼	J. M. Plumb
20.0	5S	24E	32	NW¼ NW¼	Perry Tryon
8.5	5S	24E	32	SW¼ NW¼	" "
30.0	5S	24E	32	SE¼ NW¼	J. M. Plumb
9.7	5S	24E	32	NE¼ SE¼	Ira Hancock
9.5	5S	24E	32	NE¼ SE¼	A. A. Wilkins
7.6	5S	24E	32	NW¼ SE¼	" " "
5.8	5S	24E	33	NE¼ NW¼	Calvin I. Kempton and Heber Kempton
4.7	5S	24E	33	NE¼ NW¼	John D. Colvin
0.4	5S	24E	33	NE¼ NW¼	Claude M. Lee
1.6-	5S	24E	33	NE¼ NW¼	Anna M. Moyes
0.1	5S	24E	33	NE¼ NW¼	Elijah Hawkins
0.4	5S	24E	33	NE¼ NW¼	J. N. Hawkins
0.5	5S	24E	33	NE¼ NW¼	A. A. Wilkins
3.2	5S	24E	33	NE¼ NW¼	School District No. 11, County of Graham, State o Arizona.
5.1	5S	24E	33	NE¼ NW¼	Annie B. Hancock
0.9	5S	24E	33	NW¼ NW¼	Claude M. Lee
0.4	5S	24E	33	NW¼ NW¼	Heber Kempton
0.4	5S	24E	33	NW¼ NW¼	Thomas F. Fuller
0.5	5S	24E	33	NW¼ NW¼	Perry Tryon
1.2	5S	24E	33	NW¼ NW¼	Fred Kempton

TABLE No. 11 (Continued)
Curtis Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
2.7	5S	24E	33	NW¼ NW¼	Isaac O. Palmer
2.5	5S	24E	33	NW¼ NW¼	W. E. Platt
11.2	5S	24E	33	NW¼ NW¼	Ann T. Nelson
3.2	5S	24E	33	NW¼ NW¼	William Fuller
1.0	5S	24E	33	NW¼ NW¼	Van D. Palmer
0.7	5S	24E	33	NW¼ NW¼	A. A. Wilkins
1.4	5S	24E	33	NW¼ NW¼	Alva Thatcher
2.5	5S	24E	33	NW¼ NW¼	Thomas F. Fuller
1.5	5S	24E	33	NW¼ NW¼	Alva Thatcher
0.8	5S	24E	33	NW¼ NW¼	Elijah Hawkins
1.0	5S	24E	33	NW¼ NW¼	J. N. Hawkins
9.2	5S	24E	33	SW¼ NW¼	William Fuller
12.8	5S	24E	33	SW¼ NW¼	Thomas F. Fuller
0.7	5S	24E	33	SW¼ NW¼	Van D. Palmer
15.8	5S	24E	33	SW¼ NW¼	A. A. Wilkins
1.9	5S	24E	33	SE¼ NW¼	" " "
15.0	5S	24E	33	SE¼ NW¼	" " "
13.2	5S	24E	33	NE¼ SW¼	" " "
14.8	5S	24E	33	NE¼ SW¼	Ira Hancock
6.7	5S	24E	33	NW¼ SW¼	Thomas F. Fuller
12.3	5S	24E	33	NW¼ SW¼	A. A. Wilkins
18.7	5S	24E	33	NW¼ SW¼	Ira Hancock
30.4	5S	24E	33	SW¼ SW¼	(Lester Carpenter &
31.1	5S	24E	33	SE¼ SW¼	(Frank Carpenter
22.1	6S	24E	2	NW¼ SW¼	Miles Messinger
1.1	6S	24E	2	SW¼ SW¼	" "
14.0	6S	24E	2	SE¼ SW¼	Joseph Moyes
0.8	6S	24E	3	NW¼ NE¼	Jesse A. Hancock
17.9	6S	24E	3	SW¼ NE¼	" " "
10.5	6S	24E	3	SE¼ NE¼	" " "
17.9	6S	24E	3	NE¼ SE¼	Miles Messinger
6.1	6S	24E	4	NE¼ NE¼	Thomas F. Fuller
9.3	6S	24E	4	NE¼ NE¼	William Carpenter
17.4	6S	24E	4	NW¼ NE¼	Thomas F. Fuller
23.1	6S	24E	4	NW¼ NE¼	William Carpenter
17.2	6S	24E	4	SW¼ NE¼	" "
3.3	6S	24E	4	SW¼ NE¼	Amy T. Leavitt
11.0	6S	24E	4	SE¼ NE¼	William Carpenter
11.1	6S	24E	4	SE¼ NE¼	Jesse A. Hancock
2.3	6S	24E	4	NE¼ NW¼	Thomas F. Fuller
0.1	6S	24E	4	SE¼ NE¼	Jesse A. Hancock

TABLE No. 12
Fourness Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands described in the preceding column when jurisdiction acquired herein.
5.9	6S	27E	35	SE¼ SE¼	David Jurado
2.1	7S	27E	2	NE¼ NE¼	" "
1.5	7S	27E	2	NE¼ NE¼	Jose Samora
0.1	7S	27E	2	NW¼ NE¼	David Jurado
3.4	7S	27E	2	NW¼ NE¼	Jose Samora
14.3	7S	27E	2	NW¼ NE¼	Francisco Montez
25.8	7S	27E	2	SW¼ NE¼	" "
11.6	7S	27E	2	SW¼ NW¼	Emula Viala
0.8	7S	27E	2	SE¼ NW¼	" "
17.8	7S	27E	2	SE¼ NW¼	Mrs. Clara Fourness
33.4	7S	27E	2	NE¼ SW¼	Jose Morales
5.0	7S	27E	2	NE¼ SW¼	J. M. Grijalva
9.6	7S	27E	2	NW¼ SW¼	" " "
12.1	7S	27E	2	NW¼ SW¼	Jose B. Garcia
4.9	7S	27E	2	NW¼ SW¼	Jose Varale
14.1	7S	27E	2	NW¼ SW¼	Sisto Molino
12.1	7S	27E	2	SW¼ SW¼	" "
3.6	7S	27E	2	SW¼ SW¼	Jose Varale
7.7	7S	27E	2	SW¼ SW¼	Jose B. Garcia
3.6	7S	27E	2	SW¼ SW¼	J. M. Grijalva
1.1	7S	27E	2	SE¼ SW¼	" " "
5.1	7S	27E	2	SE¼ SW¼	Jose Morales
7.2	7S	27E	2	NW¼ SE¼	" "
5.8	7S	27E	3	SE¼ NE¼	Andreas Serna
1.3	7S	27E	3	SE¼ NE¼	V. Carrasco
21.7	7S	27E	3	NE¼ SE¼	Cleve Curtis & Don Curtis
17.1	7S	27E	20	SW¼ NW¼	C. V. Massey
11.3	7S	27E	20	NW¼ SW¼	" " "

TABLE No. 13
Colvin-Jones Canal—Lands and parties affected by priorities antedating 1905.

Number of acres	Lands — Description — Referred to G. & S. R. B. & M. — Twp.	Rge.	Sec.	Subdivision	Ownership — Parties owning lands descri in the preceding column w jurisdiction acquired herein.
15.0	4S	23E	27	NW¼ NE¼	W. F. Bolinger
15.1	4S	23E	27	SW¼ NE¼	Mrs. W. E. Irwin
5.9	4S	23E	27	SE¼ NE¼	" " " "

that plaintiff has and owns rights in the waters of the Gila River, and in and to the use of said waters, as follows:

(1) The right on behalf of the Pima and other Indians of the Gila River Indian Reservation, their descendants, successors and assigns, to divert 210,000 acre feet of the waters of the Gila River during each irrigation season, from the natural flow in said river at the Ashurst-Hayden and Sacaton diversion dams—as of an immemorial date of priority and to the extent that such waters are available under said priority—at a rate of diversion not exceeding 437.5 cubic feet per second at any time during such season for the reclamation and irrigation of the irrigable Indian allotments on said reservation, which amount to 49,896 acres, as they now are or hereafter may be made, and of the administrative area on said Reservation which amounts to 650 acres, to the extent that the herein described water right, which is sufficient for and limited to the needs of 35,000 acres, will reclaim and irrigate the same. The waters available under this right and priority shall be divided and distributed to the lands of the Florence-Casa Grande Project as decreed and provided in subdivision (3) of this Article.

(2) The right, on behalf of the Apache and other Indians of the San Carlos Indian Reservation, their descendants, successors and assigns, to divert 6,000 acre feet of the waters of the Gila River, during each irrigation season, from the natural flow in said river at diversion points on said river within said reservation—or above the eastern boundary thereof under such rights of way as may now exist or be acquired therefor; due measures being taken to avoid injuries to other water users by said last mentioned diversions,—as of a date of priority of the year 1846 and to the extent that such waters are available under said priority—at a rate of diversion not exceeding 12.5 cubic feet per second at any time during such season, for the reclamation and irrigation of 1000 acres of the irrigable lands within the said reservation (or in part or wholly within the valley of the Gila River above the eastern boundary of said Reservation, if lands are there acquired by the United States for that purpose), situated in the County of Graham, State of Arizona, and more particularly described as within said reservation and that portion of the valley of the Gila River above the San Carlos Reservoir and flow line thereof; that said water right, however, if or when sanctioned by law, at the discretion of the Secretary of the Interior and with the consent of the San Carlos Irrigation and Drainage District expressed by its board of directors, may be purchased by or for the benefit of the San Carlos Project and used for said project as other of that project's stream flow right below the San Carlos Reservoir are or may be used under this decree, provided, however, that such right is and shall be treated as a project right to which no individual or individual lands shall have or assert an interest or priority as against any lands given rights in the Priority Schedule; and defendants, Gila Valley Irrigation District, Virden Irrigation District and Franklin Irrigation District through their boards of directors, having offered and agreed to facilitate the aforesaid purchase of said water right so that it may be transferred and used as aforesaid for the benefit of the San Carlos Project as other of that Project's stream flow rights are or may be used below said reservoir under this decree and to pay the United States theref the sum of Sixty-Two Thousand Five Hundred ($62,500.00) Dollars, said payments to be made by each of said Districts, in the proportion that the number of acres of land in said dist decreed water rights herein bears to the whole number of acres of land in said three districts' so decreed water rights, and to pay said sum within two years from the acceptance of said offer, if said offer shall be accepted within five years from the date of this decree. Said offer, however, to be considered as made by said districts only when all requirements of Arizona law with regard to making binding offers of such a character shall have been complied with, it is hereby decreed that if said offer is made and accepted at said purchase price sum or at any other sum agreed upon by the said three districts and the United States, the said water right shall be transferred as aforesaid for the benefit of San Carlos Project, but, in no event shall be used or usable or be asserted as against the lands given rights in the Priority Schedule above the San Carlos reservoir on account of which have been paid the full proportionate per acre share of the cost of said purchase.

(3) The right to divert 372,000 acre feet of the waters of the Gila River, during each irrigation season, from the natural flow in said stream at the Ashurst-Hayden and Sacaton diversion dams, as of the date of priority of 1916, and to the extent that such waters are available under said priority—at a total rate of diversion not exceeding 775 cubic feet per second at any time during such season, for the reclamation and irrigation of the 62,000 acres of the irrigable lands of the so-called Florence-Casa Grande Project, or its equivalent, more particularly described as follows:

(a) The aforesaid Indian allotments now or hereafter made on the said Indian Reservation, and the said administrative area, amounting in the aggregate to 50,546 acres to the extent that thirty-five sixty-seconds of the herein described water right, which is sufficient for and limited by the needs of 35,000 acres, will reclaim and irrigate the same.

... acres of land in the private ownership of White persons (also referred to herein as "White lands") described as follows:

Twp. 4 S., R. 8 E.:

Section 36:

SE¼ less 2 acres in Northwest Corner;

S½ SW¼;

Twp. 4 S., R. 9 E.:

Section 25:

10 acres in NE¼ NE¼, between North Side Canal and Gila River;

South 24 acres of SE¼;

South 17 acres of SE¼ SW¼;

S½ S½ SW¼ SW¼;

Section 26:

30 acres in N½ SE¼ between North Side Canal and Gila River;

60 acres in SW¼ between North Side Canal and Gila River;

Section 27:

S½ SW¼;

North 30 acres of S½ SE¼;

South 25 acres of S½ SE¼;

Section 28:

S½ S½;

Section 29:

S½ SW¼;

SE¼ SE¼;

S½ SW¼ SE¼;

Section 31:

E½ NW¼;

S½ NE¼;

Section 32:

N½ N½ N½ N½ NW¼;

NW¼ NE¼;

Section 33:

N½ N½;

55 acres in S½ NE¼, North of Gila River;

Section 34:

100 acres in NW¼;

60 acres in N½ NE¼;

E½ SE¼;

SW¼ SE¼;

Section 35:

147.50 acres in SW¼;

195.68 acres in E½;

Section 36:

W½ NW¼;

71.73 acres in E½ NW¼;

78.00 acres in W½ NE¼;

E½ NE¼;

137.58 acres in SE¼;

Twp. 4 S., R. 10 E.:

Section 10:

20 acres between North Side Canal and Gila River in SE¼;

Section 11:

S½ SW¼ SW¼ SW¼;

Section 14:

N½ NW¼ NW¼ NW¼;

Section 15:

90 acres between Florence Canal and Gila River, in NE¼;

Section 16:

149.00 acres in South part of Section between North Side Canal and Arizona Eastern Railroad and between Arizona Eastern Railroad and Gila River;

Section 17:

160.00 acres in that part lying between North Side Canal and Gila River and East of East line of W½ SW¼;

Section 20:

S½ NE¼;

SE¼;

30 acres in SE¼ SW¼;

Section 21:

119.00 acres in W½ W½;

80 acres in N½ South of Gila River;

Section 28:

W½ NW¼;

12 acres in NE¼ NW¼;

13 acres in NW¼ SW¼;

Section 29:

W½;

202.99 acres in E½;

Section 30:

NE¼ NE¼;

S½ NE¼;

SE¼;

E½ SW¼;

E½ SW¼ SW¼;

S½ W½ SW¼ SW¼;

S½ N½ W½ SW¼ SW¼;

Section 31:

NW¼, less 4 acres of deeded highway;

SE¼ NE¼;

NW¼ SW¼;

NW¼ SW¼ SW¼;

(continued)

3 acres in Northwest Corner of SW¼ SW¼ SW¼;

N½ SE¼;

Section 32:

70 acres in N½ NW¼;

Twp. 5 S., R. 7 E.:

Section 1:

5 acres in the Southeast corner of NW¼;

Twp. 5 S., R. 8 E.:

Section 6:

S½ NE¼;

Section 7:

SE¼ NE¼;

NE¼ SE¼;

Section 8:

South 56.00 acres of S½ NE¼;

SW¼;

Section 9:

South 120 acres of NE¼;

South 25 acres of N½ NW¼;

SW¼ NW¼;

N½ NW¼ SW¼;

W½ NW¼ NW¼ SE¼;

Section 10:

S½ SW¼ NE¼;

S½ S½ SE¼ NE¼;

S½ S½ NW¼;

N½ SW¼;

N½ NW¼ SE¼;

North 30 acres of NE¼ SE¼;

Section 14:

NE¼;

SW¼ SW¼;

E½;

NW¼;

Section 18:

SE¼;

S½ NW¼;

S½ SW¼;

Section 21:

SE¼ NW¼;

E½ SE¼;

Section 22:

S½;

Section 23:

E½;

SE¼ SW¼;

Section 24:

SW¼;

E½ except SE¼ SE¼ NE¼;

Section 25:

All of Section 25;

Section 26:

N½ N½ NW¼ NW¼;

Section 27:

SW¼;

South 35.00 acres in SE¼ NW¼;

E½ SE¼;

Section 34:

NE¼;

Section 35:

NW¼;

5.82 acres in Northwest Corner of NE¼;

Twp. 5 S., R. 9 E.:

Section 1:

10 acres in N½ NW¼ SE¼, North of Florence;

W½ NE¼;

(continued)

North 17 acres of NE¼ NE¼;

8.22 acres in Northeast corner of NW¼;

S½ SW¼ SW¼ NW¼;

N½ NE¼ SE¼;

60 acres in SW¼ North of Florence Canal;

.57 acres in Lot 6, 7 and 8, Block 6, Turner's Addition;

12. acres in Blocks 48, 49, 52 and 53, Douglas Addition;

Section 2:

North 58.32 acres in NE¼ West of Florence Towns

NW¼;

4.18 acres in Northwest Corner of NW¼ SW¼;

Section 3:

N½ NW¼ NE¼;

N½ NE¼ NW¼;

S½ N½ N½;

S½ N½;

North 56.01 acres of the W½ SW¼;

North 33.48 acres of the E½ SW¼;

North 18.02 acres of the NW¼ SE¼;

Section 4:

278.31 acres in E½, South of Gila River;

Section 5:

33 acres in W½ E½, South of Gila River;

20 acres in SW¼, South of Gila River;

Section 6:

W½ W½ NW¼;

W½ E½ SW¼ NW¼;

NW¼ SW¼;

Section 7:

125.00 acres in N½, South of Gila River;

Section 8:

260.00 acres in N½;

Section 9:

10 acres in NE¼ NE¼;

S½ S½;

Section 10:

SE¼ NW¼;

NE¼ SW¼;

SE¼ SW¼ NW¼;

NE¼ NW¼ SW¼;

Section 11:

127 acres in W½ North and West of Florence Canal;

North 110 acres of NE¼;

Section 15:

W½ NW¼ except NE¼ NW¼ NW¼;

E½ NE¼;

SW¼ NE¼;

W½ SW¼;

50 acres in N½ S½ North of Florence Canal;

Section 16:

N½;

SE¼;

N½ SW¼;

Section 17:

S½;

NE¼;

Section 18:

SW¼;

W½ SE¼;

SE¼ SE¼;

SW¼ NW¼;

Section 19:

All of Section 19;

Section 21:

NW¼;

SW¼ except 15 acres in Southeast Corner;

N½ NW¼ SE¼;

North 15 acres in N½ NE¼ SE¼;

Section 22:

W½ W½ NW¼;

Section 28:

40 acres in N½ NW¼, West of Florence Canal;

Section 29:

West 60 acres in S½ NE¼;

76.20 acres in SE¼, West of Florence Canal

W½;

Section 30:

E½;

NE¼ NW¼;

Section 31:

All of Section 31;

Section 32:

310 acres in W½ West of Florence Canal;

Twp. 5 S., R. 10 E.:

Section 6:

30 acres in Northwest part of NW¼;

Twp. 6 S., R. 5 E.:

Section 13:

North 58.11 acres of E½ NE¼;

SE¼;

SE¼ NW¼;

Section 14:

NE¼;

SE¼ SW¼;

Section 15:

S½ NE¼;

East 15 acres of SE¼ NW¼;

(continued)

S½ S½ N½ NE¼;

South 25 acres of SE¼ SE¼;

Section 22:

E½ SE¼ SE¼;

Section 23:

East 55 acres of N½ NW¼;

East 15 acres of N½ SE¼ NW¼;

North 30 acres of NE¼ SW¼;

S½ SW¼ SW¼;

SE¼;

North 30 acres of NW¼ NE¼;

East 30 acres of SE¼ NE¼;

Section 24:

South 14 acres of W½ W½;

S½ SE¼;

SE¼ SW¼;

Section 25:

North 145 acres of E½ W½;

W½ NE¼;

NE¼ SE¼;

Section 26:

E½ SE¼;

SW¼ SE¼;

NW¼;

S½ SW¼;

NE¼ SW¼;

Section 35:

S½ NE¼;

NE¼ NE¼;

NE¼ NE¼ NW¼;

Twp. 6 S., R. 6 E.:

Section 18:

NW¼ NW¼;

S½ SE¼ SE¼;

Twp. 6 S., R. 6 E.: (continued)

Section 19:

South 30 acres in SE¼ NE¼;

SE¼ SW¼ NE¼;

South 30 acres in SE¼ SE¼;

Section 20:

SW¼ NW¼;

15 acres in SE¼ NW¼;

SW¼ NE¼ SW¼;

Section 22:

NW¼ NW¼;

N½ NE¼ NW¼;

Section 25:

SE¼;

N½ SW¼;

Section 27:

All of Section 27;

Section 28:

SW¼;

NW¼ SE¼;

Section 29:

74 acres in S½ SW¼;

NW¼ SW¼;

16 acres in NW¼ SE¼ Southwest of Railroad;

Section 30:

SW¼ SW¼ NE¼;

Section 31:

N½;

Section 32:

E½ E½;

Section 33:

W½ SW¼;

SW¼ NW¼;

Section 34:

20 acre parcel in Blocks 1, 2, 25, 26, and 27, Arizola Townsite;

6 acre parcel in Lot 1, Block 38, Arizola Townsite;

6 acre parcel in Lot 2, Block 39, Arizola Townsite;

Twp. 6 S., R. 7 E.:

Section 12:

SW¼;

Section 13:

SE¼;

Section 15:

NW¼;

Section 19:

SW¼ SE¼;

Section 20:

SW¼;

W½ SE¼;

Section 22:

NW¼ SW¼;

W½ SE¼;

Section 23:

NW¼;

E½ SW¼;

W½ SE¼;

Section 25:

S½;

Section 26:

All of Section 26;

Section 27:

SE¼;

E½ NE¼;

Section 28:

NW¼;

Section 30:

36.61 acres in NW¼ SW¼;

Section 31:

SE¼;

Section 32:

W½ SW¼ NW¼;

North 45 acres in W½ SW¼;

Twp. 6 S., R. 8 E.:

Section 1:

S½;

Lots 9 and 10 containing 80 acres;

S½ NE¼;

Section 5:

SE¼ SE¼;

Section 7:

SW¼ containing 158.40 acres;

Section 11:

110 acres in North part of NE¼;

Section 12:

All of Section 12;

Section 13:

W½;

Section 15:

SE¼;

Section 18:

Lot 1, containing 39.92 acres;

Section 19:

East 157 acres in SW¼;

NE¼ SE¼;

W½ SE¼ SE¼;

E½ E½ SE¼ SE¼;

Section 20:

NW¼ SW¼;

E½ SW¼;

N½ SW¼ SW¼;

Section 21:

NW¼;

Section 28:

E½ NW¼;

W½ NE¼;

S½ S½ NW¼ NW¼;

Section 30:

N½;

Section 35:

N½ NW¼ NW¼;

Twp. 6 S., R. 9 E.:

Section 6:

277.40 acres in W½;

Section 19:

Lots 2 and 3, containing 60 acres;

Twp. 7 S., R. 5 E.:

Section 1:

SE¼;

N½ NE¼ NW¼;

SE¼ NW¼ NW¼;

SW¼ NE¼ NW¼;

Twp. 7 S., R. 6 E.:

Section 3:

North 56.5 acres of E½ SW¼;

North 56.5 acres of W½ SE¼;

Section 4:

N½;

N½ SE¼;

W½ SW¼;

Section 5:

E½;

Section 6:

W½ NW¼ comprising 74.96 acres;

N½ NE¼ SW¼;

Twp. 7 S., R. 7 E.:

Section 5:

7 acres in Northwest Corner;

Section 6:

23 acres in Northeast Corner;

entered into between the owners of said privately owned lands and the United States, it is hereby further specifically ordered, adjudged and decreed that suitable devices for measuring the flow of water available and susceptible of being diverted by the aforesaid dam or dams to the canals of the said Florence-Casa Grande Project (now a part of the San Carlos Project system) shall be maintained and daily or more frequent measurements of said flow shall be made; that the first 300 cubic feet per second or less of water flowing in the river at the said dam or dams, available as a whole under the several rights and priorities of plaintiff, including its immemorial right described and set up in subdivision 1 of this article and the so-called rights by purchase, and susceptible of being diverted for the said project, shall be divided and distributed, less deductions for project canal losses as hereinafter provided, sixty and six-tenths per centum thereof to the Indian lands of said project and thirty-nine and four-tenths per centum to the White lands thereof; that of the next 300 second-feet of water or less thus flowing and available, less deductions on account of losses as aforesaid, fifty-one and seven-tenths per centum thereof shall be apportioned to the said Indian lands, and forty-eight and three-tenths per centum thereof to White lands; that all water available as aforesaid in excess of said 600 second-feet shall be divided, less deductions on account of losses as aforesaid, fifty-six and one-tenth per centum to said Indian lands and to said privately owned lands, forty-three and nine tenths per centum, except that during periods of high water when it shall be possible and practicable to divert water for the use of the Indian lands within said project, or some of them, by means of the Sacaton Dam, the entire amount of water diverted for the said project by the said Ashurst-Hayden Dam shall be used for the irrigation of privately owned lands and of such of said Indian lands as cannot be adequately supplied from said Sacaton Dam; that furthermore the amounts of water thus apportioned to the White lands within said project shall be distributed to said lands in the following order:

(a) Certain of said lands to the extent of some 9,752.83 acres together with 790 acres in Sections 1 and 2, Twp. 5 S., Range 8 E., G. and S.R.B. and M., being identical with those tracts which are described in the Schedules of Rights and Priorities set out under Article V hereof and identified in said article as applying to the so-called rights by purchase of plaintiff, shall have a call upon the waters available under such apportionment in the order of their priorities as set out in said schedule.

(b) The remainder of said lands, amounting to some 17,247.17 acres, shall have the next three successive calls upon such waters as are available under such apportionment and in the following order:

FIRST

Twp. 4 S., R. 9 E.:

Section 25:

S½ S½ SW¼ SW¼;

Section 35:

9.5 acres in SE¼ SE¼ SW¼;

Section 36:

4 acres in Blocks 12, A,B,C,D,E and part of 37, Florence Townsite;

West 56 acres of that portion of SE¼ south of County Road;

Twp. 4 S., R. 10 E.:

Section 15:

20 acre parcel described as follows: Beginning at Southwest Corner of NW¼ SW¼ NE¼; thence northeast to Northeast corner of SE¼ NW¼ NE¼; thence south to Southeast corner of NE¼ SW¼ NE¼; thence west to point of beginning;

Section 29:

16.33 acre parcel described as follows: Beginning at a point on the west line of the SE¼ 221 feet south of the Northwest corner of said SE¼; thence south 89° 50' East 1290 feet; thence south 42° 11' west 1030 feet; thence south 89° 50' west 600 feet to west line of the SE¼; thence north along west line of the SE¼ 760 feet to point of beginning;

Section 30:

North 53.34 acres of N½ SE¼;

Twp. 5 S., R. 8 E.:

Section 6:

S½ NE¼;

Section 7:

SE¼ NE¼;

Section 8:

South 56 acres of NE¼;

Section 9:

W½ NW¼ NW¼ SE¼;

South 25 acres of N½ NW¼;

Section 10:

East 15 acres of S½ SW¼ NE¼;

N½ NW¼ SE¼;

Twp. 5 S., R. 9 E.:

Section 1:

W½ NE¼;

North 17 acres of NE¼ NE¼;

Northwest triangular half of N½ NW¼ SE¼;

Section 29:

SW¼ SE¼ NE¼;

Twp. 6 S., R. 6 E.:

Section 19:

Two acres in Southeast corner of SE¼ SE¼ SE¼ NE¼;

Twp. 6 S., R. 8 E.:

Section 1:

S½;

Twp. 7 S., R. 5 E.:

Section 1:

SE¼ NW¼ NW¼;

SW¼ NE¼ NW¼;

N½ NE¼ NW¼;

SECOND

Twp. 4 S., R. 10 E.:

Section 11:

S½ SW¼ SW¼ SW¼;

Section 14:

N½ NW¼ NW¼ NW¼;

Section 15:

50 acre parcel North of Florence Canal in E½ NE¼;

Section 20:

SE¼ SW¼;

Section 29:

South 43 acres of N½ SW¼;

40 acre parcel North of Florence Canal in South part of W½ SE¼;

Twp. 5 S., R. 8 E.:

Section 14:

SW¼ SW¼;

Section 21:

N½ NE¼ SE¼;

Section 22:

SE¼;

Section 23:

W½ NE¼;

North 23 acres of NE¼ NE¼;

Section 25:

SW¼;

Section 27:

E½ SE¼;

Twp. 5 S., R. 9 E.:

Section 2:

Block 10, containing 2 acres in Western addition to Florence Townsite;

Section 9:

S½ SE¼;

Section 11:

SW¼ NW¼;

N½ SE¼ NW¼;

NW¼ NW¼ SW¼;

West 7 acres of SW¼ NW¼ SW¼;

Section 15:

50 acre parcel North of Florence Canal in NE¼ SW¼; and NW¼ SE¼;

Section 21:

W½ NW¼;

Twp. 6 S., R. 5 E.:

Section 13:

North 35 acres of NE¼ NE¼;

Section 15:

S½ S½ N½ NE¼;

Section 22:

E½ SE¼ SE¼;

Section 23:

North 30 acres of NW¼ NE¼;

E½ W½ SE¼ NE¼;

W½ W½ E½ SE¼ NE¼;

East 30 acres of NE¼ NW¼;

East 15 acres of N½ SE¼ NW¼;

W½ W½ NE¼ NW¼;

East 15 acres of NW¼ NW¼;

North 30 acres of NE¼ SW¼;

S½ SW¼ SW¼;

South 50 acres of N½ SE¼;

North 30 acres of N½ SE¼;

SW¼ SE¼;

Section 24:

W½ SW¼ SE¼;

West 30 acres of SE¼ SW¼;

Section 25:

NW¼ NE¼ SE¼;

S½ NE¼ SE¼;

Section 26:

South 12 acres of W½ NE¼ SW¼;

North 30 acres of NE¼ SE¼;

Twp. 6 S., R. 6 E.:

Section 18:

40 acres comprising NW¼ NW¼;

S½ SE¼ SE¼;

Section 19:

SE¼ SW¼ NE¼;

Section 20:

SW¼ NE¼ SW¼;

5.00 acres comprising lot 3, McMurray Addition to Casa Grande;

SW¼ SE¼ NW¼;

Section 29:

W½ SW¼;

South 4 acres of N½ N½ SE¼ SW¼;

Section 32:

NE¼ SE¼;

Section 34:

20 acres in Blocks 1, 2, 25, 26 and 27, Arizola Townsite;

Twp. 6 S., R. 7 E.:

Section 23:

E½ SW¼;

W½ SE¼;

Section 31:

N½ SE¼;

West 45 acres of S½ SE¼;

Section 32:

SW¼ NW¼ SW¼;

(Continued)

S½ SW¼ SW¼ NW¼;

E½ NW¼ SW¼;

N½ N½ N½ SW¼ SW¼;

Twp. 6 S., R. 8 E.:

Section 5:

SE¼ SE¼;

Section 11:

N½ NE¼;

N½ N½ SE¼ NE¼;

N½ SW¼ NE¼;

Section 19:

W½ SE¼ SE¼;

E½ E½ SE¼ SE¼;

Section 20:

N½ SW¼ SW¼;

Twp. 6 S., R. 9 E.:

Section 6:

44 acre parcel West of Florence Canal, in Lot 13 and SE¼ NW¼;

Twp. 7 S., R. 6 E.:

Section 6:

N½ NE¼ SW¼;

Twp. 7 S., R. 7 E.:

Section 8:

23 acres in Lot 1, North of Casa Grande Canal.

THIRD

Twp. 4 S., R. 8 E.:

Section 36:

East 3 acres of N½ N½ N½ NW¼ SE¼;

South 15 acres of N½ NW¼ SE¼;

Twp. 4 S., R. 9 E.:

Section 25:

10 acre parcel described as follows: Beginning 200 feet north from the southeast corner of NE¼ NE¼; thence north 660 feet; thence southwest to point on west line of said NE¼ NE¼; 200 feet north from southwest corner of said NE¼ NE¼; thence east to point of beginning;

Section 26:

60 acres in SW¼ between North Side Canal and Gila River;

30 acres in N½ SE¼ between North Side Canal and Gila River;

Section 27:

S½ SW¼;

North 30 acres of S½ SE¼;

South 25 acres of S½ SE¼;

Section 28:

S½ S½;

Section 29:

S½ SW¼;

SE¼ SE¼;

S½ SW¼ SE¼;

Section 31:

E½ NW¼;

S½ NE¼;

Section 32:

NW¼ NE¼;

N½ N½ N½ N½ NW¼;

Section 33:

N½ NE¼;

55 acre parcel in S½ NE¼, North of Gila River;

N½ NW¼;

Section 34:

N½ NW¼;

Northwest triangular half of N½ S½ NW¼;

N½ N½ NE¼;

Northwest triangular half of S½ N½ NE¼;

Section 35:

20-acre parcel described as follows: Commencing at southwest corner of Section 35; thence north 160 rods; thence east 56 rods; thence south 160 rods; thence West 56 rods to point of beginning;

Section 36:

1.08 acres comprising Lots 30, 40 and 66, Florence Townsite;

5.50 acres South of County Road in NE¼ NE¼ SE¼;

S½ SE¼ NE¼ SE¼;

N½ NE¼ SE¼ SE¼;

Twp. 4 S., R. 10 E.:

Section 10:

20 acres in SE¼ between Gila River and Arizona Eastern Railway;

Section 31:

SE¼ NE¼;

N½ SE¼;

Twp. 5 S., R. 7 E.:

Section 1:

5 acres in an exact square in Southeast corner of NW¼;

Twp. 5 S., R. 8 E.:

Section 7:

NE¼ SE¼

Section 8:

SW¼;

Section 10:

W½ SW¼ SW¼ NE¼;

S½ S½ NW¼;

N½ SW¼;

Section 14:

NE¼;

Section 17:

E½;

NW¼;

Section 18:

S½ NW¼;

S½ SW¼;

SE¼;

Section 22:

SW¼;

Section 23:

SE¼ SW¼;

Section 27:

South 35 acres of SE¼ NW¼;

SW¼;

Section 34:

NE¼;

Section 35:

5.82 acres in Northwest corner of NE¼;

Twp. 5 S., R. 9 E.:

Section 1:

S½ SW¼ SW¼ NW¼;

N½ NE¼ SE¼;

Section 5:

15 acres in W½ E½;

Twp. 5 S., R. 9 E. (continued)

Section 5:

20 acres in SW¼;

Section 7:

35 acres in E½ NW¼;

Section 9:

10 acres in W½ NE¼ NE¼ South of County Highway;

Section 10:

N½ SE¼ NW¼;

SE¼ SE¼ NW¼;

S½ NE¼ SW¼;

NE¼ NE¼ SW¼;

Section 11:

60 acres in NE¼;

South 15 acres of W½ NW¼ NW¼;

North 15 acres of E½ NE¼ NW¼;

E½ NW¼ NW¼;

Section 15:

E½ NE¼;

SW¼ NE¼;

Section 16:

All of Section 16, excepting therefrom the S½ SW¼;

Section 17:

NE¼;

S½;

Section 18:

SW¼ NW¼;

SW¼;

W½ SE¼;

SE¼ SE¼;

Section 21:

E½ NW¼;

145 acres in SW¼, north and west of Florence Canal;

(continued)

N½ NW¼ SE¼;

North 15 acres of NE¼ SE¼;

Section 22:

W½ W½ NW¼;

Section 28:

W½ NW¼ NW¼;

North 15 acres of E½ NW¼ NW¼;

N½ NW¼ NE¼ NW¼;

Section 29:

NW¼ SE¼;

West 3.2 acres of NW¼ NE¼ SE¼;

33.0 acres in SW¼ SE¼ West of Florence Canal;

Section 31:

S½;

Section 32:

SW¼;

Twp. 6 S., R. 5 E.:

Section 13:

S½ S½ S½ NE¼ NE¼;

North 18.11 acres of SE¼ NE¼;

SE¼ NW¼;

SE¼;

Section 14:

NE¼;

Section 24:

South 14 acres of W½ SW¼ NW¼;

Section 26:

NW¼;

North 8 acres of W½ NE¼ SW¼;

S½ SW¼;

SW¼ SE¼;

Section 35:

S½ NE¼;

NE¼ NE¼ NW¼;

Twp. 6 S., R. 6 E.:

Section 19:

South 28 acres of SE¼ NE¼;

Section 20:

SW¼ NW¼;

Section 22:

NW¼ NW¼;

N½ NE¼ NW¼;

Section 25:

SE¼;

N½ SW¼;

Section 27:

All of Section 27;

Section 28:

N½ SW¼;

SW¼ SW¼;

NW¼ SE¼;

Section 31:

N½;

Twp. 6 S., R. 7 E.:

Section 12:

SW¼;

Section 13:

SE¼;

Section 15:

NW¼;

Section 19:

SW¼ SE¼;

Section 20:

SW¼;

W½ SE¼;

Section 22:

NW¼ SW¼;

W½ SE¼;

Section 23:

NW¼;

Section 25:

S½;

Section 26:

All of Section 26;

Section 27:

SE¼;

Section 28:

NW¼;

Section 30:

36.61 acres comprising Lot 3;

Twp. 6 S., R. 8 E.:

Section 7:

SW¼;

Section 12:

All of Section 12;

Section 13:

W½;

Section 15:

SE¼;

Section 18:

39.92 acres comprising Lot 1;

Section 19:

East 157 acres of SW¼;

NE¼ SE¼;

Section 20:

NW¼ SW¼;

E½ SW¼;

Section 21:

NW¼;

Section 28:

W½ NE¼;

E½ NW¼;

S½ S½ NW¼ NW¼;

Section 30:

N½;

Section 35:

N½ NW¼ NW¼;

Twp. 6 S., R. 9 E.:

Section 6:

70.20 acres comprising Lots 5 and 6;

West 63 acres of Lots 11 and 12;

30.20 acres comprising Lot 14;

Section 19:

60 acres comprising Lots 2 and 3;

Twp. 7 S., R. 5 E.:

Section 1:

SE¼;

Twp. 7 S., R. 6 E.:

Section 4:

N½;

W½ SW¼;

N½ SE¼;

Section 5:

E½;

Section 6:

74.96 acres comprising Lots 4 and 5.

(c) That the Secretary of the Interior or his agents in dividing the waters of the said Florence—Casa Grande Project shall see that the losses of water in the whole system of project canals (now a part of the San Carlos Project System) are shared as equitably as may be to the end that, with respect to such losses, no water right under the project shall enjoy any advantage of location, position or otherwise over any other project water right; but losses occurring in the Indian and private canals leading from said project canals shall be disregarded in the division of water hereinabove provided for; and furthermore whenever the quantity of water diverted into the canals of said project shall, in the aggregate, be so small that, after deducting the losses of transmission in the project canals and then dividing the residue between the Indian lands and the lands in private ownership as hereinabove provided for, the share allotted to the Indian rights would be too small to reach the Indian reservation, the Secretary of the Interior, or his agent in charge of said project, shall permit all of said water to be applied to the irrigation of privately owned lands in accordance with their priorities.

(4) The right to divert 603,276 acre feet of the water of the Gila River, during each irrigation season from the natural flow in said stream at the Ashurst—Hayden and Sacaton Dams above described—as of the date of priority of not later than June 7, 1924 (and for the purposes of this decree and for them only as of said date) and to the extent that such waters are available under said priority—at a total rate of diversion not exceeding 1256.5 cubic feet per second at any time during such season, for the reclamation and irrigation of the 100,546 acres of the irrigable lands of the San Carlos Project and for supplying water to the State of Arizona, and towns, villages and municipalities of that state, and federal agencies, as provided in the Act of March 7th, 1928, and in the so-called Repayment Contract bearing date the 8th of June, 1931, said 100,546 acres of project lands being more particularly described as follows:

(a) 49,896 acres of land within the Gila River Indian Reservation which have been, or may be allotted to individuals among the Indians thereof (also referred to herein as "Indian Lands"), together with 650 acres within said reservation comprising the School Farm, Agricultural Experiment Station and Administrative Area.

(b) 50,000 acres of land in private ownership of white persons (also referred to herein as "White Lands"), made up of such White Lands designated to come into the San Carlos Project by order of the Secretary of the Interior of April 25th, 1928, and August 9th, 1934, said designated lands being described as follows:

Twp. 4 S. R. 8 E:

Section 36:

S½ SW¼;

SE¼ less 2 acres in Northwest Corner;

Twp. 4 S. R. 9 E:

Section 25:

10 acres in NE¼ NE¼ between North Side Canal and Gila River;

South 34 acres of S½ S½ SW¼;

S½ S½ SE¼;

Section 26:

30 acres in N½ SE¼, between North Side Canal and Gila River;

60 acres in SW¼ between North Side Canal and Gila River;

Section 27:

S½ SW¼;

North 30 acres of S½ SE¼;

South 25 acres of S½ SE¼;

Section 28:

S½ S½;

Section 29:

S½ SW¼;

S½ SW¼ SE¼;

SE¼ SE¼;

Section 31:

E½ NW¼;

S½ NE¼;

Section 32:

N½ N½ N½ N½ NW¼;

NW¼ NE¼;

Section 33:

N½ N½;

55 acres in S½ NE¼ North of Gila River;

Section 34:

100 acres in NW¼ North of Gila River;

60 acres in N½ NE¼ North of Gila River;

E½ SE¼;

SW¼ SE¼;

S½ SE¼ SW¼;

Section 35:

SW¼ except 5.46 acres in NW Corner;

177.68 acres in E½ lying South of Gila River and North and West of the town of Florence;

Section 36:

NW¼ except 2.65 acres in SW¼ SE¼ of said NW¼;

NE¼ except West 2 acres thereof;

SE¼ except 72.5 acres in South Central part thereof;

Twp. 4 S., R. 10 E:

Section 11:

S½ SW¼ SW¼ SW¼;

Section 14:

N½ NW¼ NW¼ NW¼;

Section 15:

90 acres between Florence Canal and Gila River in NE¼;

Section 16:

149 acres in South part of Section 16 between North Side Canal and Arizona Eastern Railway and between Arizona Eastern Railway and Gila River.

Section 17:

160 acres in that part lying between North Side Canal and Gila River and east of the east line of W½ SW¼;

Section 19:

23.67 acres in SE¼ SE¼ south of Gila River;

Section 20:

21.48 acres in NW¼ south of Gila River;

S½ N½;

NE¼ SE¼;

79.99 acres in S½ SE¼;

Section 21:

W½ SW¼;

Section 28:

83.68 acres in W½ W½ North of Florence Canal;

24.50 acres in NE¼ NW¼ North of Florence Canal;

Section 29:

NE¼;

SW¼;

128.18 acres in SE¼ North and West of Florence Canal;

Section 30:

NE¼ NE¼;

S½ NE¼;

SE¼;

E½ SW¼;

E½ SW¼ SW¼;

S½ W½ SW¼ SW¼;

S½ N½ W½ SW¼ SW¼;

Section 31:

NW¼, less 4 acres of deeded highway;

NE¼;

157.47 acres in SW¼ North and West of Florence Canal;

89.38 acres in SE¼ North and West of Florence Canal;

Section 32:

106.96 acres in NW¼ North and West of Florence Canal;

Twp. 5 S., R., 7 E:

Section 1:

5 acres in an exact square in the South east corner of NW¼;

Section 12:

North 183.02 acres east of Reservation line;

Twp. 5 S., R. 8 E:

Section 1:

N½;

N½ SW¼;

North 110 acres of SE¼;

Section 2:

NE¼;

NE¼ NW¼;

S½ NW¼;

Section 5:

SW¼;

W½ SE¼;

66.66 acres in E½ SE¼ South and West of Gila River;

Section 6:

S½ NE¼;

N½ SE¼;

Section 7:

S½ N½;

319.92 acres in S½;

Section 8:

All of Section 8;

Section 9:

S½;

NW¼;

115.90 acres in NE¼ South of Gila River;

Section 10:

South 380.55 acres (Railroad Right-of-way deducted);

Section 13:

S½ NE¼;

SE¼ NW¼;

S½ SW¼ NW¼;

S½;

Section 14:

All of Section 14:

Section 15:

E½;

304.78 acres in W½ (Railroad Right-of-way deducted);

Section 16:

SE¼ SE¼ containing 37 acres;

Section 17:

All of Section 17;

Section 18:

All of Section 18, containing 641.36 acres;

Section 21:

E½;

S½ NE¼ NW¼;

SE¼ NW¼;

Section 22:

NE¼;

141.57 acres in NW¼ (Railroad Right-of-way deducted);

E½ SE¼;

Section 23:

All of Section 23;

Section 24:

All of Section 24;

Section 25:

All of Section 25;

Section 26:

All of Section 26;

Section 27:

SW¼;

142 acres in NW¼ (Townsite addition deducted);

304.72 acres in E½ (Railroad Right-of-way deducted);

Section 28:

NE¼;

Section 34:

152.35 acres in NE¼ (Railroad Right-of-way deducted);

Section 35:

N½;

Section 36:

N½;

E½ E½ SE¼;

Twp. 5 S., R. 9 E.:

Section 1:

10 acres in N½ NW¼ SE¼, North of Florence Canal;

Section 2:

North 53.32 acres in NE¼ West of Florence Townsite;

SE¼ SE¼;

NW¼;

4.18 acres in NW corner of SW¼;

Section 3:

NE¼;

E½ NW¼;

SW¼ NW¼;

S½ NW¼ NW¼;

NE¼ NW¼ NW¼;

North 56.01 acres of the W½ SW¼;

North 33.48 acres of the E½ SW¼;

North 18.02 acres of the NW¼ SE¼;

Section 4:

South 122.18 acres of the NE¼;

156.13 acres being the SE¼ except 3.87 acres in SE corner.

Section 6:

W½ W½ NW¼;

W½ E½ SW¼ NW¼;

NW¼ SW¼;

Section 8:

SE¼ SE¼;

Section 9:

10 acres in NE¼ NE¼;

S½ S½;

Section 10:

S½ SW¼;

NE¼ SW¼;

SE¼ NW¼;

SE¼ SW¼ NW¼;

NE¼ NW¼ SW¼;

NE¼ SE¼;

E½ NE¼;

Section 11:

N½ NW¼;

SW¼ NW¼;

N½ SE¼ NW¼;

NW¼ NW¼ SW¼;

West 7 acres SW¼ NW¼ SW¼;

81.65 acres in NE¼ North of Florence Canal;

31.76 acres in NE¼ South of Florence Canal;

Section 15:

302.89 acres in N½ West of Florence Canal;

140 acres in S½ North of Florence Canal;

Section 16:

All of Section 16;

Section 17:

S½;

NE¼;

Section 18:

SW¼;

SW¼ NW¼;

S½ SE¼;

NW¼ SE¼;

Section 19:

All of Section 19;

Section 20:

All of Section 20;

Section 21:

308.10 acres in W½ west of Florence Canal;

141.68 acres in NE¼ West of Florence Canal;

N½ NW¼ SE¼;

2.8 acres in NW¼ NE¼ SE¼ West of Florence Canal;

12.43 acres in the N½ NE¼ SE¼ East of Florence Canal;

Section 22:

9.54 acres in W½ W½ NW¼ West of Florence Canal;

30.46 acres in W½ W½ NW¼ South of Florence Canal;

Section 28:

56.63 acres in NW¼ west of Florence Canal;

Section 29:

547.85 acres West of Florence Canal (Pima Lateral Deducted);

Section 30:

632.65 acres (Pima Lateral deducted);

Section 31:

All of Section 31;

Section 32:

169.62 acres in N½ West of Florence Canal;

102.13 acres in SW¼ west of Florence Canal;

57.87 acres in SW¼ East of Florence Canal;

Twp. 6 S., R. 5 E.:

Section 13:

E½ NE¼;

SE¼;

(Continued)

SE¼ NW¼;

150 acres in SW¼ (Railroad right-of-way deducted);

Section 14:

NE¼;

SW¼;

155.50 acres in SE¼ (Railroad right-of-way deducted);

Section 15:

S½ NE¼;

S½ S½ N½ NE¼;

East 15 acres of SE¼ NW¼;

South 25 acres of SE¼ SE¼;

Section 22:

E½ SE¼ SE¼;

Section 23:

All of Section 23;

Section 24:

S½;

NW¼;

137.30 acres in NE¼ (Railroad Right-of-way deducted);

Section 25:

All of Section 25;

Section 26:

All of Section 26;

Section 35:

NE¼;

NE¼ NE¼ NW¼;

Section 36:

N½;

SE¼;

97.40 acres in SW¼ North and East of Casa Grande Canal;

Twp. 6 S., R. 6 E.:

Section 18:

NW¼ NW¼;

S½ SE¼ SE¼;

Section 19:

SE¼ SW¼ NE¼;

4.06 acres in SE¼ NE¼;

Section 20:

SW¼ NE¼ SW¼;

15 acres in Southeast corner of SE¼ NW¼;

Section 22:

NW¼ NW¼;

N½ NE¼ NW¼;

Section 25:

S½;

Section 27:

All of Section 27;

Section 28:

315 acres in S½ (Railroad Right-of-way deducted);

Section 29:

S½ SW¼;

30 acres in NE¼ SW¼ (Railroad Right-of-way deducted);

73.85 acres in S½ SE¼; (Railroad right-of-way deducted);

16.00 acres in NW¼ SE¼ Southwest of Railroad;

Section 30:

SW¼ SW¼ NE¼;

S½ containing 313.76 acres;

Section 31:

All of Section 31;

Section 32:

All of Section 32;

Section 33:

43.76 acres in N½ NW¼ South of Railroad;

10.33 acres in Northeast Corner of NE¼ NW¼;

S½ NW¼;

SW¼;

68.52 acres in E½ E½ North of Railroad;

39.17 acres in W½ E½ North of Railroad;

170 acres in E½ South of Railroad;

7.89 acres being Lots 0 to 7, Block 1, Monte Vista Acres;

2.00 acres being Lots 8 and 9, Block 1, Monte Vista Acres;

.14 acres being the East 20 feet of Lot 1, Block 2, Monte Vista Acres;

.86 acres being Lot 1, Block 2, Monte Vista Acres; except the East 20 feet;

6.00 acres being Lots 2 to 7, Block 2, Monte Vista Acres;

2.00 acres being Lots 8 and 9, Block 2, Monte Vista Acres;

2.00 acres being Lots 1 and 2, Block 3, Monte Vista Acres;

6.00 acres being Lots 3 to 8, Block 3, Monte Vista Acres;

1.00 acre being Lot 9, Block 3, Monte Vista Acres;

3.00 acres being Lots 10 to 12, Block 3, Monte Vista Acres;

1.23 acres being Lots 13 and 14, Block 3, Monte Vista Acres;

Section 34:

50 acres in S½ south of Railroad;

2.08 acres being Block 3, Arizola Townsite;

2.40 acres being Block 4, Arizola Townsite;

2.51 acres being Block 5, Arizola Townsite;

1.64 acres being Block 6, Arizola Townsite;

4.62 acres being Block 7, Arizola Townsite;

(Continued)

4.62 acres being Block 8, Arizola Townsite;

4.62 acres being Block 9, Arizola Townsite;

4.62 acres being Block 10, Arizola Townsite;

4.62 acres being Block 11, Arizola Townsite;

4.62 acres being Block 12, Arizola Townsite;

4.80 acres being Block 13, Arizola Townsite;

4.80 acres being Block 14, Arizola Townsite;

4.80 acres being Block 15, Arizola Townsite;

1.05 acres being Lots 1 to 4, Block 16, Arizola Townsite;

.92 acres being Lots 10 to 12, Block 16, Arizola Townsite;

.22 acres being Lot 13, Block 16, Arizola Townsite;

1.26 acres being Lots 14 to 18, Block 16, Arizola Townsite;

2.40 acres being the S½ of Block 16, Arizola Townsite;

.48 acres being Lot 10, Block 17, Arizola Townsite;

.87 acres being Lots 12 to 15, Block 17, Arizola Townsite;

.83 acres being Lots 16 to 18, Block 17, Arizola Townsite;

4.80 acres being Block 18, Arizola Townsite;

4.80 acres being Block 19, Arizola Townsite;

2.40 acres being the S½ of Block 20, Arizola Townsite;

2.40 acres being the N½ of Block 20, Arizola Townsite;

4.80 acres being the Block 21, Arizola Townsite;

4.62 acres being Block 22, Arizola Townsite;

2.31 acres being the N½ of Block 23, Arizola Townsite;

2.31 acres being the S½ of Block 23, Arizola Townsite;

3.40 acres being Lots 5 to 32, Block 24, Arizola Townsite;

11.68 acres being Lots 1 to 10, Block 28, Arizola Townsite;

5.36 acres being Lots 11, 12, S½ of 13, S½ of 14 in Block 28, Arizola Townsite;

(Continued)

5.36 acres being Lots —N½ 13, N½ 14, 15 and 16, in Block 28, Arizola Townsite;

11.62 acres being Lots 17 to 22, Block 28, Arizola Townsite;

33.04 acres being Block 29, Arizola Townsite;

17.46 acres being the E½ of Block 30, Arizola Townsite;

16.75 acres being the W½ of Block 30, Arizola Townsite;

17.72 acres being the E½ of Block 31, Arizola Townsite;

17.28 acres being the W½ of Block 31, Arizola Townsite;

11.30 acres being Lots 1 and 4, Block 32, Arizola Townsite;

6.12 acres being Lot 2, Block 32, Arizola Townsite;

11.73 acres being Lots 3 and 6, Block 32, Arizola Townsite;

5.89 acres being Lot 5, Block 32, Arizola Townsite;

28.59 acres being Lots 1 to 5, Block 33, Arizola Townsite;

5.77 acres being Lot 6, Block 33, Arizola Townsite;

12.62 acres being Lot 1, Block 34, Arizola Townsite;

12.46 acres being Lot 2, Block 34, Arizola Townsite;

22.24 acres being Lots 1 to 4, Block 35, Arizola Townsite;

11.78 acres being Lots 5 and 6, Block 35, Arizola Townsite;

2.00 acres being the NE Corner of Lot 1, Block 36, Arizola Townsite;

2.62 acres being Lot 1, Except 2 acres, Block 36, Arizola Townsite;

4.62 acres being Lot 2, Block 36, Arizola Townsite;

9.24 acres being Lots 3 and 4, Block 36, Arizola Townsite;

4.62 acres being Lot 1, Block 37, Arizola Townsite;

9.24 acres being Lots 3 and 4, Block 37, Arizola Townsite;

6.00 acres being Lot 1, Block 38, Arizola Townsite;

3.03 acres being the E½ of Lot 2, Block 38, Arizola Townsite;

3.03 acres being the W½ of Lot 2, Block 38, Arizola Townsite;

6.00 acres being Lot 3, Block 38, Arizola Townsite;

17.00 acres being Lots 1, 3 and 4, Block 39, Arizola Townsite;

6.00 acres being Lot 2, Block 38, Arizola Townsite;

18.04 acres being Block 40, Arizola Townsite;

18.08 acres being Block 41, Arizola Townsite;

36.51 acres being Block 42, Arizola Townsite;

20.00 acres being Blocks 1, 2, 25, 26 and 27, Arizola Townsite;

<u>Section 35:</u>

S½;

<u>Section 36:</u>

All of Section 36;

<u>Twp. 6 S., R. 7 E.:</u>

<u>Section 12:</u>

SW¼;

<u>Section 13:</u>

SE¼;

<u>Section 15:</u>

NW¼;

<u>Section 19:</u>

S½ SE¼;

<u>Section 20:</u>

SW¼

W½ SE¼;

SE¼ SE¼;

<u>Section 21:</u>

S½ S½;

<u>Section 22:</u>

S½;

<u>Section 23:</u>

W½;

W½ SE¼ except 5 acres in Southeast Corner thereof;

<u>Section 25:</u>

All of Section 25;

<u>Section 26:</u>

N½;

138.52 acres in SW¼ North of Casa Grande Canal;

SE¼;

<u>Section 27:</u>

All of Section 27;

<u>Section 28:</u>

S½;

NW¼;

N½ NE¼;

<u>Section 29:</u>

All of Section 29;

<u>Section 30:</u>

E½;

N½ SW¼ containing 76.61 acres;

S½ SW¼;

<u>Section 31:</u>

All of Section 31;

<u>Section 32:</u>

531.54 acres, all North of Casa Grande Canal;

<u>Section 33:</u>

468.15 acres, all North of Casa Grande Canal;

<u>Section 34:</u>

207.24 acres, All North of Casa Grande Canal;

<u>Twp. 6 S., R. 8 E.:</u>

<u>Section 1:</u>

E½ containing 478.20 acres;

39.43 acres being E½ Lots 3 and 6,

34.15 acres being the East part of Lot 11;

240.00 acres being the South part of the W½;

Section 5:

SE¼ SE¼;

Section 7:

SW¼ containing 158.40 acres;

Section 11:

N½ NE¼;

N½ N½ SE¼ NE¼;

N½ SW¼ NE¼;

Section 12:

All of Section 12;

Section 13:

W½;

250 acres in E½ West of Florence Canal;

Section 15:

SE¼;

Section 18:

NW¼ NW¼ (Lot 1) containing 39.92 acres;

Section 19:

S½ Containing 326.42 acres;

Section 20:

S½;

Section 21:

W½;

Section 28:

NW¼;

W½ NE¼;

17.51 acres, the West part of the SW¼ North of the Casa Grande Canal;

Section 29:

NW¼;

104.91 acres in N½ S½ North of Casa Grande Canal;

Section 30:

NE¼;

NW¼ containing 167.54 acres;

177.70 acres in S½ North of Casa Grande Canal;

Section 35:

N½ NW¼ NW¼;

Twp. 6 S., R. 9 E.:

Section 6:

388.87 acres West of Florence Canal;

Section 7:

100.60 acres in W½ West of Florence Canal;

Twp. 7 S., R. 5 E.:

Section 1:

40 acres in N½ NW¼;

81.76 acres in NE¼ North of Casa Grande Canal;

SE¼;

Twp. 7 S., R. 6 E.:

Section 1:

572.83 acres North of Casa Grande Canal;

Section 2:

457.80 acres North of Southern Pacific Railroad;

77.87 acres in W½ South of Casa Grande Canal;

Section 3:

576.64 acres North of Casa Grande Canal (Railroad right-of-way deducted.);

Section 4:

N½;

SW¼;

76.73 acres in N½ SE¼ North of Casa Grande Canal;

Section 5:

All of Section 5;

Section 6:

509.55 acres being all North of Casa Grande Canal except Lots 10 and 24, Eddy Subdivision;

10.00 acres being Lots 10 and 24, Eddy Subdivision;

Section 10:

16.35 acres being all North of Casa Grande Canal;

Twp. 7 S., R. 7 E.:

Section 5:

11.17 acres in NW¼ North of Casa Grande Canal;

Section 6:

304.91 acres, being all North of Casa Grande Canal.

... San Carlos Project by means of the Coolidge Dam (said Reservoir and Dam being situate within the San Carlos Indian Reservation) to the extent of the full 1,285,000 acre-feet capacity of said Reservoir at all times when said waters are available above said dam for such storage under the aforesaid prio ity; and the right in that relation to accomplish and control the release from said reservoir of the waters so stored and thus reduced to ownership, and to conduct the same down th channel of the Gila River to the Ashurst-Hayden and Sacaton diversion dams of the San Carlos Project and there to recapture and divert, and control the diversion of, the same by me of said dams for conveyance in the canals leading therefrom to the above described 100,546 acres of the lands of said Project for the reclamation and irrigation thereof, and for th supplementation of amounts available therefor at said dams from the natural stream flow under plaintiff's rights as same are decreed herein, and for State and Federal purposes unde act of March 7, 1928 as hereinbefore described.

(6) The right, as against and only against the parties to this cause, to divert from the Gila River 17,950 acre feet of water, — for the irrigation of 2992.5 acres of Indian lands at the Gila Crossing District on said Reservation— each irrigation season at a rate of diversion not exceeding 37.4 cubic feet per second of time, from the waters occurring or recurring in said river beginning at the point where the Southern Pacific Railway crosses said river in Section 13, Township 3 South, Range 4 East of Gila and Salt River Base and Meridian or between said point and a point one hundred feet above where the Salt River empties into the Gila River, at the diversion points on said reservation as now or hereafter located, as of the following dates of priority:

For 954 acres of said lands January 1st, 1873.
" 587 " " " " " ", 1876.
" 660 " " " " " ", 1877.
" 139 " " " " " ", 1900.
" 58.5 " " " " " ", 1903.

It is further provided that water rights with the priorities fixed as aforesaid are for the irrigation of said Gila Crossing Indian lands, but subject at all times, to all rights on said Gila River above said point hereinabove described, and provided also that said rights are subject to the right of the San Carlos project, to divert and use return flows, or water otherwise occurring in the river above said point and the right of said project to pump and otherwise interfere with and control the return flow from the lands with said project.

That certain of the foregoing rights, as listed under items (1), (3) and (4) above are inclusive one of the other so that diversions thereunder do not accumulate, and the amounts in acre feet per season and cubic feet per second stated in the 3rd item include those given in the 1st and those stated in the 4th item include those given in the 1st and 3rd; in each instance representing the total diversion allowable under that priority and those prior thereto as described in said items.

VII

That all Indian lands and all white lands now or hereinafter designated by the Secretary of the Interior as within the San Carlos Project and under said San Carlos Reservoir shall be entitled to share equally in all of the stored and pumped water of said Project in so far as that shall be physically feasible, and said lands shall share equally in all of the water of said Project o every nature as long as the stored and unstored water supply for said Project shall be sufficient for Project needs, and as far as that shall be physically feasible; but when, through lac stored and pumped water, there shall be an insufficient supply of water for all of the lands of said Project lying under said reservoir, which condition or fact shall be determined by Secretary of the Interior or his duly authorized agent, the lands so situated, in addition to their proper share of such stored and pumped waters as may be available to the Project, shal entitled to and have apportioned to them the unstored flow of the Gila River which is available as a whole, and susceptible of being diverted, for the Indian and White lands of the afore Florence-Casa Grande Project together with the 790 acres in Sec. 1 and 2 T. 5 S., R. 8 E., G. and S.R.B. and M., hereinbefore mentioned, under and in pursuance of the various rights a priorities of the United States decreed herein for said lands, as follows, to-wit: said flow shall be divided between said Indian and White lands and distributed to such lands, whether same shall be also included in the San Carlos Project or not, in accordance with the apportionment and division ordered and decreed in the third subdivision of Article VI hereof, and surplus which may remain and be available in said river, under the priorities of plaintiff, for other lands (beyond those of the Florence-Casa Grande Project and said 790 acres) include San Carlos Project under the priorities of plaintiff and provisions of this decree, shall first go to such of the Indian Lands in the San Carlos Project, and then in equitable proporti such of the private and public lands thereof as are not also included in the Florence-Casa Grande Project and said 790 acres.

VIII

That the diversions of water from the Gila River by the so-called upper valleys defendants (parties defendant to whom rights to divert water from the Gila River at points above the San Carl Reservoir are decreed herein), comprising the defendant canal companies named below, with the parties defendant named in the Priority Schedule and attached tables who are decreed rights throu the canals of said companies and are served thereunder, and certain individual parties defendant who are accredited with rights to divert directly from the stream through private ditches, t wit:

Albert Canal Company, Billingsley Extension Canal Company, Black & McCleskey Canal Company, Brown Canal Company, Colmenero Canal Company, Colvin-Jones Canal Company, Cosper & Windham Canal Company, Cosper & Windham Extension Canal Company (Under contract whereby Cosper & Windham Canal Company makes actual diversion) Curtis Canal Company, Dodge-Nevada Canal Company, Duncan Canal Company, Fort Thomas Consolidated Canal Company, Fourness Canal Company, Graham Canal Company, Moddle Canal Company, Montezuma Canal Company, San Jose Canal Company, Sexton Canal Company, Shriver Ditch Company, Smithville Canal Company, Sunflower Canal Company, Sunset Canal Company, Tidwell Canal Company, Union Canal Company, Valley Canal Company, York Canal Company, York Cattle Company;

R. H. Angle, J. H. Brown, T. D. Burton, W. C. Craufurd, J. W. Foote, R. C. Gilleland, J. H. Henderson, C. C. Hester, F. E. Ross, R. Sexton, Laura Short;

and/or their predecessors in interest, for the irrigation of the lands described in said Priority Schedule made part of Article V hereof, since their inception have been made under right which were and are junior and subject to certain extensive rights of plaintiff to divert the waters of said stream at points below the diversions of said defendants and also below the Sa Carlos Reservoir, which said rights of plaintiff are set down and referred to in said Priority Schedule, but are further identified and particularly described in Article VI and VII hereo it being evidenced thereby that the earliest right of plaintiff is prior in time to all and every of the rights of said defendants, and certain of plaintiff's other rights are prior in time to certain of the rights of said defendants; that, however, plaintiff and said defendants, in recognition of the desirability of making it practicable for said defendants to carry on the irrigation of said upper valley lands to the extent to which the areas to which their said rights apply heretofore have been irrigated and so that the said San Carlos Act shall inure in part to their benefit and this suit may be compromised and settled, have agreed that the following provisions shall be and they are hereby embodied in this decree, which said provisions in turn, and in so far as they affect the other parties in this cause, shall inure to the benefit of and be binding upon them, to-wit:

(2) That on the first day of January of each Calendar year, or as soon thereafter as there is water stored in the San Carlos Reservoir, which is available for release through the gates of the Coolidge Dam for conveyance down the channel of the Gila River and for diversion and use on the lands of the San Carlos Project for the irrigation thereof, then the Water Commissioner, provided for herein, shall, to the extent and within the limitations hereinafter stated, apportion for the ensuing irrigation year to said defendants from the natural flow of the Gila River an amount of water equal to the above described available storage, and shall permit the diversion of said amount of water from said stream into the canals of said defendants for the irrigation of said upper valleys lands in disregard of the aforesaid prior rights of plaintiff used on lands below said reservoir; the diversion of said amount of water by said defendants to be in accord with the priorities as between themselves stated in said Priority Schedule and for the irrigation of the lands covered by the rights accredite to said defendants in said Priority Schedule and the quantity of water permitted to be taken by said defendants in disregard of prior rights of the United States below is in addition to and not exclusive of the rights of said defendants to take from the stream in the regular order of their priorities as shown by the Priority Schedule, but of course within the duty of the water limitations of this decree; that if and when at any time or from time to time in any year, water shall flow into said reservoir after said date of first apportionment and shall be stored there and become added to the available stored water in said reservoir, the said commissioner shall make further and additional apportionments to said defendants of the natural flow of said stream as the same is available at the diversion points of said defendants, which said apportionments shall in turn correspond with and be equivalent in quantity to the amount of such accessions or newly available stored water supply; that in calculating apportionments of the stored water supply the Water Commissioner shall make appropriate deductions for losses for evaporation, seepage or otherwise that may be suffered between the time of the apportionment and that of the diversion of a corresponding quantity of water

from the stream; that such apportionments, corresponding with net accessions during each annual period after first apportionment, shall be made by said Water Commissioner at least as frequently as once per calendar month (provided accessions to stored supply have occurred during that period) and at such more frequent intervals as the conditions in his judgment m[illegible] demand—his decisions in these regards to be subject to summary review by the Court as provided in Article XII hereof—and said Water Commissioner shall see to it that his said apportionments, when made, forthwith shall be placed of record herein and so posted or published as to inform all interested parties in that regard with reasonable promptness and despatch; it being herein explicitly provided that no apportionment or apportionments, made during any calendar year, shall carry over or be available in any manner for the succeeding year; that the diversions made by said defendants of the natural flow of the Gila River thus apportioned to them in disregard of the said prior rights of plaintiff shall be regulated by the Water Commissioner (under the authority and powers given him by this decree and/or by such further orders of the Court as may be made in that relation) in accord with the rights and priorities accredited to each of said defendants in said Priority Schedule, provided always that such diversions shall be limited to the amount of water then apportioned, as aforesaid, and in any event, during each irrigation season, do not and shall not exceed the total amount of water called for under the right accredited in said Priority Schedule to any given defendant, namely; 6 acre feet per acre for the irrigation season as defined in Article V hereof; and provided further that the drafts on the stream by the upper valleys defendant[illegible] shall be limited to a seasonal year diversion which will result in an actual consumptive use from the stream of not to exceed 120,000 acre feet of water; said consumptive use made in any seasonal year shall be determined by adding the recorded flows at a gauging station located in the Gila River at Red Rock Box Canyon above the heading of the Sunset Canal in New Mexico and a gauging station located in the San Francisco River immediately above its confluence with the Gila River and deducting from said sum the recorded flows at a gauging station located on the Southern Pacific Railway bridge crossing the Gila River near Calva, Arizona; and the Water Commissioner shall determine what diversions are permissable and reduce diversi[illegible] in the inverse order of their priorities when and to the extent necessary to accomplish the aforesaid result. The aforesaid measurements shall include the whole flow of the stream, including floods, at the three points of measurement, and no allowance shall be made for accretions or additions to the flow between the point of measurement at Red Rock Box Canyon, and the confluence of the Gila and San Francisco Rivers, and in turn between the confluence of the Gila and San Francisco Rivers, and the aforesaid gauging station at the Southern Pacific Railway bridge. Said method of measurement is adopted as sufficiently accurate for practical purposes and as better suited for administering this decree than any more refined method of determining actual consumptive use.

(3) Upon agreement made by the owner of any right set forth in the Priority Schedule for land in the Safford Valley water may be diverted by the owner of land in the Duncan Valley within the duty of water in this decree set forth and within the apportionment of water for said Duncan Valley land in disregard of such Safford Valley right or rights, and that such waiver shall in no way deprive the Safford Valley lands thus waiving of their full apportionment of water herein provided for based on water stored in the San Carlos Reservoir or their full right to take from the stream, in accordance with their priority and within the duty of water fixed by the decree as against water rights of the United States held on account of the San Carlos Project, but the right of the United States to insist upon its priorities as defined and modified herein as against Duncan Valley Lands shall not be abridged by this provisi[illegible]

(4) That water released at the will of the plaintiff and for the purposes of the plaintiff from the San Carlos Reservoir at any time after the date of this decree other than for the proper irrigation of 80,000 acres of land or its equivalent in the San Carlos Project, shall be considered as stored in the San Carlos Reservoir at and after the date of such releases, and available as a basis for the above described apportionment of the natural flow to said defendants as it would be if such withdrawals had never been made.

(5) PROVIDED ALWAYS, that if by reason of lack of available storage in the San Carlos Reservoir no apportionment of the natural flow of said river is or can be made available to said defendants, then the diversions of said defendants, of or as soon as apportionments previously made to them [illegible]ave been consumed, shall no longer be made in disregard of the prior rights of plaintiff below said San Carlos Reservoir, but shall instead be made under and in accord with the rights and priorities set down in Article V, and the Priority Schedule made part hereof, and Article VI of this decree to-wit: in accord with their several priorities as same are set down in said Priority Schedule and subject to the prior rights of plaintiff as same are referred to therein and further described in Article VI of this decree.

(1) That the defendant Kennecott Copper Corporation shall be entitled, as of the dates of priority set down in the Priority Schedule made part of Article V hereof, for industrial, municipal, domestic and related beneficial purposes, to divert from the underground waters of the Gila River by means of its pumps, as same are or may be located within the lands describ in said Priority Schedule under the heading "Point of Diversion," during the annual period beginning January 1st of each year, the amounts of water stated in said schedule, at the rate o diversion in cubic feet per second there given; subject, however, to the proviso that the total amount of water diverted and maximum rate of diversion, under the rights for such purposes accredited to said defendant in said Priority Schedule as of the priority dates of 1878, 1879, 1880, 1884, 1885, 1887, 1890, 1895, 1906, 1908, and 1909, shall not exceed the quantity of water in acre feet per annum or rate of diversion in cubic feet per second stated for the right of 1909, to wit: 13,221 acre feet and 22.22 cubic feet per second; That the rights for industrial, municipal, domestic and related purposes accredited to said defendant as of the dates of priority named below were first initiated, and thereafter perfected, by the diversion and application of the waters of the Gila River, through canals leading from the stream, to the irrigation of those certain acreages of the lands described below which are set down opposi said dates of priority, which said dates respectively represent the year in which said acreages were first irrigated, to-wit:

Date of Priority	Number of Acres	Area Containing Lands Thus Irrigated.
1878	65.00	SE¼ and SE¼ SW¼, Section 9;
1879	95.00	S½ SW¼, Section 10;
1880	130.00	NW¼ SW¼, S½ SW¼ and SW¼ SE¼, Section 14;
1884	165.00	SE¼, NE¼ and NW¼ Section 15;
1885	60.00	NE¼ Section 16; and
1887	60.00	N½ NW¼ and N½ NE¼ Section 23;
1890	10.00	All in Township 5 South, Range 15 East of the Gila
1895	40.00	and Salt River Base & Meridian.
1906	15.00	
1908	153.00	

That the use for irrigation under said rights, when the pumps and plant of said defendant were put in operation in the year 1909, was changed and transposed into uses for industrial, municipa domestic and related purposes, and the waters called for under said rights and priorities, or so much thereof as was available, since have been diverted from the stream or the undergroun waters thereof by means of the pumps of said defendant and continuously and beneficially applied to said purposes;

(2) That the requirements of said defendant each year for the above described purposes demand that it divert from the underground waters of the Gila River, in so far as same can be ma available in that relation, at the continuous rate of ten thousand gallons per minute, or 22.22 cubic feet per second; same being equivalent by volume measurement to a maximum of 16,221 ac feet per annum; that prior to the construction of the San Carlos Reservoir and the storage of water therein the natural flow of the Gila River at and/or in the vicinity of the reduction pla and pumps of said defendant maintained an underground water plane, which when pumped from to meet the said requirements of defendant, had averaged an approximate minimum elevation, as gaug at said defendant's test well at that place, of 1920 feet above sea level (Nevada Consolidated Copper Company datum) and an approximate maximum elevation of 1930 feet above sea level (datum idem); that said diversions by said defendant then were, and since to the extent undertaken have been, made under rights which were and are junior and subject to certain extensive rights of plaintiff to divert the waters of the Gila River at points below the diversions of said defendant, and also below the San Carlos Reservoir, which said rights of plaintiff

... referred to in Article V hereof and the Priority Schedule included therein, and further defined in Article VI and VII hereof, it being evidenced hereby that the early right of plaintiff is prior in time to all and every of the rights of said defendant and certain of plaintiff's other rights are prior in time to certain of said defendant's rights and thereby are credited with dates of priority earlier than those of said defendant; that, however, plaintiff and defendant by way of consent hereto, in recognition of the desirability of makin it practicable for said defendant to continue and further carry on its operations to the extent of its aforesaid requirements and so that this suit may be compromised and settled, have agree that the following provisions shall be embodied in this decree, which said provisions in turn, and in so far as they affect the other parties in this cause, shall inure to the benefit of an be binding upon them, to-wit:

(3) That said defendant shall be entitled to divert, by means of its said pumps as they now exist or may be replaced, so much of the underground waters of the Gila River as may be available at its said pumps and as will meet its said requirements—but not to exceed the amount of 16,221 acre feet during each annual period reckoning from January 1st of each year as aforesaid, and limited to a maximum rate of diversion of 10,000 gallons per minute, viz. 22.22 cubic feet per second—in disregard of the said prior diversions rights of plaintiff below said San Carlos Reservoir as same are set out and defined in this decree as aforesaid; that if during those periods when no appreciable releases of water from the San Carlos Reservoir are being made into the channel below the Coolidge Dam, the said diversions of defendant by means of said pumps (limited to the amounts required for beneficial application to the above described industrial, municipal, domestic and related purposes and in any event to the said 16,221 acre feet per year and 22.22 cubic feet per second) shall cause the pumping water plane to fall below 1920 feet above sea level, as gauged at said test well of defendant (Nevada Consolidated Copper Company datum), or some other mutually agreed upon point and datum, then, if there is any natural flow in the Gila River at the point where said stream enters the San Carlos Reservoir, so much thereof (or so much as is available if the amount is insufficient) as will bring the level of said pumping water plane, as gauged at said test well of defendant, or other point aforesaid, to the average of the approximate maximum and minimum elevations aforesaid to wit: 1925 feet above sea level (datum idem), will be allowed to flow through said reservoir into the channel below—if the storage level in said reservoir is high enough physically to permit its release through the Coolidge Dam—said operations to be of simultaneous character in that releases through said Coolidge Dam, equivalent to the natural flow entering the reservoir or such portion thereof as may be sufficient for the above described purpose, shall be made forthwith when it is determined (mutually by the plaintiff and defendant, or in case of disagreement by the Water Master, whose decision may be reviewed as provided in Article XII hereof) that the pumping water plane, under the conditions above described, has fallen below the 1920 foot level aforesaid; that such releases of natural flow through the Coolidge Dam shall be accomplished so as to make the most practical and workmanlike use of the amount available for the purposes thereof, taking into consideration the vital necessity of avoiding in so far as possible the waste of water into the steam below the gravels in which the pumping water plane is being maintained;

(4) That the diversions of water from the Gila River by said defendant and its predecessors in interest for the irrigation of the lands described in the Priority Schedule for which said defendant is accredited rights for irrigation as of the dates of priority of 1908, 1916, and 1926, since their inception have been made under rights which were and are junior and subject to those certain and extensive rights of plaintiff to divert the waters of said stream at points below the said diversions of defendant; which said rights of plaintiff are set down and referred to in Article V hereof, and the Priority Schedule included therein and are further defined in Article VI and VII hereof, it being evidenced thereby that the early right of plaintiff is prior in time to all and every of the rights of said defendant and certain of plaintiff's other rights are prior in time to certain of said defendant's rights, and thereby are accredited with priorities which are earlier than the aforesaid rights of defendant; that, however, plaintiff and defendant, by way of consent hereto and in recognition of the desirability of making it practicable, in so far as possible, for said defendant to carry on the irrigation of its said lands to the extent of the acreages to which its said rights of 1908, 1916 and 1926 apply, and so that this suit may be compromised and settled, have agreed that the following provisions shall be embodied in this decree, which said provisions in turn, and in so far as they affect the other parties in this cause, shall inure to the benefit of and be binding upon them, to-wit:

(5) That when, under the rule and method of apportionment stated in Article VIII of this decree, there is apportioned to the so-called upper valleys water users amounts of water from natural flow of the Gila River corresponding with the available storage in the San Carlos Reservoir, then there also shall be apportioned to the defendant Kennecott Copper Corporation, from the natural flow of said river as hereinafter defined, for the irrigation of its said lands, an amount of water per acre thereof corresponding with the amount per acre apportioned to said upper valleys as aforesaid; and thereupon, said defendant shall be entitled to divert—in disregard of the said prior diversion rights of plaintiff below as same are set out and defined in this decree as aforesaid—at the points of diversions and by means of the ditches ascribed to it in the Priority Schedule, so much of the natural flow of the Gila River, limited always to the amount of water then apportioned to it as aforesaid, as can be beneficially applied to the irrigation of the lands to which said rights apply; said diversions as o course to be limited in any event to the amounts of water in acre feet per irrigation season and rates of diversion in cubic feet per second stated for said rights in the Priority Schedu that in as much as the waters flowing in the Gila River at defendant's said points of diversion, during a great portion of the irrigation season, will be made up in large measure of sto water which has been released from the San Carlos Reservoir and is being piloted down the stream channel to the diversion dams and distributing canals of the San Carlos Project, the natu flow available as aforesaid to said defendant, under the limitations of said apportionment, shall be gauged by and deemed to correspond with the natural flow of the Gila River and San Car River at the points where said streams enter the San Carlos Reservoir, plus such contributions thereto between the Coolidge Dam and said diversion points of defendant as may occur, but subject to such drafts upon such total as may be made by owners of rights of diversion under this decree prior to said rights of defendant (if any there are) between said Coolidge Dam and said diversion points of defendant.

(6) PROVIDED ALWAYS, that the foregoing provisions of this Article IX are hereby explicitly made subject to the proviso that whenever under Article VIII hereof, by reason of lack of available storage in the San Carlos Reservoir and the consumption of previous apportionments thereunder, no apportionment of the natural flow of said river is or can be made available to the so-called upper valleys defendants in disregard of the prior rights of plaintiff below said reservoir, and therefore diversions by said defendants and plaintiff are required to b made under and in accord with the rights and priorities set down in Article V (and the Priority Schedule therein) and VI of the decree, then the diversions of defendant, as against all other parties in this cause, whether for industrial, municipal, domestic and related purposes as described in subdivisions (1) to (3) above—or for irrigation as described in subdivision (4) and (5) if or when its apportionment in that relation also has been consumed—shall be subject to and be made in accord with its priorities as same are stated in the Priority Schedul and not otherwise, saving and excepting only that its diversions for said industrial, municipal, domestic and related purposes as against plaintiff's prior rights of diversion below sha still be regulated and controlled as provided in subdivisions (2) and (3) of this Article; subject to the further proviso, however, that the natural flow of the Gila River as measured wh it enters the San Carlos Reservoir, or drafts upon it in conformity with priorities against later rights above, will not be available in any event below said reservoir unless the storag level therein is sufficiently high to permit its release through the Coolidge Dam. It is further provided that the pumped diversions of said defendant when being made under subdivision (2) and (3) of this Article, at times of greatest peak loads, may exceed by 10% the rate of 22.22 cubic feet per second stated above, if water therefor is available at said pumps, but that the total diversions for any year (January 1st to December 31st inclusive) in such event shall still be limited to 16,221 acre feet.

X

(1) That the diversions of water from the Gila River by defendants Joseph J. Anderson, Grady L. Herring and T. H. B. Glasspie, and their predecessors in interest for the irrigation of lands described in the Priority Schedule made part of Article V hereof, for which said defendants are accredited rights for irrigation as of the dates of priority named in said schedule since their inception have been made under rights which were and are junior and subject to those certain and extensive rights of plaintiff to divert the waters of said stream at points bel the said diversions of defendants; which said rights of plaintiff are set down and referred to in Article V hereof and the Priority Schedule included therein and are further identified Articles VI and VII hereof, and thereby are accredited with priorities which are earlier than the aforesaid rights of defendants; that, however, plaintiff and said defendants, by way of consent hereto and in recognition of the desirability of making it practicable in so far as possible for said defendants to carry on the irrigation of their said lands to the extent of acreages to which their said rights apply and so that this suit may be compromised and settled, have agreed that the following provisions shall be embodied in this decree, which said provisi in turn, and in so far as they affect the other parties in this cause, shall inure to the benefit of and be binding upon them, to wit:

(2) That when, under the rule and method of apportionment stated in Article VIII of this decree, there is apportioned to the so-called upper valleys water users amounts of water from natural flow of the Gila River corresponding with the available storage in the San Carlos Reservoir, then there also shall be apportioned to said defendants, from the natural flow of sai river as hereinafter defined, for the irrigation of their said lands, an amount of water per acre thereof corresponding with the amount per acre apportioned to said upper valleys as afo said; and thereupon, said defendants shall be entitled to divert—in disregard of the said prior diversion rights of plaintiff below as same are set out and defined in this decree as aforesaid—at the points of diversion and by means of the ditches ascribed to them in the Priority Schedule, so much of the natural flow of the Gila River, limited always to the amount of water then apportioned to them as aforesaid, as can be beneficially applied to the irrigation of the lands to which their said rights apply; said diversions as of course to be limite in any event to the amounts of water in acre feet per irrigation season and rates of diversion in cubic feet per second stated for said rights in the Priority Schedule; that in as much as the waters flowing in the Gila River at defendants' said points of diversion, during a great portion of the irrigation season, will be made up in large measure of stored water which has been released from the San Carlos Reservoir and is being piloted down the stream channel to the diversion dams and distributing canals of the San Carlos Project, the natural flow available as aforesaid to said defendants, under the limitations of said apportionment, shall be gauged by and deemed to correspond with the natural flow of the Gila River at the point where said stream enters the San Carlos Reservoir, plus such contributions thereto between the Coolidge Dam and said diversion points of defendants as may occur, but subject to such drafts upon such total as may be made by owners of rights of diversion under this decree prior to said rights of defendants (if any there are) between said Coolidge Dam and said diversi points of defendants.

(3) PROVIDED ALWAYS, that the foregoing provisions of this Article X are hereby explicitly made subject to the proviso that whenever under Article VIII hereof, by reason of lack of avilable storage in the San Carlos Reservoir and the consumption of previous apportionments thereunder, no apportionment of the natural flow of said river is or can be made available to so-called upper valleys defendants in disregard of the prior rights of plaintiff below said reservoir, and therefore diversions by said defendants and plaintiff are required to be made un and in accord with the rights and priorities set down in Article V (and the Priority Schedule therein) and VI of the Decree, then the diversions of the defendants above named, as against the other parties in this cause—if or when their apportionment in that relation also has been consumed—shall be subject to and be made in accord with their priorities as same are stat in said Priority Schedule and not otherwise; subject to the further proviso, however, that the natural flow of the Gila River, as measured where it enters the San Carlos Reservoir, will not be available below said reservoir on occasions when the storage level therein is not sufficiently high to permit its release through the Coolidge Dam.

XI

That the lands within the Gila River watershed for the irrigation of which rights are decreed herein are arid or semi-arid in character and require irrigation in order that crops of valu may be produced thereon; that except as herein specifically provided no diversion of water from the natural flow of the stream into any ditch or canal for direct conveyance to the lands s be permitted as against any of the parties herein except in such amount as shall be actually and reasonably necessary for the beneficial use for which the right of diversion is determ and established by this Decree, to-wit: shall be made only at such times as the water is needed upon their lands and only in such amounts as may be required under the provisions here for the number of acres then being irrigated; that in cases where by this Decree water is allowed to be diverted by and through any ditch by the owner thereof for another party, the ter the contractual relations existing between them are not intended to be determined herein; that wherever the total area under a particular canal is decreed more than one water right, e having the same or different priorities or in its different parts having different rights and priorities, the total area may have used upon it all of its several rights in the order of priorities, subject only to the requirement that no greater net draft on the stream be made than if each right in the order of its priority were used only on the particular lands for whic was originally acquired or reserved; that rotation, which is a well known, recognized and effective practice in irrigation administration (constituting in effect the combining of flows allowed to be diverted from a given stream under two or more rights so as to provide for the alternate use of more adequate irrigation heads as between neighboring or other ditches tak from such stream), shall be permitted at all times and shall be required whenever necessary in order to obtain reasonable economies in the use of water, or in order to give to each di or water user a more advantageous method of irrigation, providing that such rotation shall not injuriously affect any of the rights determined or allowed by this decree; that the Wate Commissioner provided for herein shall arrange for and enforce such rotation, but shall consult with, and endeavor to obtain the agreements of, such water users as in his judgment sho resort thereto, and shall embody his action in this regard into such reports as he may make or be required to make to the Court herein; that if no valid objection thereto be made by o water users, an owner of any right decreed herein, when the allowable diversion thereunder in the judgment of the Water Commissioner does not constitute an adequate irrigation head fo his lands, may with or without agreement for rotation, when permitted by said Water Commissioner, divert a larger head or flow into his ditch for short periods of time in lieu of the sa flow allowed to him under his said right, providing always that such use shall not exceed for the irrigation season the amount in acre-feet herein specified and allowed to be diverted from the stream for his lands; that appropriations and priorities of the same date rank as having rights of the same standing, and as having a simultaneous call upon the stream source the proportion which said rights, as decreed herein, bear to each other in amounts entitled to be diverted thereunder; that any of the parties to whom rights to water have been decree herein shall be entitled, in accord with applicable laws and legal principles, to change the point of diversion and the places, means, manner or purpose of the use of the waters to wh they are so entitled or of any part thereof, so far as they may do so without injury to the rights of other parties as the same are defined herein.

XII

That a Water Commissioner shall be appointed by this Court to carry out and enforce the provisions of this decree, and the instructions and orders of the Court, and if any proper orders, rules or directions of such Water Commissioner, made in accordance with and for the enforcement of this decree, are disobeyed or disregarded he is hereby empowered and authorized to cu the water from the ditch then being used by the person so disobeying or disregarding such proper orders, rules or directions; promptly reporting to the Court his said action in such c and the circumstances connected therewith and leading thereto; that whenever the necessities of the situation appear to the Court so to require, the Court shall authorize the employme the Water Commissioner of such person or persons to assist that officer as to the Court may seem necessary to carry out properly the provisions of this decree and the orders of the Co that the term of employment, expenses and compensation of said Water Commissioner and his assistants, the payment thereof and the means and methods for securing funds with which to pa same, shall be fixed by orders which the Court may hereafter from time to time make; that any person, feeling aggrieved by any action or order of the Water Commissioner, in writing and oath, may complain to the Court, after service of a copy of such complaint on the Water Commissioner, and the Court shall promptly review such action or order and make such order as m proper in the premises; that the owner or owners of each ditch or canal herein authorized to divert water from the natural flow of the Gila River for direct conveyance to and irrigati lands, unless specifically excused by the Court or Water Commissioner, shall at his own expense install and at all times maintain at any appropriate place at or near the head of said d a reliable and readily operated regulating headgate and a measuring box, flume or other device which may be locked and set in position—the same to be approved by the Water Commissione so that the water diverted into said ditch or canal at any and all times may be regulated and measured; that upon failure of any owner or owners to install structures of the above describ character on or before one year from the date of this decree or on or before such different day as the Court or Water Commissioner shall set or determine—after due notice from the Wate Commissioner so to do—the said Water Commissioner is herein authorized to cut off diversions of water into said ditch or canal until such devices and structures shall be installed and maintained

XIII

That each and all of the parties to whom rights to water are decreed in this cause (and the persons, estates, interests and ownerships represented by such thereof as are sued in a representat capacity herein), their assigns and successors in interest, servants, agents, attorneys and all persons claiming by, through or under them and their successors, are hereby forever enjoi and restrained from asserting or claiming—as against any of the parties herein, their assigns or successors, or their rights as decreed herein—any right, title or interest in or to th waters of the Gila River, or any thereof, except the rights specified, determined and allowed by this decree, anc each and all thereof are hereby perpetually restrained and enjoined fro diverting, taking or interfering in any way with the waters of the Gila River or any part thereof, so as in any manner to prevent or interfere with the diversion, use or enjoyment of sa waters of the Gila River or any part thereof, so as in any manner to prevent or interfere with the diversion, use or enjoyment of said waters by the owners of prior or superior rights therein as defined and established by this Decree; that nothing herein shall prejudice the rights of any of the parties hereto or of their grantees, assigns or successors in interest, un any transfer or legal succession in interest after the commencement of this action, to any of the rights hereby adjudicated; that except as hereinbefore mentioned or otherwise stated, t provisions of this Decree shall bind, and inure to the benefit of, the grantees, assigns and successors in interest of the owners of rights and parties hereto, whether substituted as part or appearing in this case or named herein or not; that the several parties to this suit shall pay their own costs in this action as directly incurred or authorized by them respectively, provided that any compensation of the Water Commissioner, or amounts shown to be coming to him or the reporter, if any there be, shall be paid in such manner, at such times and by such parties as may be ordered by the Court; that the Court retains jurisdiction hereof for the limited purposes above described, this decree otherwise being deemed a final determination the issues in this cause and of the rights herein defined.

ALBERT M. SAMES,
Judge.

Done in Open Court this twenty ninth day of June, 1935.

STIPULATION FOR AND CONSENT TO THE ENTRY OF A FINAL DECREE IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF ARIZONA IN THE CASE OF UNITED STATES OF AMERICA, V. GILA VALLEY IRRIGATION DISTRICT, ET AL.

Come now the parties hereto, either in person or by their solicitors, and inform the Court that they have reached a settlement of the issues in this cause and have adjusted and settled their respective claims as between each other; that they have set up in the within and foregoing decree the respective rights of all parties hereto, and request the Court to adopt said decree as its finding herein and that it be entered as its final decree in this cause, settling and adjudicating the rights of the parties hereto.

For The United States of America

HOMER CUMMINGS,

The Attorney General.

HAROLD L. ICKES,

The Secretary of the Interior.

CLIFTON MATHEWS, F. E. FLYNN,

Clifton Mathews, Esq., June 24, 1935.

United States Attorney, Solicitors for the plaintiff. April 11, 1935.

GERTRUDE M. CONVERSE,

Gertrude M. Converse, Solicitor for the San Carlos Irrigation and Drainage District, defendant heretofore ranged in interest, on the side of the plaintiff, and for the following other defendants:

Archie L. Bartlett; Fred W. Bassler; Maude M. Bassler; George W. Burgess; Louis Cathemer; Hazel A. Converse; Eldora Curry; Roland Curry; Salvadore S. Feliz; Juan S. Feliz; Manuel S. Feliz; Pedro S. Feliz; J. J. Fraser; F. P. Jamieson; J. C. Jamieson; W. O. Kidder; Edith Knappenberger; Frank Knappenberger; Ed Lacy; Elizabeth M. Martin; Rolland H. Moorehouse; L. S. Nafzig r; M. N. Nafziger; Leon M. Nowell; George W. Smith; C. H. Southworth; Dugald Stewart; James R. Treat; Louise M. Trekell; and Don A. Trekell.

KIBBEY, BENNETT, GUST, SMITH AND ROSENFELD,

by J. L. GUST,

Kibbey, Bennett, Gust, Smith and Rosenfeld.

Solicitors for the following defendants:

D. E. Adams; D. T. Adams; L. A. Adams; Joseph Alder; H. L. Alexander; Ephriam J. Allen; J. A. Allen; John W. Allen; Lewis Allen; S. E. Allen; A. A. Allred; Della Allred; Edith M. Allred; Elden Allred; E. M. Allred; J. N. Allred; Mrs. Maude Allred; Myron J. Allred; Phoebe Allred; Ruth Allred; Sesario Alvillar; H. J. Anderson; Tom Aranda; Fannie Bailey; Mrs. V. M. Baker; W. S. Baker; George P. Ballard; Felix Bareda; Pablo Barela; Mrs. Sarah Barney; Mrs. Sophia Barney; W. T. Barney; E. D. Barry; Innocente Bartolda; Severa Bartolda; Thomas Batty; Walter Batty; C. M. Beal; J. H. Beal; Mrs. J. S. Beals; William N. Beebe; Frank V. Beers, Administrator of the Estate of R. H. Beers, deceased; Thomas H. Bell; W. A. Bennett; William Bigler; John Bilby; John Billingsley; Hyrum Bingham; J. H. Bingham; Lester Bingham; R. William Bingham; Warren Bingham; W. R. Bingham; D. W. Birdno; Mrs. John J. Birdno; Mary Lorraine Birdno; E. W. Black; Edsil Blain; W. M. Blair; Ben Blake; Ed Blake; I. B. Blake; Mrs. Thomas Blake; T. F. Boggs; W. F. Bollinger; Charles Boots; C. B. Boren; William Boren; H. G. Boyle; Mrs. Artie Branam; L. S. Branam; Wallace Branch; Brown Canal Company; Gratz D. Brown; Jaared T. Brown; L. J. Brown, Jr.; William Brunson; Adelaide M. Bryce; A. J. Bryce; David J. Bryce; E. P. Bryce; G. A. Bryce; Heber B. Bryce; J. W. Bryce; R. A. Bryce; Mrs. Sarah Bryce; W. C. Bryce; William E. Bryce; E. G. Bullard; Charles Burrell; George Burrell; Manuel Burrell; T. D. Burton; J. D. Busby; Mary Butler; W. F. Butler, Jr.; Edward Carpenter; Frank Carpenter; John Carpenter; Lester Carpenter; William Carpenter; Mrs. Jesus Carrasco; V. Carrasco; Antone Carreon; Albert Carter; Alof P. Carter, Administrator of the Estate of E. L. Carter, Deceased; W. A. Carter, Sr.; Ethel B. Carter; W. R. Chambers; J. A. Chapman; W. W. Chapmen; Pablo Chavarria; P. Chendilla; D. W. Cheney; Mrs. A. W. Chesley; J. E. Chesley; H. R. Chiarson; Antone Christensen; Victor Christenson; Citizens Bank; Edward M. Claridge; Charles S. Clark; H. J. Clark; W. A. Clark; H. S. Clarke; Aeshel Clifford; Elijah Clifford; Henry Clifford, Sr.; L. A. Clifford; W. H. Clifford; B. F. Cluff; Benjamin F. Cluff, Administrator of the Estate of Joseph Cluff, deceased; Mrs. J. E. Cluff; John Cluff; Evans Coleman; H. L. Colvin; John D. Colvin; Colvin-Jones Canal Company; C. S. Conway; C. S. Conway, Administrator of the Estate of F. W. Hays, deceased; C. L. Coombs; George Coombs; H. V. Coombs; Isaac Coombs; N. E. Coombs; William Coombs; Grady Coppedge; James Corder; John C. Cosper; Henry Crabbe; Mrs. W. E. Craig; G. E. Crandall; R. D. Crandall; G. L. Crawford; H. W. Crockett; W. W. Crockett; A. J. Curtis; Ammon Curtis; Curtis Canal Company; Cleve Curtis; Don Curtis; Mrs. Elizabeth Curtis; Emery Adelbert Curtis; Eugene Curtis; Ezra Curtis; Mrs. Frank Curtis; M. M. Curtis; Mrs. Virginia Curtis; L. C. Cutler; Charles E. Dallas; Mrs. Julia Daly; Willis K. Daly; Mrs. Hester Damron; John R. Davidson; A. B. Decker; Z. B. Decker; Etta G. Deller; Mrs. Henry Dial; Guy Dixon; A. J. Dodge; Dodge-Nevada Canal Company; David Dodge; Mrs. Layman Dodge; Thomas Dodge; J. M. Dominges; Claro Dominques; Mrs. Lily Duke; J. W. Earvin; Benjamin Echols; Ramoldo Elias; H. B. Elledge; Davidsel Ellsworth; Ernest Ellsworth; Francis Ellsworth; William Ellsworth; Mrs. Charlotte F. Elmer; J. H. Elmer; Mrs. Sarah S. Elmer; Hart D. Empie; Miguel Encinas; Catalina Entzminger; Mrs. Belle Epley; John C. Epley; P. Estrada; Austin Evans; George

C. Evans; E. C. Eyring; Amadeo Fajardo; C. E. Farley; J. A. Farley; Luther Farley; A. M. Farmer; F. A. Farrell; C. J. Farrington; J. W. Felshaw; M. P. Ferguson; F. M. Ferrell; C. E. Ferrin; Ether S. Ferrin; Robert Ferrin; W. M. Ferrin; Jose Figuerroa; J. H. Fine; Seth P. Fletcher; Elias Flores; Nora Floyd; Joseph E. Follett; I. A. Follett; L. L. Follett; W. L. Follett; George Foote; Orson F. Foote; W. R. Foote; Fort Thomas Consolidated Canal Company; Hugh Foster; John H. Foster; J. A. Foster; Karl Foster; Fourness Canal Company; Mrs. Clara Fourness; J. L. Foutz; Augustin Franco; Pedro Franco; J. L. Freeman; M. S. Freeman; Alma Freestone; Charles E. Freestone; R. L. Freestone; P. H. Freudenthal; Archie Fuller; Lawrence Fuller; Thomas F. Fuller; William Fuller; Millard Fyffe; E. Gallego; Casimiro Garcia; G. Garcia; Jesus Garcia; Jose B. Garcia; Juan Garcia; Marajilda Garcia; Rafael Garcia; Tomas Garcia; Victoriano Garcia; Thomas Gardner; Ramon Gauna; Fernando Gervantez; Charles Gietz; Gila Valley Irrigation District; Albert Gillespie; Edward L. Gillespie; James Gillespie; Shell Gillespie; William H. Gillespie; Forrest Gilliland; J. R. Gillmore; J. R. Golding; Mrs. S. C. Gonzales; Mrs. Francis Goodman; George A. Gourley; Graham Canal Company; Mattie Graham; Epitacio Granillo; J. L. Green; Reece D. Green; J. W. Greenhalgh; R. H. Greenhalgh; Christino Grijalva; J. M. Grijalva; Merejildo Grijalva; C. J. Grover; Hugh C. Hamman; E. E. Hancock; Ira Hancock; Jesse A. Hancock; H. B. Harms; A. Harper; John H. Harper; Delbert Hatch; George L. Hatch; G. J. Hatch; Elijah Hawkins; J. N. Hawkins; C. D. Haynie; L. B. Head; George W. Healy; C. M. Hendricks; Sam Henry; Spence C. Heywood; John Hicks; C. N. Higgins; Heber M. Higgins; Mrs. Clara Hinton; Calvin Hocker; F. H. Holiday; Scott Holladay; S. N. Holman; J. N. Holyoak; William H. Holyoak; Mrs. Arthusa Hoopes; Bert Hoopes; H. E. Hoopes; John L. Hoopes; George A. Hoops; E. D. Householder; E. D. Howard; J. M. Howard; Joseph Howard; S. D. Howard; Almera Hubbard; Thomas H. Hundley; A. C. Hunt; Sarah A. Hunt; Mrs. S. J. Hunter; Mrs. W. E. Irwin; George P. Jacobson; Martin Jacobson; P. J. Jacobson; S. L. Jenkins; S. P. Jenkins; James Jensen; David Johns; Charles P. Johns; D. L. Johns; J. C. Johns; L. A. Johns; W. A. Johns; Mrs. William Johns; D. C. Johnson; Norman J. Johnson; P. Johnson; Orlando Jolly; James E. Jones; David Jurado; Leo Keiffer; P. M. Kelly; A. J. Kempton; Asa B. Kempton; Bell Kempton, Administratrix of the Estate of A. N. Bryce, deceased; Calvin I. Kempton; Fred Kempton; Heber Kempton; Ira N. Kempton; Mrs. Margaret R. Kempton; R. H. Kempton; Donald Kennedy; J. D. Kennison; Charles Kerby; George Killian; Heber C. Kimball; Spencer Kimball; Thomas S. Kimball; F. E. Kirkpatrick; Charles Kruger; Cora Kruger; E. M. Lambson; A. O. Lamoreaux; Guy W. Lamoreaux; R. D. Lamoreaux; Beatrice Larson; Charles S. Larson; C. O. Larson; Eral Larson; Ephriam Larson; James M. Larson; Joe Larson; Lehi Larson, Sr.; Maroni Larson; Mildred B. Larson; Mrs. Olivea Larson; Orvil Larson; William Larson; Alex Layton; Charles M. Layton; C. M. Layton, Jr.; H. W. Layton; Leslie W. Layton; M. M. Layton; Oscar G. Layton; R. G. Layton, Jr.; Roy A. Layton; Amy T. Leavitt; Claude M. Lee; J. D. Lee; J. Y. Lee; Marion Lee; Mrs. W. A. Lewis; Mrs. Nisia Lindsey; Al Lines; Joseph H. Lines; Milton Lines; W. A. Lines; Charles Luster; R. L. McAllister; D. C. McBride; Ether McBride; James A. McBride; Laura McBride; P. H. McBride; P. H. McBride, Jr.; W. E. McBride; Mrs. Laura McCullom; C. J. McElroy; Martha McElroy; A. F. McEuen; E. W. McEuen; M. P. McEuen; Virgil R. McEuen; Thomas McGuire; A. O. Mack; C. M. Mack; Henry H. Mack; J. A. Mack; J. H. Mack; William S. Mack; Robert Mackey; Abran Madrid; James Mallon; W. J. Mallon; Angus Maloy; G. B. Maloy; M. D. Maloy; Clark Mangum; S. Marcus; S. S. Marshall; W. G. Marshall; Clarence Martin; J. B. Martin; J. S. Martin; Mrs. W. F. Martin; Juan Martinez; C. V. Massey; J. T. Massey; Mrs. L. A. Massey; George A. Mathews; Simon Mathews; C. A. Matthews; Mrs. Chloe Matthews; D. H. Matthews; Eliza Matthews; Jane L. Mattice; John W. Mattice; Lewis P. Mattice; Ben Mauer; Kimball Maxham; Mrs. F. M. Modhurst; Miguel Mena; Manuel Mendez; Damesio O. Meraz; Gerald Merrill; H. M. Merrill; Martha A. Merrill; P. C. Merrill; P. C. Merrill, Administrator of the Estate of Joe Pensyl, deceased; P. M. Merrill; S. A. Merrill; Miles

Messinger; Louis Michelena; Mrs. M. Michelena; Mrs. J. S. Miles; G. W. Miller; Sisto Molino; Francisco Montez; Jesus Montez; Montezuma Canal Company; E. E. Montierth; George Montierth; Leslie Montierth; M. G. Montierth; Wendell Montierth; Edward Moody; Edwin Moody; J. M. Moody; Winford Moody; J. R. Moore; Jose Morales; Mrs. Belle Morris; Cicero Morris; E. M. Morris; Frank Morris; George Albert Morris; John W. Morris; Robert Morris; William Morris; M. Mortensen; C. N. Motes; D. T. Motes; Ernest Motes; P. L. Motes; Anna M. Moyes; Joseph Moyes; J. R. Naillon; Aron T. Nelson; L. A. Nelson; W. L. Nelson; H. L. Norton, Jr.; H. L. Norton, Sr.; J. E. Norton; P. A. Norton; S. N. Norton; William R. Norton; John Nulton; J. H. Nuttall; Braulio Ochoba; Elam Olsen; Victorino Olivas; W. Ollerton; Oscar Olsen; N. Ortiz; Elsie L. Overly; J. T. Owens, Jr.; O. E. Owens; Mrs. C. R. Pace; Mrs. Isabelle Pace; W. W. Pace; Asa Packer; E. K. Packer; Joaquin Padilla; Mrs. Marcelina Padilla; E. Palmer; I. J. Palmer; Isaac O. Palmer; J. I. Palmer; Lee L. Palmer; Mrs. Nancy Palmer; Roy Palmer; Van D. Palmer; George O. Peck; William A. Peck; Calista B. Peel; Mabel Perkins; Juvenal Perolas, Administrator of the Estate of Damas De Leon, deceased; Maranda Perkins; Jacob Peters; Alma Peterson; P. O. Peterson; Wilfred Peterson; E. C. Phillips; Jesse C. Phillips; Rudger Phillips; W. A. Pitt; Ben T. Platt; W. E. Platt; E. M. Plumb; Henry E. Plumb; J. M. Plumb; S. V. Pollack; A. T. Pollock; James H. Porter; S. V. Porter; W. A. Posy; W. A. Posy, Administrator of the Estate of Orson Elliott, deceased; D. T. Preston; M. F. Preston; W. F. Preston; W. J. Preston; Harriett Pulsipher; J. E. Pulsipher; Jesse B. Quinn; Anastacio Quiroz; D. Raper; B. O. Rapier; Miles Reay; Robert E. Reed; Sarah E. Reed; Mrs. W. R. Reed; T. J. Rex; Carlysle Reynolds; S. E. Reynolds; J. F. Rhinehart; W. G. Richards; George F. Richards; Gilbert Richardson; Rebecca Richardson; Sarah L. Richardson; Lito Rios; W. H. Roach; I. P. Robinson; Charles Rogers; David Rogers; H. P. Rogers; Joseph Rogers; Mrs. Louisa Rogers; A. Robner; C. N. Rose; Niels J. Roseberry; Espedion Sadilla; C. B. Sale; Ethlon Saline; John Saline; Roy Saline; W. D. Saline; Jose Samora; Abel Sanchez; Adiel Sanchez; Daniel Sanchez; Eliseo Sanchez; F. Sanchez; Isias Sanchez; Manuel Sanchez; D. W. Sanders; George Sanders; San Jose Canal Company; Clarence Scarlett; J. W. N. Scarlett; L. B. Scarlett; W. F. Scarlett; J. E. Schurtz; S. E. D. Sears; Andreas Serna; Santos Serna; Mrs. John Shields; A. J. Shifflet; J. S. Shifflet; R. R. Shipp; Francis M. Skinner; Maroni Skinner; Mrs. Martha Skinner; A. A. Smith; Mrs. D. E. Smith; E. D. Smith; H. L. Smith; J. M. Smith; Joanna Smith; L. W. Smith; M. M. Smith; R. A. Smith, Sr.; Mrs. W. R. Smith; Mrs. J. B. Smithson; Smithville Canal Company; Charles F. Solomon; J. W. Sowell; S. A. Sowell; W. H. Spafford; W. D. Spear; Mrs. C. F. Stanley; Lee N. Straton, Administrator of the Estate of Mrs. N. A. Bell, deceased; Albert Stephens, N. W. Stevenson; T. J. Steward; Pratt Stewart; John Stowe; Brigham Stowell; Mathews Stuart; E. P. Stuermer; W. R Summers; D. V. A. Talley; James M. Talley; J. T. Talley; T. Hugh Talley; Van Talley; K. V. B. Talley; H. M. Tate; F. R. Taylor; John E. Taylor; L. M. Taylor; Sarah Taylor; William C. Taylor; William H. Taylor; P. H. Teeple; S. B. Tenny, Jr.; Alva Thatcher; L. M. Thatcher; Tidwell Canal Company; Ida Tidwell; John Tidwell and E. L. Tidwell, Jr., Administrators of the Estate of E. L. Tidwell, deceased; George A. Todd; John T. Traylor; W. O. Tuttle; Frank N. Tyler; Oscar Tyler; William O. Tyler; M. P. Tryon; Union Canal Company; H. C. Usher; The Valley Bank & Trust Company; George Van Gausig; Harry Van Order, Administrator of the Estate of Harry Van Order, deceased; Antonio Vasquez; Jose Varale; Emula Viala; Jose Villareal; W. R. Waddell; Jerome Walker; J. P. Walker; Charles Wamslee; Mrs. J. C. Wamslee; Mattie Wamslee; William Wamslee; Mrs. H. E. Warner; Henry A. Waters; Charles Watson; Lorenzo Watson; Fred Waughtal; Fred Webb; J. D. Webb; F. A. Webster; O. F. Webster; William Webster; A. E. Weech; Adam Welker; Arthur Welker; C. D. Welker; J. A. Welker; R. A. Welker; Willard Welker; A. T. West; John West; B. F. Whitmer, Sr.; B. F. Whitmer, Jr.; Mrs. Mildred Whitmer; Fred H. Wiemer; W. W. Wild; A. A. Wilkins; Mrs. Charlotte Wilkins; Dan Williams; S. O. Williams; Isaac Williamson; T. L. Willis; J. M. Wilson; Mrs. Virgia R. Wilson; Mrs. W. A. Wilson; Alonzo Winsor; F. M. Woodward; W. A. Woolsey; Carrie B. Yett; and Dan Young;

J. C. Anglin; Pedro Bertolda; George A. Bigler; J. Bingham; Alof P. Carter; W. A. Carter, Jr.; Edgar H. Chesley; Church of Jesus Christ of Latter Day Saints; Benjamin F. Cluff, Administrator of the Estate of Phoebe Cluff, deceased; W. D. Cluff; County of Graham, State of Arizona; Joseph Greenhalgh; Annie B. Hancock; M. M. Hancock; Zeb Ison; S. L. Johns; W. M. Kerby; A. O. Lamoreaux, Jr.; Layton Corporation of the Church of Jesus Christ of Latter Day Saints; Art Lee; Henry Lines; George Clyde Mathews; Fred M. Mitchell; E. R. Naillon; Robert L. Nash; Lloyd Norton; Mrs. E. Olsen; Pima Corporation of the Church of Jesus Christ of Latter Day Saints; Pima Townsite; Mrs. Mattie Prina; Charles M. Pursley; George Reynolds; Mrs. Nancy Reynolds; David L. Ridgeway; Pedro Ruiz; Town of Safford; Safford School District No. 1, County of Graham, State of Arizona; School District No. 7, County of Graham, State of Arizona; School District No. 8, County of Graham, State of Arizona; School District No. 11, County of Graham, State of Arizona; School District No. 12, County of Graham, State of Arizona; School District No. 31, County of Graham, State of Arizona; George R. Shurtz; Townsite of Solomonville; Sunflower Canal Company; A. V. Tate; Town of Thatcher; O. F. Webster, Administrator of the Estate of Thomas G. Webster, deceased; Mrs. M. C. White; Nephi Williams; Mrs. G. R. Young; and Emma B. Mellinger.

H. A. ELLIOTT, by A. R. LYNCH,

A. R. LYNCH,

H. A. Elliott and A. R. Lynch,

Solicitors for the following defendants:

J. L. Aker; Albert Canal Company; H. Albert; Mrs. Eliza Alexander; M. M. Allred; Hans Anderson; T. J. Anderson; R. H. Angle; T. W. Arnett; Albert L. Barber; E. G. Barlow; J. R. Beavers; Florentino Billaba; Billingsley Extension Canal Company; B. F. Billingsley; Black & McCleskey Canal Company; W. Bleinstein; Silas Bradshaw; T. J. Branyon: C. M. Brooks; M. H. Brooks; R. W. Brooks; W. W. Brooks; J. H. Brown; S. A. Brown; T. W. Brown; Nellie E. Buck, Administratrix of the Estate of David Buck, deceased; J. C. Burleson; David F. Campbell, Jr.; Mary E. Campbell; J. E. Cardon; J. W. Carter; Mrs. Tom Carter; Ypolita Cascarilla; Mrs. Maggie Cauthen; A. D. Cheatham; Betty Marsh Cheatham; E. V. Cheatham; I. M. Cheatham; Mary Ann Cheatham; S. C. Cheatham; J. K. Chilton; L. T. Christensen; R. F. Cloudt; M. A. Clouse; Mrs. Jas. I. Cohn; G. W. Collins; Colmenero Canal Company; Cosper & Windham Canal Company; Cosper & Windham Extension Canal Company; Alice H. Cosper; George H. Cosper; George H. Cosper, Jr., Administrator of the Estate of George Cosper, deceased; Mussett Cosper; J. L. Crabtree; F. M. Craig; W. C. Craufurd; J. H. Cready; F. M. Crockett; Mrs. M. J. Daniels; E. G. Davidson; David Davis; E. Day; Mrs. M. A. Dees; Carl M. Donaldson; Duncan Canal Company; Duncan Union High School District, Gus Duncan; Byron Echols; M. B. Echols; Joseph C. Elledge; R. E. Elledge; W. H. Elledge; G. I. Elmer; John Evans; Amos F. Fearin; J. W. Foote; S. A. Foster; W. F. Foster; J. R. Fowler; Ernesta Francese, Administratrix of the Estate of Frank Francese, deceased; Franklin Irrigation District; R. H. Friestone; J. B. Fullerton; B. J. Gale; Mrs. E. A. Gale; I. B. Gale; Otto Gale; W. T. Gale; James A. Gamble; F. N. Gault; W. A. Gill; Aubra Gilliland; J. M. Gilliland; R. C. Gilliland; Emil Girard; Trivio Gonzales; H. Grady; John Hagan; H. B. Harris; M. L. Harris; Waide Harris; G. Lynn Hatch; J. L. Henderson; C. C. Hester; O. L. Hext; Floyd Hightower; C. F. Hill; J. W. Hill; Nellie R. Hoch; C. F. Houlihan; Rachel Jensen; R. T. Johns; Delbert Johnson; G. W. Johnson; Thomas H. Johnson; F. W. Jones; John B. Jones; Mary Jane Jones; Parley P. Jones; T. V. Jones; Willard E. Jones; Culver Kartchner; Mrs. S. L. Kemp; Richard Kirtland; A. T. Layton; A. N. Livvix; W. W. Lloyd; Anna H. Lunt; Edward Lunt; George A. Lunt; G. V. Lunt; Heaton Lunt; Owen Lunt; P. L. Lunt; Randall Lunt, Administrator of the Estate of Jasper Gale, deceased; R. H. Lunt; W. V. McCarty; J. F. McGrath; R. J. McLaren; M. J. Mabin; William Manske; C. C. Martin; J. A. Martin; J. H. Merrian, Executor of the Estate of Alice E. Day, deceased; E. A. Merrill; Fenley F. Merrill; Orson A. Merrill; T. S. Merrill; R. E. Miller; James A. Mitchell; Moddle Canal Company; Robert M. Montgomery; Theodore H. Moody; R. C. Moore; Hans Mortensen; Hiram K. Mortensen; J. Alfred Mortensen; Peter Mortenson; W. T. Mosley; L. D. Moyers; L. G. Moyers; W. F. Moyers; H. J. Nunn; T. A. Nunn; J. P. Oberholser; O. G. Odell; James Opie; Nancy O. Pace; W. C. Packer; C. C. Passmore; E. C. Payne; H. M. Payne; Junius E. Payne; Leslie B. Payne; W. U. Phillpott; C. Pirtle; Mrs. M. E. Pittman; G. W. Quinn; Margarete I. Ragsdale; Nance E. Ragsdale; Mrs. Ethel Rainbolt; Oscar Rainville; O. Reyes; Ralph Richardson; Rebecca Richardson; Sarah L. Richarsdon; Orson J. Richens; J. R. Robbs; Ernest V. Romney; Eugene Romney; Julius Romney; F. E. Ross; W. T. Sanders; K. M. Schade; Frank Schultz; School District No. 2, County of Hidalgo, State of New Mexico; School District No. 7, County of Hidalgo, State of New Mexico; Andy Scott; Brooks Scott; Secton Canal Company; R. Sexton; Delores B. Shirk; Laura Short; Shriver Ditch Company; W. F. Shriver; Mrs. E. M. Simmons; Jesse B. Simms; Sinclair Realty Company; Henry L. Smith; J. G. Smith; V. Soto; Emma Spoon, Administratrix of the Estate of J. H. Spoon, deceased; A. L. Stewart; M. E. Stewart; Mrs. R. S. Stewart; George W. Stinson; W. P. Stover; Nicholas Saurez; Florence R. Swofford; Sunset Canal Company; Charles Telles; Sam R. Tilley; W. D. Tucker; George Utter; Valley Canal Company; Virden Irrigation District; Peter Wahline; Alvin Warner; J. L. T. Watters; B. Y. Whipple; West White; Joe Whittridge; W. W. Wilkey; D. E. Wilkins; E. J. Wilkins; J. D. Wilkins; Lila Williams; Roy D. Williams; Mrs. T. M. Williamson; B. A. Wilson; George A. Wilson; Page S. Windham; N. C. Wright; George W. Wyatt; York Canal Company; and York Cattle Company;

W. E. Bowers; J. E. Payne, Trustee, Church of Jesus Christ of Latter Day Saints; A. C. Gruwell; M. N. Jensen; Milton N. Jensen; A. E. Keller; Maude Larsen; Mitchel McDonald; O. Mortensen; Amanda Nations; M. D. Patton; G. Q. Payne; Helen A. Payne; E. W. Richens; R. Richens; School District No. 27, County of Greenlee, State of Arizona; Nancy A. Smith; and E. Thygerson.

GIBBS AND GIBBS, BY B. H. GIBBS,

Gibbs and Gibbs, Solicitors for the defendant

T. H. B. Glasspie.

BAKER AND WHITNEY, BY A. B. BAKER,

Baker and Whitney, Solicitors for the defendant

Arizona Eastern Railroad Company.

W. S. NORVIEL,

W. S. Norviel, Esq., Solicitor for the following defendants:

Catherine A. Norviel; Helen Slaughter, and H. D. Thornton.

FLOYD M. STAHL,

Floyd M. Stahl, Esq., Solicitor for the following defendants:

John H. Dennison; Pearl Dennison; Stowe Phelps; and O. I. Purdy.

CHALMERS, FENNEMORE & NAIRN, BY H. M. FENNEMORE,

Chalmers, Fennemore and Nairn, Solicitors for the following defendants:

Nevada Consolidated Copper Company; Ray Consolidated Copper Company; and H. M. Fennemore, and Kennecott Copper Corporation.

CHARLES H. REED,

Charles H. Reed, Esq., Solicitor for the following defendants:

Town of Florence.

O. J. BAUGHN,

Otis J. Baughn, Esq., for himself and as Solicitor for
The following defendants:

Margaret P. Brown; Estate of Dora M. Clark; Mira B. Doran; Lissa J. Fulton; William G. Knight; Rafael O. Larona; Lola LeBaron; H. H. McNeil; Helen S. Sheafe; Charles M. Sheafe; James S. Sheafe.

ROBERT DENTON,

Robert Denton, Esq., for himself and as Solicitor for
the following defendants:

Florence-Casa Grande Water Users Association; Mark Twain Clemans; Earl G. Clemans; Edith M. Clemans; Hazel H. Clemans; Winnefred W. Clemans; W. J. Clemans, Jr.

SIDNEY SAPP,

Sydney Sapp, Esq., Solicitor for the following defendants:

E. B. Newman, Administrator of the Estate of H. H. Scoroe, deseased; S. W. Newman.

The following defendants sign for themselves individually.

ERNEST W. McFARLAND,

Ernest W. McFarland.

GRADY L. HERRING,

Grady L. Herring.

GEORGE M. BROCKWAY,

George M. Brockway.

PETER D. OVERFIELD,

Peter D. Overfield.

Filed June 29, 1935.

J. LEE BAKER, Clerk,
United States District Court for the District of Arizona.
By WM. H. LOVELESS, Deputy Clerk.

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ARIZONA'S CHANGING RIVERS:

ORIGINAL

96-003-018
Gila River

001-009

RECEIVED 3-12-1998

HOW PEOPLE HAVE AFFECTED THE RIVERS

Barbara Tellman
Richard Yarde
Mary G. Wallace

Water Resources Research Center
College of Agriculture
The University of Arizona
March 1997

GILA RIVER

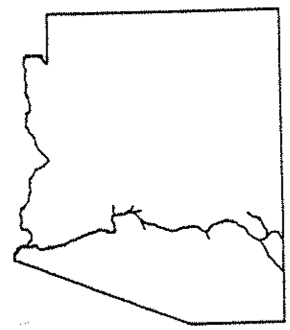
Because the Gila River crosses the state from east to west it was very important as a travel corridor. Many people traveled along the lower Gila River on their way California in the nineteenth century, starting with the 1849 Gold Rush. It has been the source of irrigated agriculture for over two thousand years. Today much of Arizona's commercial agriculture depends on the Gila River.

The River

The Gila River gathers waters from most of Arizona's rivers—the Santa Cruz, San Pedro, Salt and many other rivers. It is one of the longest rivers in Arizona, stretching some 600 miles across Arizona, from its two sources in the Mogollon Mountains in western New Mexico to its confluence with the Colorado River in western Arizona. It is Arizona's largest watershed, covering over half the state's total land area, excluding only the Little Colorado basin in the northeast, the Bill Williams River and a few small drainages along the Mexican border and in northern Arizona.

Early Indian Settlement

Although a few humans may have reached the Gila River earlier than 12,000 years ago, real occupation of the area began after 10,000 B.C. The life of the early pre-historic Indians was tied to water from the river and its tributaries. Early inhabitants were dependent on surface water and could not travel more than a few days from dependable water. Food-gathering and hunting were the mainstays of life. Because some resources were only available seasonally and over wide ranges, the early human inhabitants moved from camp to camp in search of water and food.



About 300 B.C., the Mogollon people began to settle in the narrow canyons along the Upper Gila River and its tributaries. Perennial flows in this area supported a variety of agricultural activities. Corn was grown in the Gila River watershed and later in the more arid lowlands. The Mogollon gradually settled in permanent sites using irrigated agriculture and runoff farming and built contour terraces on slopes and checkdams along upper drainages. Mogollon communities continued to grow and then declined by the mid-twelfth century.

The Hohokam inhabited the central part of he Gila River Basin and began to form community groups beginning before 800 A.D. Communities were located along the mainstem of the Gila River. By the mid-eleventh century more than 250 communities were in the watershed.

One large Hohokam population center was Snaketown, at the confluence of the Salt and Gila rivers. Another large community, Casa Grande, was on the south bank of the river near present-day Coolidge. Here, the Gila flowed perennially, except in drought years. One main canal diverted water from the river, and a series of irrigation ca-

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"*... a beautiful mountain stream about thirty feet wide and one foot deep on the shallows, with clear water and pebbly bed fringed with trees and hemmed in by mountains, the bottom not more than a mile wide. The signs of beaver, the bear, the deer, the turkey, besides the tracks of herds of Indian horses, were plain to be seen in the sand.*" Abraham Johnston, describing the Gila River in 1848.

"... all its inhabitants are fisherman, and many have nets and other tackle with which they fish all year, sustaining themselves with the abundant fish and with their maize, beans, and calabashes. ..." Father Eusebio Kino, describing Pima Villages in 1699.

nals brought water to the fields. Where surface flows were scarce, the flow of washes was channeled into alluvial areas and hillside terraces. Probably most, if not all, of the summer flow of the river was diverted at the peak of Hohokam settlement.

A drought at the end of the thirteenth century caused a shift in Hohokam population. Some people who lived along the smaller tributaries moved to the mainstem of the Gila River. Here the Hohokam thrived until the mid to late fifteenth century.

The Spanish-Mexican Period

When the Spaniards arrived, they found the ruins of the Hohokam and Mogollon people, with Pimas and Maricopas living along the Gila River, probably descendants of the Hohokam. Fray Marcos de Niza led the first exploration in 1539 and crossed the headwaters of the Gila River on his way to New Mexico. He was followed by Francisco Vasquez de Coronado who also crossed the Gila River after coming up through the San Pedro River Valley. A member of Coronado's party described the Gila River as a "deep and reedy stream." No settlements or presidios were established during this period along the Gila River.

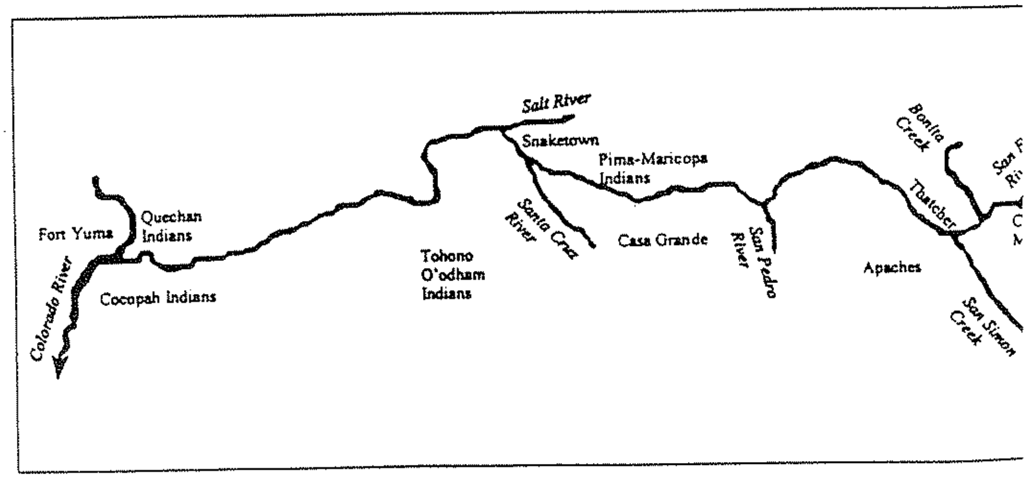
The early explorers were followed more than a century later by Father Eusebio Kino who traveled extensively along three-fourths of the Gila River between 1691 and 1702. He reported seeing irrigated crops and an abundance of fish in the river. Other missionaries noted that Pima Indians raised many crops along the river and on "an island" in the river near Casa Grande. Although he established no missions along the Gila River, Kino' influence was widespread. He brought cattle, seeds, and other items. Until Kino introduced wheat, Arizona Indians did not have any crops suitable for cultivation in the winter. The Pim Indians quickly began to cultivate wheat, and grew as much as 220,000 pounds of wheat in 1859, farming about 15,000 acres along the Gi River and provided food for the military, explc ers and other Indians in the territory,

The Apaches moved into the upper reache: of the watershed and controlled much of the a in the seventeenth century. They relied primaı on raids for cattle, horses, wheat, and other foods, but did some floodplain farming.

Anglo-American Explorers

In 1825 the Patties are were among the fir: Americans to enter the area, trapping beaver. Beaver were plentiful. Pattie noted of the rive he called the Helay, that "At this point we con menced setting our traps. The river here was beautiful, running between banks covered with tall cottonwoods and willows." He also found other wildlife, such as otters, turkeys, antelopε mountain lions, and javelinas.

Pattie noticed how the river changed near Safford valley. Instead of steep canyons, "We



Historic sites along the Gila River.

"Leaving behind these Pima settlements and trekking down stream we came upon broad savannas of reed grass and clumps of willow and a beautiful spring with good land for pasture. ... Passing on down river another five or six leagues and keeping it always in view with its willows and cottonwoods, we came to its confluence with the Rio de la Asuncion [Salt]. ... A very pleasant country surrounds this fork of the rivers. Here the eye is regaled with creeks, marshes, fields of reed grass and an abundant growth of alders [sic, willows] and cottonwood." Sedelmayr 1744

found the river skirted with very wide bottoms, thickset with the mosquito [sic] trees. Willow, cottonwoods, and other trees lined the river." Here he trapped a rare Arizona river otter.

Pattie was one of the first Anglos to "navigate" the Gila River. Below the Salt, he described the river as "about 200 yards wide, with heavily timbered bottoms." He finished the last part of his journey on the Gila in a "canoe" he built with the help of his companions as the river was too deep to cross by horseback. At another point, under attack by Indians, "We made rafts to which we tied our guns, and pushing them onward before us, we thus swam the river." The Patties trapped beaver the entire length of the Gila, sometimes trapping as many as 60 in one morning. Pattie described the river near the Salt River as "remarkably circuitous, and has a great number of islands, on which we took beavers."

"We cut down two trees suitable for canoes, and accomplished these important objects in one day. ... On the morning of the fourth we commenced digging out our canoes, and finished and launched two. ... We continued to prepare, and launch them, until we had eight in the water. ... We started on the 9th, floating with the current, which bore us downward at the rate of four miles per hour. ... We now floated pleasantly downward at our leisure, having the abundance of the meat of fat beavers." James Pattie, 1828

In 1846, Stephen Watts Kearny led a battalion of men during the Mexico-U.S. War to survey the area, and they mapped the entire river. Lt. Emory, the expedition's official diarist, estimated the flow of the river as about half of that of the Colorado River. He also noted many fish in the river, including some that weighed between 25 and 30 pounds. They noted large-scale irrigation by the Indians through surface water diversions.

After 1846, the "Gila Trail" was well known as a route for travelers across Arizona. During the California Gold Rush of 1849, as many as 60,000 emigrants crossed through Arizona using this trail. The 49ers traded with the Maricopa and Pima Indians along the Gila River. As one traveler observed, the river was a "deep, narrow, and rapid stream of warm muddy water, with the banks covered with a dense growth of wild willow and weeds, tall cottonwoods. ... A dam has been constructed and by small canals the water is conveyed over the bottoms and thrown into the fields." In 1854, another explorer noted that the Pima Indians had diverted the entire flow for irrigation west of the confluence with the Salt. The river upstream from these diversions was again described as flowing between "steep banks 15 feet high and completely overhung with willows and cottonwoods."

These early explorers were followed by surveyors, the military and many others. John Bartlett traversed the area in 1852 and found the Gila River dry in some areas. He and his men were able to find water from four to six feet below the surface by digging two wells. He established the

"The Pima are large and fine-looking, seem well fed, ride good horses, and are variously clothed, though many have only center cloth. They have an extraordinary length and luxuriance of hair. With their large white cotton blankets and streaming hair, they present, when mounted, quite a fine figure. But innocence and cheerfulness are their most distinctive characteristics." Indians sold wheat, corn, flour, and other staples. "The camp is full of Indians of all sorts and a great many have flour, corn, beans, or some eatable to trade. ... They have watermelons for sale. For the last hundred miles all vegetation is green. There are at least two thousand people in camp, all enjoying themselves very much." Philip St. George Cooke, 1846.

"... the water was clear and palatable, flowing with a moderate current over an alternating bed of sand, pebbles, and rock. The stream was, in July, about twenty feet wide and twelve inches deep. Its banks were fringed throughout with cotton-wood and willow thickets, with mesquite at the base of the terraces. Below the gorge ... the valley opens out in a broad plain, increasing in widths the Pima villages are approached." J.G. Parke, describing the area where the San Pedro meets the Gil in 1855.

confluence of the Salt and Gila rivers as the centerpoint of his Arizona survey.

Other travelers commented on the Gila River. In 1854, James G. Bell, who was driving a large herd of cattle across Arizona, reported the existence of the "Gila Lagoons," located about three miles from the Gila River, which he described as "good cool water." (He bathed in the waters, a treat in the desert of the 1850s). Later, John Audubon reported "a great many lagoons, nearly all muddy," varying in salt content, with its quality ranging from drinkable to nondrinkable. In some places it was "a cake of pure salt."

All the early explorers believed the river to be perennial, although in some places the flow briefly disappeared, such as the area downstream from the Pima and Maricopa irrigation fields.

Mining

While the Indians and the Spaniard probably did some gold and silver mining near the Gila River, mining increased as technology improved in the nineteenth century. Silver mining began in 1859 in the headwaters area. However, it wasn't until the end of th Civil War that miners in search of gold, silver, and copper moved in great numbers to the Gila River. By 1900, three major mines operated in the Clifton-Morenci area, along the San Francisco River, a headwater stream.

The major effects of mining on the Gila Riv particularly the upper region, were diversions of water, water pollution, use of trees for construction and fuel, and changes in stream channels. Many of the areas around mines were stripped of all wood. The local mines burned a cord of woo for each 5.6 tons of ore mined and milled. Mile of mesquite thickets in the lower Gila were cut and turned into charcoal in 1876 alone. Erosion increased as trees were cut and pack animals made trails in the forests.

The San Carlos Reservation

The first large Indian reservation in Arizona was established along the Gila River in 1872 as part of the White Mountain Reserve. This reservation for a while served as a "catch-all" for defeated Indian tribes from various parts of the state, mixing some tribes that were traditional en mies. The Yavapai were force-marched from their mountain homes along the Verde River to these unfamiliar lowland areas along the Gila. The Chiricahua Apaches who were first given a reservation in the Chiricahua Mountains of south eastern Arizona, were later sent to the San Carlo Reservation when the Chiricahua reservation wa revoked.

Copper Mining at Clifton and Morenci

Henry Clifton was one of many gold-seekers who went to Prescott to make his fortune in 1863. Looking for greener pastures, he reached the San Francisco River in 1865, where he found a little placer gold. In his wanderings he noticed copper deposits which he reported to miners in Silver City, New Mexico. No one knows what happened to Henry, but when those miners staked out claims near the San Francisco River, they named their new town for Clifton.

They managed to raise enough money to begin mining and by 1875 they had built a smelter. The copper veins proved to be profitable and the mines were continually expanded. At least one early mining town was consumed by the growing pit. In the early days, wood cutting was so intense that the mountains for many miles around water were totally deforested and woodcutters sought trees up to 50 miles away. Copper mining and smelting requires large amounts of water and Phelps-Dodge, the current owner, had to import additional supplies from adjacent watersheds. The mines have produced steadily over the years. Production amounts and values are not publicly available. For many years pollution from the mines was a severe problem along the San Francisco and Gila rivers.

In the early years, Anglo-Americans ran cattle throughout the reservation. In 1924, however, all leases with non-Apaches were canceled to consolidate Apache control of the reservation. Tribal ranching began at San Carlos in 1937 when the federal government loaned the tribe $75,000 to start a cattle herd. Cattle ranching is a major business on the San Carlos Reservation. Agriculture is a major water use.

Ranching and Agriculture

By 1870, the Gila River valley was relatively safe from Apache attacks. In the headwaters areas, Americans began to settle along the river, drawn by the grasslands found in the upper basin. For example, Col. H.C. Hooker moved 15,000 head of cattle into the area in 1872.

Vast areas once covered with "a marvelous growth of grass" were damaged by overgrazing of livestock. Although no one knows exactly how many cattle were in the area in 1880s, clearly thousands were grazing. This, coupled with droughts, damaged the grasslands and increased erosion, especially in the upper reaches of the basin.

People have been farming along the Gila River for more than a 1,000 years. In some areas, modern canals follow the Hohokam canals. The Pima and Maricopa Indians had thriving farms along the middle Gila River by the mid-nineteenth century and sold vegetables and grains to many travelers. Agriculture greatly increased in the late nineteenth century. Mormon settlers built at least 25 canals, some as long as 12 miles, to irrigate 35,000 acres of land between Duncan and Safford before 1900. Today, farms still line the river through the Safford valley. By 1912 up to 50,000 acres of land were under cultivation.

Farmers at Florence built a canal in 1887, diverting the entire flow of the river. This left the downstream Pimas without enough water for crops. The river was then a relatively narrow stream, with occasional lagoons and beaver dams.

The Wellton-Mohawk Irrigation District

Anglo farming began in 1857 on the lower Gila River, near Wellton. The river supplied plenty of good quality water. Two canals were constructed, but by the 1880s, as the upper sections of the Gila River and the Salt River became settled, water diversions slowed surface flow considerably, often leaving nothing. To help solve the farmers problems, the U.S. Bureau of Reclamation drilled an irrigation well in 1915. By 1916, 109 wells were in operation. These were the foundation of the Gila Project, which was built in the 1930s, and later the Wellton-Mohawk Irrigation District. The Gila Project included irrigation canals and wells.

Because the surface flow was not dependable, farmers irrigated with groundwater and by 1931 they were irrigating 11,000 acres of land. Pumping caused the water table to decline, however, leaving many wells dry. Reuse of groundwater increased the salinity of the water so much that it became unusable. The farmers called for help from the federal government.

After World War II the Wellton-Mohawk Irrigation District was formed, and farmland was provided to veterans. The Gila Project, reauthorized by Congress in 1947, included provisions for canals to bring Colorado River water into the valley to relieve the salinity problem. The first canal system was finally completed in 1952, and in 1957, the project was turned over to the Wellton-Mohawk Irrigation District to irrigate 75,000 acres of land along the River.

Another problem arose, however. Because of the underlying geology, some underground water moved upwards, pushing up many years of accumulated salts. Thousands of irrigated acres went out of production when salts reached the root zone. The Bureau's solution was to transport the salty water to the Colorado River. This pumping, however, increased the salinity of the Colorado River so much that Mexican farmers were adversely impacted. Legislation in 1974 reduced the amount of irrigated acreage from 75,000 to 65,000 acres to address part of the salinity problem. A canal transports the highly saline water into a slough near the Colorado River.

In the 1980s the Bureau tried another solution to the salinity problem. Wastewater from Wellton-Mohawk was to be treated at an elaborate desalting plant in Yuma, then put back into the Colorado River at an acceptable salinity level. This plant has never been fully operational, so the water continues on to the Santa Clara Cienega where it supports a rich wetland habitat.

The District has thrived and today it is one of Arizona's major supplier of lettuce, melons and other crops.

Settlers drained the lagoons and cut the underbrush, grass and trees to create fields for cultivation. Floods, however, often eroded canals and farms along the river.

"In those days there was always a good stream flowing in the Gila River. They were never out of irrigating water and the crops were always good. ... There was always a stream of water running about two feet deep and twenty feet wide. The river bed itself was three-fourths of a mile wide with a heavy growth of cottonwood, willow, and arrow-weeds." George Webb, 1983.

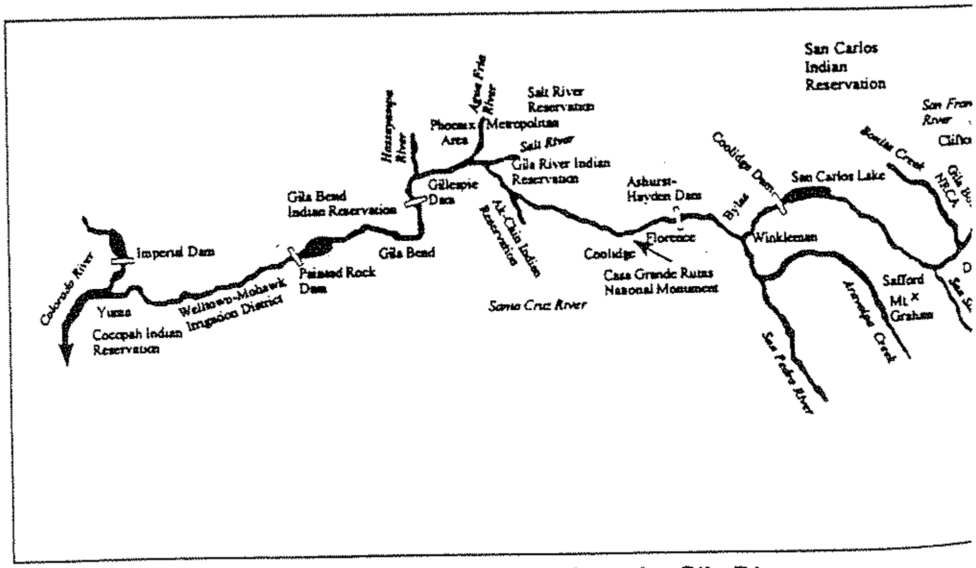
About 23,000 acres are irrigated on the San Carlos Reservation along the Gila River in the Bylas area and along the San Carlos River near San Carlos. A water rights settlement passed by Congress in 1992 settled the San Carlos Apache's claims to water from the Gila River and tributaries and allocated 200,000 acre-feet of water to the reservation. Anglo agriculture replaced much Indian agriculture, but Indian agriculture near the middle Gila River once again increased in the 1990s, with delivery of Central Arizona Project water to Pinal and Maricopa counties. The nature of agricultural activities along the river has changed. Many of the fertile floodplains in the central parts of the river, farmed for centuries by native Indians, have become severely gullied and are no longer farmed. Pumping for agriculture caused an 800-foot drop in the water table between 1924 and 1990. Severe land subsidence has resulted.

Dams

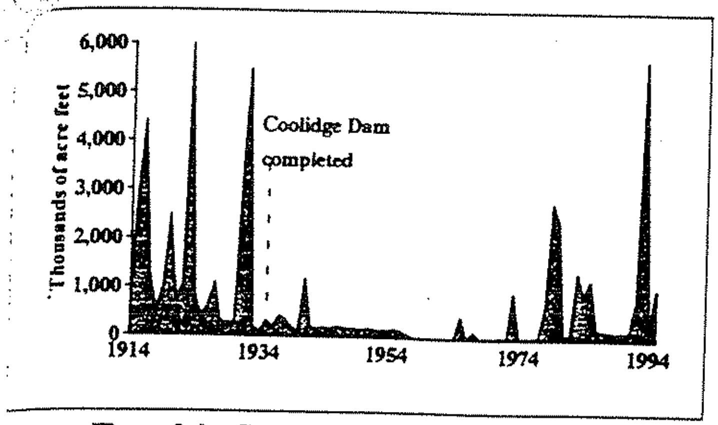
In 1863, the Pimas, who lived downstream of San Carlos, sold over 700,000 lbs. of wheat to the government and traders. By 1868, white settlers used so much of the water that the Pimas in dry years had to leave the reservation or starve. From 1869 on, the Gila River Reservation suffered from a scarcity of water. A drought later worsened the water shortage.

The San Carlos Irrigation Project, including Coolidge Dam 65 miles upstream of Florence, was proposed, in part, to deal with this problem. Built in 1929, Coolidge is the only large storage dam on the river. However, this dam has never lived up to its promises. It was supposed to create a lake 25 miles long and three-miles wide to provide water for 100,000 acres of land, one-half for Indians, one-half for non-Indians. For many years, the dam never retained much water, usually forming only a large muddy pond behind the dam. When it was dedicated in 1930, Will Rogers remarked, "If this was my lake, I'd mow it."

As George Webb, a Pima Indian, noted the dam never delivered the promised water "It took a long time for that dam to fill up and when it did, the water no longer came down the Gila. The Pimas were left without any water at all to irrigate their farms or water their stock or even to drink. They dug wells. The wells dried up. The stock began to die. The sun burned up the farms. Where everything used to be green, there were acres of desert, miles of dust, and the Pima Indians were suddenly desperately poor." Much of the water went to non-Indian farmers who often received deliveries before the Pima did, leaving Pima fields dry.



Twentieth century sites along the Gila River.



Flow of the Gila River above Gillespie Dam.

The San Carlos Irrigation Project supplies water to Indian and non-Indian farms in Pinal County, using water diverted from the Ashhurst-Hayden Dam, which was built in 1928 to serve farmers in the Florence-Casa Grande area. It is a diversion dam which diverts basically all the low flow of the river into the canals of the San Carlos Project for agriculture, ranging from 40,000 acre-feet in low years to over 450,000 acre-feet in high years.

Gillespie Dam, north of Gila Bend and built in 1921, was a diversion dam for local irrigators who grew cotton and alfalfa. A buildup of silt behind the dam created a water-logged area near Buckeye. The Wyler Greenbelt area benefits from the dam as well as return flows from agriculture and wastewater. The dam collapsed in the floods of 1993 and was not rebuilt. Powerful pumps now draw water for farms from the river near the dam site into irrigation canals.

The U.S. Army Corps of Engineers built Painted Rock Dam in 1959 to help control floods on the Lower Gila and Lower Colorado rivers. On maps, the Painted Rock Reservoir shows as an enormous lake west of Gila Bend. During the 1978 floods this lake materialized for the first time. A major flood in 1993 also filled the lake when the upstream dams had filled. Gillespie Dam had collapsed, and floodwaters were pouring from Phoenix area streets. Within a few days, Painted Rock Reservoir became the largest lake within Arizona. Indian burial grounds were flooded along with many acres of fields, and homes. Many fields in the Wellton-Mohawk Irrigation District were flooded, and a bird refuge along the river near Wellton was destroyed.

The major effects of the Gila River dams were the loss of water supplies downstream and the upstream replacement of flowing streams with slow moving lakes. Without floodwaters, seeps dried up, trees died and at least 29 species of birds left never to return. Other effects include changes in water temperature; loss of spawning areas; creation of conditions favoring nonnative fish and saltcedar, rather than native vegetation; depletion of sediment and nutrient supply; loss of normal spring floods downstream; and loss of habitat for many native bird and animal species.

Wildlife and Vegetation

The Gila River has little of its native vegetation. The river downstream of the Ashhurst-Hayden Dam has little or no water most of the time, so riparian vegetation cannot thrive. Old giant mesquite bosques have died, as have cottonwood-willow forests. In areas which still have plenty of water, saltcedar predominates.

Many animal species that lived near the river and its tributaries have also been affected. Beaver were starting to recover after the trapping period, when introduction of cattle and agriculture and beaver trapping provided too much competition. Beaver dams have largely disappeared in valley areas and to a lesser extent in the mountains, leading to changes in streamflow, with increased downstream flooding and erosion. The fish population has been radically impacted.

"By the first of the year 1931, five storage dams had been completed on the Gila River and its tributaries ... and such dams ... cut off the fresh water supply which normally fed the underground waters beneath the [Gila] project lands. Within 3 years thereafter the water in many of the district wells became highly impregnated with soluble salts, and since that time, excepting only during the year 1941 ... the water in the district wells has become increasingly salt ... an average 6,300 parts per million. This brought about the abandonment of many formerly prosperous farms. ... At present the farmers, because of the extremely salty water, are limited to the production of Bermuda grass and alfalfa. ..." Hugo Farmer, at Congressional hearings on reauthorizing the Gila Project, 1941.

Once a river filled with fish, including large squawfish, the Gila now supports little aquatic life in its middle and lower reaches.

The Gila River Indian Reservation has experienced a widespread loss of wildlife. Twenty-eight species that once frequented the reservation are no longer found there, including the grizzly, wolf and numerous birds. Almost all these losses are directly related to loss of riparian woodlands and marshes.

Junction of the Gila and Colorado Rivers in 1858.

Restoration and Preservation

In 1899, President McKinley established the Gila Forest Reserve which encompasses the headwaters of the Gila River in New Mexico. This area was included in the new Gila Wilderness in 1930. This designation partially protects those headwaters, although grazing and recreation are allowed.

BLM manages the Gila Box Riparian National Conservation Area, upstream of Safford, to preserve 21,767 acres of land along 23 miles of the river and a 15 mile segment of Bonita Creek for recreation and habitat restoration. BLM has nearly eliminated grazing along the river, but off-road vehicles and other forms of recreation are allowed. BLM's ability to restore this section of the river is limited by extensive upstream grazing on U.S. National Forest land in New Mexico which changes the nature of the river, its flood flows and sediment loads.

Wildlife habitat was restored upstream of Yuma as mitigation measures for agricultural activities at Wellton-Mohawk. This prime birding area, however, was severely damaged in the 1993 floods which also damaged agricultural fields. Since the floods, the riparian area is beginning to regenerate into wildlife habitat.

Changes in the River

While various Indian peoples had affected the river through irrigated agriculture, the major changes occurred as a result of Anglo-American activities in the nineteenth and twentieth centuries. In 1800, the river ran perennially for most of its length and was lined with cottonwood-willow forests and mesquite bosques. It was a well-defined stream, with marshes and lagoons at places. Arrowweed was plentiful. Groundwater levels were close to the surface, supporting riparian vegetation along the floodplain.

By the beginning of the twentieth century, th river channel had become broad and unstable and the marshes and lagoons were gone. Timber and grasslands along the river also disappeared, replaced by cultivated fields. Willows and cottonwood forests died out and were replaced in some places (especially near the dams) by saltcedar.

Agricultural diversions and groundwater pumping caused declines in the water table along much of the river, especially in the lower section. Pumping has lowered the water table along the river reducing surface flow. Surface flows are diverted before the river reaches Florence. Except for flood events, the River no longer flows to the Colorado River, increasing that river's salinity. Near Gila Bend, the River only flows in response to storm events or dam releases. The discharge of the river ranges from none to over one million acre-feet per year. Effluent from the Phoenix area dominates the river from the Salt River confluence beyond Gillespie Dam.

Dams have radically changed the normal flov of the river, forming lakes upstream and usually-dry riverbeds downstream. The Gila River bears little resemblance to the river of the 1850s, except for some mountain creeks that are tributary to the river.

Growth of Arizona's Towns

Statistics on the growth of towns and counties are found in **Arizona Statistical Abstract** for various years (Tucson: Economic and Business Research Program, Office of Community Affairs, Karl Eller Graduate School of Management, College of Business and Public Administration, University of Arizona). H. Walker and D. Bufkin show growth of towns through annotated maps in **Historical Atlas of Arizona** (Norman: University of Oklahoma Press, 1986). Statistics on population growth are available from the Arizona Department of Economic Security, most notably in **A Demographic Guide to Arizona 1985** (Phoenix: Population Statistics Unit Report #14, 1985).

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An important study of changes in the river is Amadeo Rea's, **Once a River: Bird Life and Habitat Changes Along the Middle Gila** (Tucson: University of Arizona Press, 1983). The impact of water diversions and dams on the Gila River can be found in Henry Dobyns, **Who Killed the Gila?** (1978, *Journal of Arizona History* 19:17-30). Descriptions of changes in vegetation and wildlife can be found in Robert Ohmart, **Past and Present Biotic Communities of the Lower Colorado River Mainstem and Selected Tributaries: Volume Five—the Gila, San Pedro and Santa Cruz Rivers** (Boulder City, NV: Bureau of Reclamation, 1986); Raymond Turner, **Quantitative and Historical Evidence of Vegetation Changes Along the Upper Gila River, Arizona** (Washington DC: U.S. Government Printing Office, 1974); and W. Minckley and T. Clark, **Formation and Destruction of a Gila River Mesquite Bosque Community** (1984, *Desert Plants* 6(1):23-27).

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Competition for Water

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COURT DECREED RIGHTS

Judicial action in a state or federal court determines decreed water rights. Court action may be initiated when a water user seeks to compare water rights with others or seeks judicial relief from alleged interference with his or her rights by other water users. Also, the ownership of rights may be determined as part of a legal division of property. Finally, decreed rights may be determined through general adjudication proceedings.

Decreed rights often involve water uses which have already been granted some form of right under state law. The court process confirms the validity of those grants, determines whether there has been proper maintenance of the right over the years, and ranks the various rights according to their relative priority. Court decrees may also quantify or prioritize rights for the first time.

When a conflict exists over the use of a limited water supply, the decree may confirm or establish rights, or specify terms under which the decreed rights may be exercised. These solutions to conflicting rights may involve a formula for distributing the available water supply, monetary mitigation of the conflict, or other means imposed by the Court.

Court decreed rights are considered to be the most valued or most certain rights because in the absence of abandonment or forfeiture, they are normally accepted as valid. Decreed rights may be included in later, more comprehensive, larger scale decrees.

The following three large decrees in the Gila River system are:

1. **Patrick T. Hurley v. Charles F. Abbott, et al.**, Entered in Territorial District Court in 1910. Established rights to the Salt River from diversions occurring at that time from Granite Reef and Joint Head Diversion Dams, which generally conforms to the present Salt River Project (SRP) water service area.
2. **Nels Benson v. John Allison, et al.**, Entered in the Superior Court of Maricopa County on November 14, 1917. Established rights to the lower Agua Fria River, the Salt River below the Joint Head Diversion Dam, and the Gila River from the Salt River confluence to the Buckeye Irrigation Company canal heading.
3. **United States of America v. Gila Valley Irrigation District, et al.** - Globe Equity No. 59 (also known as the "Gila Decree") was entered in United States District Court, in and for the District of Arizona (Tucson), on June 29, 1935. Established rights to the mainstream Gila River from the diversions in the Duncan-Virden Valley in New Mexico downstream to the Ashurst-Hayden and Sacaton Diversions in the Florence-Casa Grande region and on the Gila River Indian Community Reservation. This decree was also upheld by the 1963 United States Supreme Court decision in Arizona v. California, 373 U.S. 546 (1963), which also required New Mexico to prepare and make available annual water use

records along the San Francisco and Gila Rivers within New Mexico.

Each watershed within the Gila River system contains smaller or local decrees. Most, if not all, of these decrees involve individual water users and conflicting rights or claims of interference.

The Little Colorado River system contains one major decree:

1. **"Norviel Decree",** which is comprised of four judicial actions involving rights to the Little Colorado River from the vicinity of St. Johns to the headwaters of the river. Judge Perkins in 1914 and again in 1918 issued decrees. Judge Stanford modified Judge Perkins' 1918 decree in 1921. Finally, Judge Gibbons issued a related decree in 1923. Each succeeding decree and supplement added distinct geographic areas or types of rights not encompassed by prior decrees and attempted to incorporate all of the previous determinations. Collectively, the decrees established the relative rights, priorities, and reservoir storage rights for irrigated acreage in the Springerville, Eagar, Nutrioso, and St. Johns regions. The State Water Commissioner, W. S. Norviel, worked with the Superior Court in 1923 to compile, investigate and administer this decree which now bears his name.

In addition, there are smaller, individual decrees within the watersheds of the Little Colorado River system.

EARLY WHITE SETTLEMENTS ALONG THE GILA RIVER, ARIZONA: 1850-1890

HI 401

DONALD DOVE

INTRODUCTION

The Gila River develops in the vast mountain range west of the Rio Grande in New Mexico. It enters Arizona at a westerly course through the Arizona counties of Graham, Pinal, Maricopa, and Yuma. It terminates at the Colorado River on Arizona's western border at nearly the same latitude as it enters. The Gila winds its way through some of the finest agriculture land of the West. The Valley of the Gila is from one to five miles in width. Once this land is brought under cultivation with a sufficient amount of water, it can sustain large populations, as many of the early inhabitants before the white man discovered.

The Coolidge Dam was built because of the constant threat of flooding after heavy rains. Before that time, the river was about forty to one hundred feet across and meandered through swamps and marshes. It was lined on either side with cottonwoods and willow trees with thickets of brush and reeds. Wildlife such as deer, antelope, bear, and turkey were plentiful in the foothills and mountains and moved frequently into the lower lands. Rabbits and quail were everywhere. The Valley "...had the appearance of a hunter's paradise."[1]

The Gila River enters Arizona at an altitude of approximately 3900 feet and gradually descends through mountains and valleys to eventually reach Yuma, a little over 100 feet above sea level.

Prehistoric groups lived along the Gila River before the start of the Christian era. The Hohokam Indians dominated the lower desert region, while the people that lived in the mountainous area through which the Gila flows in eastern Arizona are called the Mogollon.

The Hohokam built extensive canals from the Gila River for irrigation of their land. The Hohokam culture covered a vast distance along the Gila during the period of existence from 200 B.C. to 1400 A.D., accumulating the south western portion of Arizona and down into Mexico.

The Mogollon mainly occupied the area east of where the Salt River enters the Gila. Through archaeological evidence, it is believed that this culture gradually terminated just after 1100 A.D. following six hundred years of existence. In many regions, especially along the Gila River, both the Mogollon and Hohokam cultures overlap.

Historical evidence shows that at the time of Spanish arrival into Arizona, several groups lived along the Gila. These groups were Indians such as the Yumans, the Papago, the Pima, and the Apache. A large number of missionaries and explorers were visitors to the Valley. Fray Marcos De Niza, a Spanish missionary, wrote about his travels across Arizona:

> "The desert having been crossed in four days, the route lay for five days through a fertile, irrigated valley, with many settlements of superior and friendly Indians."[2]

The author[3] is of the opinion that De Niza was referring to the Pima villages of the Gila Valley. Coronado, the famous Spanish conquistador who searched for the seven cities of Cibola unsuccessfully, called the river, Rio del Nombre de Jesus. The name "Gila" was apparently first applied to Arizona's main river in a report of 1630, because of the New Mexico province of Gila, or Xila, where the river has its source.[4] In 1694, Father Eusebio Kino penetrated the Gila Valley in a quest of ancient dwellings reported by the Indians. He said mass in the Casa Grande, a large adobe structure that had probably been visited by De Niza and Coronado in 1539-1540.

In 1744, Padre Sedelmair reached the Gila near the Casa Grande to visit the land north ofthe Gila. The Indians would not guide him so he proceeded on his own reaching the big bend in the river (near the current town of Gila Bend) for the first time and crossed over some forty leagues to the Colorado. In 1848, the Gila was made an international boundary between Mexico and Arizona.

The Pima Indians have lived along the Gila River for centuries, and later on land was set aside for them and another Indian group called the Maricopas. In many respects, a sad deterioration in their culture has occurred during their contact with civilization by acquiring habits of intemperance, prostitution, and pilfering, but still they are vastly superior to most other tribes.[5]

The white settlers undoubtedly had a much bigger impact on the land along the Gila because of their greater exploitation.

EARLY WHITE SETTLEMENTS OF THE GILA

The townsite of Colorado City was laid out in Arizona upon the eastern bank of the Colorado River, just below the Gila and Colorado junction. Only one store was built here and a few temporary structures stood until the Gila River flood in 1861 - 1862 which washed them away. Gold deposits were discovered near Yuma (Colorado City) in 1858 which then brought forth a gold rush.

"Yuma's population increased rapidly, and the dance halls and gambling houses along Main Street were well patronized by Indians, miners, freighters, and outlaws."[6]

In 1860, Yuma County gold output reached twenty to forty-two million dollars.[7]

In 1862, the town was changed to Arizona City. It was later renamed Yuma in 1873. A man named Jaeger moved from the town named after him of Jaegersville on the California side during the flood of the Colorado River. He moved to Arizona City from here and operated a ferry until 1877 when he sold out to the Southern Pacific Railroad which had reached the Colorado at this time. Passenger service by steamboats which were by way of the Gulf of California and the Colorado and Gila Rivers were greatly reduced by the coming of the railroad. Yuma was the first city in Arizona to be visited by the "iron horse". At this time, Yuma had a population of one thousand people.[8]

The town of Dome was located twenty-three miles east of Yuma on a small station on the Southern Pacific Railroad. The name of this town is taken from the Dome Rock range of mountains in the vicinity. At one time this was the most important mining shipping point for the mines in the area. It was also a productive farming district. In 1890, Dome had enough residents to establish a post office.[9]

The farming of the Valley was very poorly done. Many of the farmers were cattlemen first and farmers next. They would hire Mexicans to do much of the work in the fields.

The town of Gila City got its start in 1858 when a man named Jacob Snively found rich deposits of placer gold. It was in this year that one thousand people lived here. J. Ross Browne writes:

> "...Enterprising men hurried to the spot with barrels of whiskey and billiard tables: Jews came with ready-made clothing and fancy wares: traders crowded in with wagons of pork and beans: and gamblers came with cards and monte-tables. There was everything in Gila City within a few months but a church and a jail..."[10]

Many of the prospectors panned as much as one hundred dollars of gold a day and soon after the flood of 1862 had nearly destroyed the town, miners returned and the remaining deposits were rapidly exhausted by 1865. After the flood, much of the population had moved to La Paz on the Colorado River where gold had been discovered in 1862. By 1872, Gila City consisted a single house, a stable, and a corral. In 1877, a ripple of prosperity hit the town for it boasted "...a stable and corral, a one-story adobe hotel, and six human inhabitants."[11] Gila City became the first of Arizona's numerous ghost towns.

In 1774, Padre Francisco Garces found an Indian rancheria which he called Santos Apostales San Simon y Judas. Almost ninety years later, a colony of white men began a settlement at or near the old Indian rancheria and began raising grain for the freighters. Gila Bend recieved its name because it was located at a large bend of the Gila River. The town shifted its location in 1886 because the Southern Pacific Railroad laid its track farther away from the river bank.[12]

The town of Buckeye was started in 1886 by M.M. Jackson, a pioneer from Sidney, Ohio, and Thomas Clanton. The community was first known as "Sidney", but when the first irrigation canal, known as the Buckeye Canal, was built in 1885-1886, these pioneers from Ohio, the "Buckeye State", changed the name. In 1889, Clanton gave a quarter-section of land for a townsite. It is interesting to note that in 1895, deeds were still made out as Sidney but the townspeople referred to it as Buckeye.[13]

Sweetwater began to appear in records in 1868. Very little information was obtained in researching this town. George F. Cooper and Company had a store located here. One author, Robert Hinton, lists Sweetwater as a stage station.[14]

Adamsville, located three miles west of Florence, was founded in 1866 by Charles Adams. In 1869, Nick and William Bichard established a flour mill and a store. Their mill was the first really modern flouring mill in Arizona and it was the only one between Tucson and California. William Bichard and Co. supplied many of the Arizona forts with flour. The Pima Indians brought great quantities of corn to be ground at this mill. In 1870, four hundred people lived here and about this time the residents petitioned for a post office requesting the name Adamsville. They instead recieved the name Sanford after a cavalry officer. This was done according to one report by Richard McCormick, a politician who disliked Adams, however, the people continued to call the town Adamsville. The town became a ghost town when Maricopa Wells was declining and Florence had hardly started. The Mexicans are said to avoid Adamsville, for it is told that a ghost is loose among the ruins, guarding a hoard of gold.[15]

The town of Florence came into being in 1866 and was founded by Levi Ruggles. Two years later, the people asked Governor Richard McCormick to name the town and chose Florence after his sister.

Scotland. The town was constructed as the Ray Mining Company reduction works and office headquarters. Copper ore from the mines was transported to Kelvin by the narrowest narrow-gauge railroad in the territory.[20]

In Graham County (so called probably from the mountain peak of that name), the first settlement to be discussed when moving west to east on the Gila is Maxey. This town was started by the relocation of Camp Goodwin to Fort Thomas, of which Maxey was the civilian adjunct. Maxey was named by J.B. Collins for his commanding officer in the Civil War. Maxey earned a reputation as a place where government supplies could be bought from the Indian traders. In 1880, Maxey had a population of one hundred and forty-five[21] and it consisted for the most part of saloons and houses of prostitution.[22]

Eden, first known as Curtis or Curtisville, lies just east of Maxey on the North side of the Gila. It was established early in 1881 when there was was an arrival from Brigham City, Arizona, of a party of United Order settlers, headed by Moses Curtis. A year later, they built a canal from the river to cover their claims at Curtis. For a while, the community was on very short rations, sometimes only one meal a day. Some of the settlers built boweries of brush under which they rolled their covered wagons and to secure protection from Indians, frequently moved to the more populous town of Pima, nine miles from Eden. In 1882, five log houses were constructed and a schoolhouse. One year later, a large stockade was built of cottonwood poles. It was suggested that the name Eden was selected because of the agricultural possibilities.[23]

Glenbar (successsively Matthewsville, Fairview, Glenbar), founded in 1880, by Joseph Matthews and family and William Waddill. In 1881, they built a stockade and even though there were no Indian troubles in this area, the settlers moved to Pima for protection. In 1883, a flour mill was erected near Matthewsville, but still the town had very slow growth. The Matthews Ward of the Church of Jesus Christ of Latter-day Saints was created in 1888. Soon, many residents left the town and the post office was closed. Later, the few remaining residents reopened the post office under the name Fairview, however, since a Wells Fargo Station was already established under that name, a number of the Scottish residents chose Glenbar (sometimes called Hogtown by others).[24]

The Mormon church is made up of larger territorial divisions called stakes. The stakes are each divided into wards and branches, the smallest local church units.

The town of Smithville was established in 1879 by a group of Mormons. They made a camp in the thick mesquite , built a public corral and dug a well. The first year they used their covered wagons as houses. They laid the land out into sixteen block of four lots each. Each lot was one and three-fourths acres in size. The men drew lots for building locations and most of them made no effort to pick farm property. They made a living by freighting or by doing odd jobs.

The food was scarce and very expensive. The settlers subsistence consisted of wild game, corn bread, and beans and bacon formed the base of their diet. Sorgum molasses and some honey provided their sugar. Milk was scarce and the only fruit was dried apples, which were very expensive.

The Mormons, or Latter-day Saints, came into from Utah, south into Arizona, and settled in the Gila Valley around 1880 and formed several settlements below the present site of Safford. They constructed the first modern irrigation canals and began developing the resources of the Valley until by their superior knowledge of agriculture, have that portion of the Valley as productive as any portion in the West.

Most of the earliest settlers were those who failed to prosper in Utah and were relatively poor. The colonists saw few financial advantages of the new country. They made their houses of cottonwood and logs, many without floors. To these people, the church was the first place in their lives.

In 1879, Smithville built its first schoolhouse. A year later, they built the Smithville Canal and grew small crops. The name of the town was changed to Pima, after the Pima Indians. Settlers continued to come from Utah and northern Arizona. By the fall, there were thirty-six families, one hundred and forty-eight people were living in Pima. Soon all of the town claims were taken.[25]

The town of Layton came into being in 1883 by Charles Tippets from Utah. He bought the claim of John Penfold just east of Bryce. Mormon settlers arrived and named the town after the first stake president and one of the most prosperous and third in the order of population of the Saint Joseph Stake wards. A few ditches from the river were consolidated and enlarged.[26]

Bryce was established in 1883 by Ebenezer Bryce and sons. The family constructed a ditch and this was completed the next year. In 1884, Bryce also built the first house here by squatter's rights. Today the same family owns the land.[27]

The settlement of Central came into being in 1882 when six families from Forestdale (Navajo County) settled on land which was irrigated by the Central Canal. At one time, the nearby farms seemed doomed because of alkaline underground water that rose to the surface but a drainage system brought the land back to productivity. In 1883, this community with several others was organized into the Saint Joseph's Stake of Jesus Christ of Latter-day Saints. The town was a trading center for Mormon farmers.[28]

In the year of 1881, the small community of Graham began to take shape. It was included in the Saint Joseph Stake of the Mormons in 1883. Atownsite was surveyed in 1884 and a meeting house was constructed of mesquite poles with a dirt roof and walls of heavy unbleached muslin (strong, cotton cloth). A schoolhouse was also constructed this year.[29]

In a census taken in 1879, the total population of Mormon settlers in the Valley (including those not living in the Mormon towns) was eight hundred and twenty-five people.[30]

The town of Thatcher had its first beginnings when John Moody bought the Conley Ranch in 1881. A year later, four Mormon families joined him. The name of the settlement was derived from Apostle Moses Thatcher, who visited the town on Christmas of 1882 with Apostle Erastus Snow. The townsite was selected on May 13, 1883 by President Layton. One month later, a school district was established. In 1885, a new townsite was selected about one-half mile south of the original settlement. The new site was on higher land due to the encroachments of the Gila River. Thatcher soon became the headquarters of stage lines and contained a number of stores.[31]

Safford, established in 1874, had its beginnings a year earlier and became the first American colony in the Gila Valley of eastern Arizona. In 1873, the same people who farmed near Gila Bend were unsuccessful because of the washing away of their dams and headgates which were built in the sands of the Gila. They camped near the present town of Safford and financed in Tucson for the building of the Montezuma Canal and year later, laid off the present city.

The town was named after Governor Anson Pacely Killen Safford, who from Tucson, was visiting the Valley about that time. Safford had been recognized as being a rather "gentile" city, however, in 1877, the people took the law into their own hands and hanged a man named McCoy for the killing of a farmer. Quite often, tough cowboys came into Safford and shot up the saloon and stores. In an account made in 1884 by Isaac Robinson of Thatcher, he stated that:

> "Safford was the main route from the north into Mexico and the principle rendezvous for a lot of rough characters."[32]

The town of Solomonville was established by Isador Solomon in 1876, a few miles east of Safford. Four years earlier, white settlers from Gila Bend, first settled here as ranchers. Solomon established a store and for many years was a leading citizen. Many times the members of the Solomon family nearly escaped death from Indians. On one occasion, due to illness in the family, they were not able to travel on a stage which ended up in the death of all the occupants. Mr. Solomon bought several thousand acres in the Pueblo Viejo Valley and bought the Munson adobe house built in 1873. Soon after Solomon added a store to the house. When the post office was established

In 1878, the mail carrier suggested the name Solomonville.

The county seat of Graham County was located in Safford until 1883 and was moved to Solomonville until 1915 were it was again moved back to Safford. Many times governmental Indian agents would sell supplies and clothing to traders in the little towns of Globe, Maxey, and Solomonville instead of the Indians. In 1885, four hundred resided in Solomonville.[33]

The first settlers in Graham County, excluding the prehistoric Mogollon Indians, were Mexicans and Indians who were in the upper Gila Valley as early as 1871. The town of San Jose, about one and one-half miles above Solomonville, was originally named Munsonville because William Munson started a store there and sold it in 1873 to I.E. Solomon. At San Jose, the old adobe fort of Pueblo Viejo had twenty-five small adobe huts. From the San Jose Canal, a ditch was built by the Mexicans. They also constructed a grist mill which was operated northeast of San Jose. When the Mormons arrived, they utilized vast prehistoric irrigation canals which they called the Montezuma Canal. The canals which were used totaled over one hundred and twenty-three miles.[34]

The settlement of York was established in 1882. It was named after George York who had a ranch between Duncan and Clifton. In 1882, York fought off a group of Apaches but soon after, he was trailing some of his horses and was killed by Indians in Doubtful Canyon.[35]

Another author states that an early settler and his family homesteaded here. During an Indian attack, the settler, named York, stood in the middle of the road and fought until he was killed allowing his wife and children to reach the ranch house in safety.[36]

The town of Purdy is located a few miles from the Arizona-New Mexico boundary. The town recieved a post office in 1883 due to the increasing number of residents in the town. The post office was placed in the house of a rancher named Purdy. When the Southern Pacific Railroad came through in 1883, the post office was moved across the Gila River to the newly established Duncan. Four years later, he sold his property to Warden Courtney.[37]

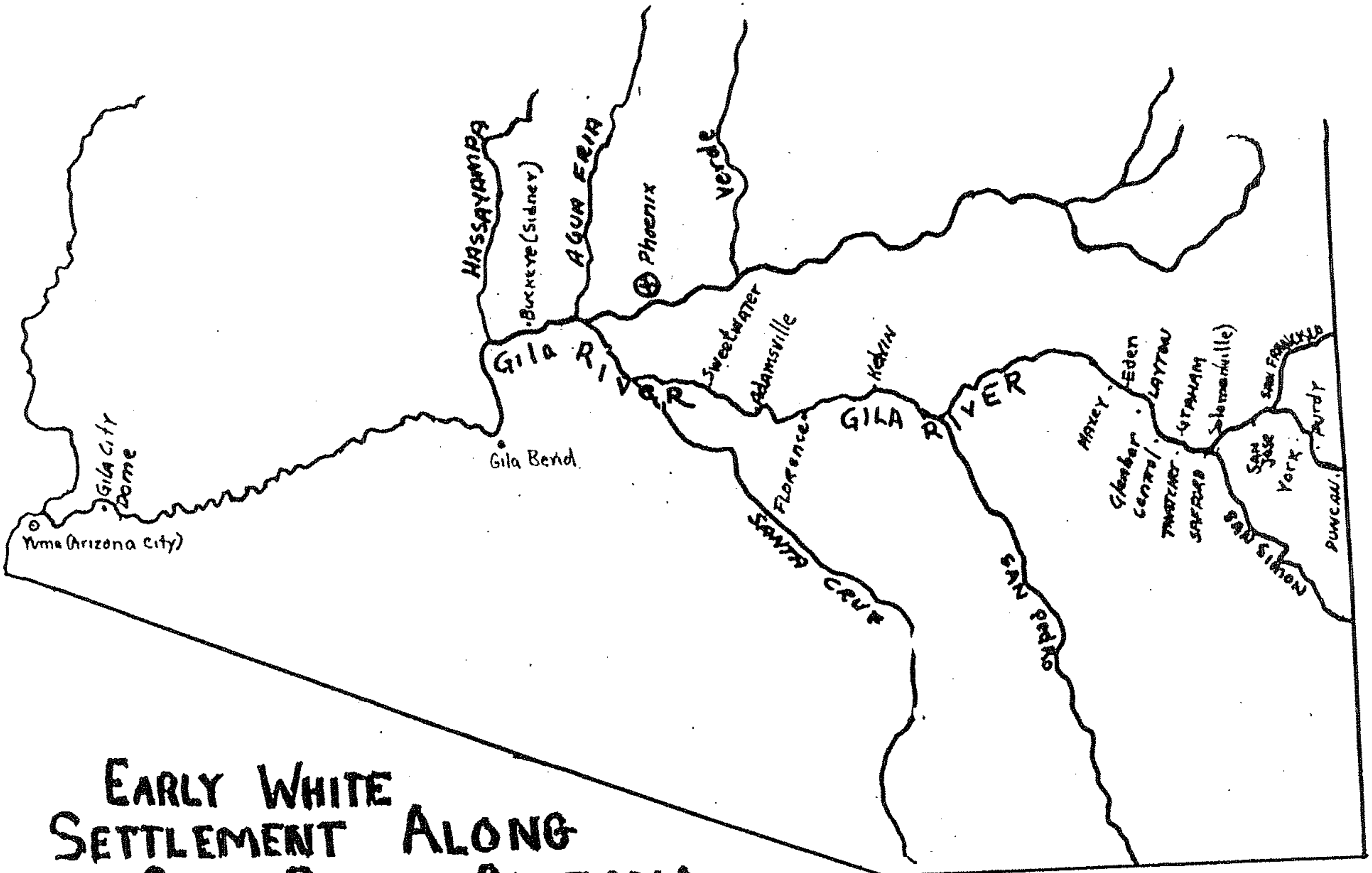
Duncan was established in 1883 when the Arizona-New Mexico Railroad was built to connect the town of Clifton with the main railroad line. One story has it that the Duncan brothers, who settled in this area, were killed by Apaches around 1885. It is also believed by some that two men sold out their interest to the Arizona Copper Company when the railroad was coming through. The town was named after one of the brothers, Duncan Smith.[38]

SUMMARY

The earliest settlers in the Gila Valley were prehistoric Indians. They occupied this region from much earlier than the birth of Christ to the middle of the Fifteenth century. They mysteriously vanished from the area. In the early Sixteenth century, Spanish missionaries and conquistadors explored and settled the region below the Gila River. In the mid 1800's, Mexican farmers settled in the upper Gila Valley. Shortly after, numerous white groups entered Arizona mainly to prosper from theriches of the land. Men came from California to mine the rich gold deposits along the Gila. Mormons from Utah and from northern Arizona to settle along the river to develop by agriculture.

The early pioneers experienced numerous hardships when they settled in the Gila Valley. The Indians plagued the settlers throughout the entire Valley, as well as most of the state. Disease (Malaria) was common in many areas where water was not flowing and disease-carrying mosquitoes could breed. This was not very common along the Gila River because it always moved. Food was scarce and in most places, very expensive. Some of the early towns were damaged by river flooding forcing the population to evacuate. Outlaws that came into the settlements disrupted everything, often shooting up the saloons and stores. These are some of the major setbacks which hindered advancement of many of the Gila Valley towns.

With the coming of the railroad, numerous towns sprang up all along its path. The town most likely to succeed would be the one where the railroad made its way through. Those who were not introduced to the "iron horse", most often dwindled and died.
Few of the early towns are still in existence and these generally have a most interesting history.



EARLY WHITE SETTLEMENT ALONG THE GILA RIVER, ARIZONA, 1850 to 1890

FOOTNOTES

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[27]Granger, p. 124.

[28]"Arizona: A State Guide," p. 343.

[29]Williams, p. 14.

[30]Williams, p. 16.

[31]"Arizona: A State Guide," pp. 342-343.

[32]McClimtock, p. 255.

[33]Bancroft, pp. 626-627.

[34]Granger, p. 131.

[35]Granger, p. 172.

[36]Lloyd IV, p. 91.

[37]Granger, p. 170.

[38]Granger, p. 166.

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62D CONGRESS, 3d Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 1013.

BRIDGES ACROSS SAN CARLOS CREEK AND GILA RIVER.

LETTER

FROM

THE SECRETARY OF THE INTERIOR,

TRANSMITTING,

PURSUANT TO LAW, RESULT OF INVESTIGATION OF CONDITIONS ON SAN CARLOS INDIAN RESERVATION, WITH VIEW TO CONSTRUCTING BRIDGES FOR THE USE OF THE INDIANS ACROSS SAN CARLOS CREEK AND GILA RIVER, IN THE VICINITY OF SAN CARLOS.

DECEMBER 4, 1912.—Referred to the Committee on Indian Affairs and ordered to be printed.

DEPARTMENT OF THE INTERIOR,
Washington, December 2, 1912.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

SIR: The Indian appropriation act for the current fiscal year approved August 24, 1912 (Public, No. 335) contains the following item:

To enable the Secretary of the Interior to make an investigation of the conditions on the White Mountain or San Carlos Indian Reservation in Arizona, with respect to the necessity of constructing, for the use of the Indians, suitable bridges across the San Carlos Creek and the Gila River, in the vicinity of San Carlos, on said reservation, one thousand dollars, and the Secretary of the Interior is hereby authorized and directed to cause surveys, plans, and reports to be made, together with an estimated limit of cost of construction of said bridges, at such sites as he may select, and submit his report thereon to Congress on the first Monday in December, nineteen hundred and twelve.

The San Carlos Indian Agency is located approximately 1¼ miles west of the confluence of the San Carlos and Gila Rivers. There are approximately 500 Indians living east of San Carlos who must cross both rivers to reach the agency. The Bylas farming district is located on the south side of the Gila River and east of the proposed bridge site. It is estimated that 4,000 acres of land are available for the use of the Indians of this district, and ditches are now con-

118 small farms, ranging from 5 to 10 acres each, and it is the largest farming district located on the opposite side of the river from the agency. There is a great deal of travel across the San Carlos Res- ervation, and, while the rivers can be forded during low water, there is always danger of getting into quicksand, especially in the Gila River. When the water rises only a little it is considered very dan- gerous to attempt to ford the river without a guide. The amount of travel over this part of the reservation is steadily increasing, and the necessity for bridges becomes more apparent each year. Indians ford the rivers when they are extremely dangerous, and it is not un- common to find teams stick in the quicksand. Some are helped out by others and some are lost.

A ford is now found across the Gila River a few hundred feet from the juncture with the San Carlos River which can not be used for loaded wagons for a period of about 120 days of each year on account of high water. The Indians usually ride to the river, leave their teams there, and walk across the railroad bridge to reach the agency during these high-water periods. Both the San Carlos and Gila Rivers must be crossed in traveling from Globe to Bowie or other points on the Southern Pacific Railroad, and the main wagon road leads to the ford referred to above. Bridges would prove a great convenience to the general public, in addition to being an actual necessity for the use of the Indians and for the purpose of satisfac- torily carrying on the work of the agency. The most favorable site for a bridge at this time is just below the railroad bridges, a short distance above the confluence of the two rivers. This site is consid- ered impracticable, however, by reason of the fact that if a dam were constructed at the so-called San Carlos Dam site the water impounded would probably overflow such bridge site. In this connection atten- tion is invited to the provision in the same act:

That the Secretary of War be, and he hereby is, directed to convene a board of not less than three engineers of the Army of wide reputation and large expe- rience to make the necessary examinations, borings, and surveys for the purpose of determining the reasonability and practicability of constructing a dam and reservoir at or in the vicinity of the Fox Canyon, on the San Carlos Indian Reservation, known as the site of the proposed San Carlos Reservoir on the Gila River, Arizona, and the necessary irrigation works in connection therewith to provide for the irrigation of Indian, private, and public lands in the Gila River valley, said board of engineers to submit to Congress the results of their examinations and surveys, together with an estimate of cost, with their recom- mendations thereon, at the earliest practicable date.

Therefore, in considering the best location for bridges above the flood line of the proposed San Carlos Reservoir, it was found neces- sary to go approximately 6 miles northeast of the San Carlos Rail- road station on the Gila, and 4 miles northeast on the San Carlos River. These rivers run through adobe and sand formations, and quicksand is found in large quantities. The proposed locations are shown on the map which accompanies this report. If these locations are accepted it will be necessary to build a pile and rock wing 100 feet in length to protect the approach to the San Carlos River bridge and also to change the channel of the Gila River above the bridge site to prevent the river from cutting through the south approach, leaving the bridge on an island.

It is estimated that the cost of construction of the proposed bridge

would be $19,800, and for the bridge across the Gila River, includin the change in the course of the river and approaches, $45,500. Ther is inclosed a copy of a report of November 2, 1912, addressed to th Indian Office by Supervisor of Construction John Charles, who mad an investigation of the conditions, together with copies of the plan specifications, etc., which accompanied his report.

Respectfully,

WALTER L. FISHER, *Secretary.*

DENVER, COLO., *November 2, 1912.*

The COMMISSIONER OF INDIAN AFFAIRS,
Washington, D. C.

SIR: I respectfully submit herewith surveys, drawings, and spec fications and estimates for two bridges, one across the San Carlo and one across the Gila River, on the White Mountain or San Carlo Reservation, Ariz., as directed in office letter, dated September 1912.

My instructions included the following:

In examining the sites for proposed bridges on the San Carlos Reservatio there should be taken into consideration the probability of constructing a da at San Carlos Dam site and the consequent backing up of water, and t bridges should be so located as not to be flooded in case the dam should ev be constructed.

The San Carlos Agency is located approximately 1¼ miles we from the confluence of the San Carlos and Gila Rivers. A ford now found across the Gila River a few hundred feet from this jun tion, which can not be used with loaded wagons for a period approximately 120 days in each year on account of high wate The Indians usually ride to the river, leave their teams there, an walk across the railroad bridge to reach the agency during the periods.

The most favorable site for bridges at this time, without consi ering the backwater from the proposed reservoir, is directly belo the railroad bridge a short distance above the confluence of t rivers. I have secured data for these locations should they required.

In considering the best location for bridges above flow line of t proposed San Carlos Reservoir, it was found necessary to go a proximately 6 miles northeast from the San Carlos Railroad static on the Gila and 4 miles northwest on the San Carlos Rivers. The rivers run through adobe and sand formation, and quicksand found in large quantities in both rivers.

There are approximately 500 Indians living east of San Carlo who must cross both rivers to reach the agency. The Bylas farmi district is located on the south side of the Gila River and east of t proposed bridge site. It is estimated that 4,000 acres of land available for the use of the Indians in this district. Ditches a now in to cover about 1,400 acres, and 750 acres are platted and w be under cultivation this year. This land is divided up into 1 small farms, ranging from 5 to 10 acres each. This is the large farming district located on the opposite side of the river from th submerge valuable land below the agency, and many Indian families will be compelled to find homes elsewhere. The amount of land that would be submerged and the number of Indians that would be disturbed are unknown to me.

There is a great deal of travel over this reservation, and, while the rivers can be forded when the stage of water is low, there is always some danger of getting into quicksand, especially in the Gila. When the water raises only a little, it is considered very dangerous to attempt to ford this river without a guide. The amount of travel over this part of the reservation is steadily increasing, and the necessity for bridges becomes more apparent each year. Indians ford these rivers when they are extremely dangerous, and it is not uncommon to find teams stick in the quicksands. Some are helped out by others and some are lost.

Both rivers must be crossed in traveling from Globe to Bowie or other points on the Southern Pacific Railroad. The main wagon road leads to the ford referred to before. Bridges would prove a great convenience to the general public, in addition to actual necessity for the use of the Indians and for the purpose of carrying on the work of the agency.

If the bridges are located as shown on the drawings it will be necessary to build a pile-and-rock wing 100 feet in length to protect the approach to the San Carlos Bridge, at an estimated cost of $1,500. It will be necessary to change the channel above the bridge site on the Gila River in order to prevent the river from cutting through the south approach and leaving the bridge on an island. This work is estimated to cost $4,500. A great deal of road work will be necessary if these bridges are constructed. Supt. Lawshe informed the writer that he could do this road work from other funds, however, and this appropriation should provide for the bridges and approaches in their vicinity.

Estimate of cost.

Bridge across San Carlos River	$17,500.00
Construction of wing for protecting approach	1,500.00
Building approaches	800.00
Total San Carlos Bridge	19,800.00
Bridge across Gila River	40,000.00
Changing course of river above site	4,500.00
Building approaches	1,000.00
Total Gila River Bridge	45,500.00

These appropriations should be made immediately available in order to take advantage of favorable season of year for building.

Respectfully,

JOHN CHARLES,
Supervisor of Construction.

ALBUQUERQUE, N. MEX., *October 30, 1912.*

JOHN CHARLES, Esq.,
Supervisor, Denver, Colo.

... beg to submit my report relative to the two locations of

The best available site on the San Carlos River is about 4 miles northwest [illegible] San Carlos railroad station, which is the nearest practicable point. This woul[d] necessitate a bridge 360 feet in length. It would be necessary at this bridg[e] site to build a pile-and-rock wing 100 feet in length to protect the north ap[-] proach of bridge; approximate cost of said wing, $1,500.

The best available site across the Gila River above the flow line of the pr[o-] posed reservoir is about 6 miles northeast of the San Carlos railroad statio[n] which is the nearest practical point for a bridge. At this point it will be nece[s-] sary to construct a bridge 975 feet in length. About one-half mile above th[e] location of this site it will be necessary to change the channel of the river, a[t] an approximate cost of $4,500.

The formation of the beds of the rivers at both sites is sand and gravel, an[d] would suggest steel cylinders and piling for support of the spans. Would als[o] suggest that these bridges be composed of a system of 150-foot spans and appr[o-] priate approaches.

The best and most practical sites on both rivers are a short distance belo[w] the present railroad bridges across each of these rivers, were it not for th[e] proposed dam and reservoir.

Respectfully submitted.

A. D. OGLE,
Constructing Engineer.

DENVER, COLO., *October 31, 1912.*

Mr. JOHN CHARLES,
Supervisor, Interior Department, Kittredge Building, City.

DEAR SIR: In accordance with your instructions I have prepared prelimina[ry] plans, specifications, and estimate of cost for the construction of two bridg[es] near San Carlos, Ariz.

The bridges for which these plans have been prepared are the ones locate[d] above the level of the proposed reservoir.

At present prices I estimate the cost of the bridge over the San Carlos Riv[er] at $17,500 and the bridge over the Gila River at $40,000.

These estimates do not include earth approaches.

These estimates are based upon the use of mill material for the spans a[nd] upon the work being erected at a favorable season of the year.

Very truly,

A. F. SMITH, *Constructing Engineer.*

Specifications for furnishing and erecting a steel highway bridge over the Sa[n] Carlos River near San Carlos, Ariz.

The site for proposed bridge is about 4 miles north and west of San Carl[os,] Ariz., a station on the Southern Pacific Railroad. It is the duty of the bidde[rs] to acquaint themselves with the general local conditions.

Bid must be accompanied by stress diagrams and preliminary design of t[he] whole structure in duplicate.

The successful bidder, when notified, must submit a complete set of sh[op] detail drawings, which must be approved by the Commissioner of Indian Affai[rs] before commencing work.

The work included in this project is the building, complete and ready f[or] use, of three 123-foot steel spans with a 16-foot roadway, two concrete ab[ut-] ments, and two tubular piers, as shown on the accompanying plans.

LOADING AND UNIT STRAIN.

The loading and unit strains assumed shall be in strict accordance with [re-] quirements for class "G" bridges as per Theodore Cooper's Specificatio[ns] for Steel Highway and Electric Steel Railway Bridges and Viaducts, 19[..] edition, except that the concentrated load assumed shall be 15 tons instead [of] 12 tons.

The filling and grading of the approaches are not included in this projec[t] and will be done by the United States Government after completion of t[he] bridge.

SUBSTRUCTURE.

RAILROADS of ARIZONA vol. II

by DAVID F. MYRICK

SAN DIEGO Howell-North Books CALIFORNIA

First Edition
Manufactured in the United States of America

For information write to:

Howell-North Books
P.O. Box 3051
La Jolla, California 92038

Library of Congress Cataloging in Publication Data

Myrick, David F
Railroads of Arizona

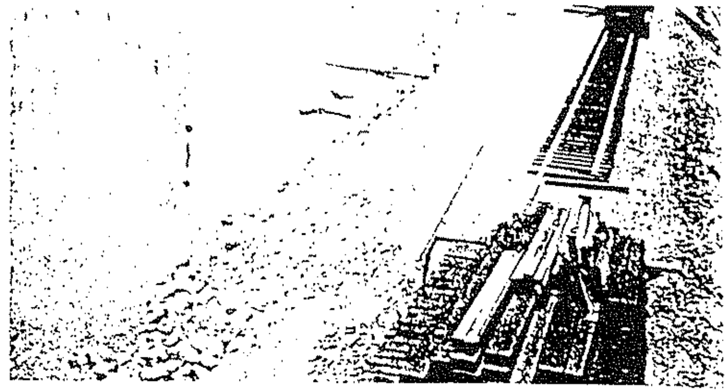
Bibliography: v. 2, p.
Includes indexes.
CONTENTS: v. 1. The southern roads. — v. 2. The central roads.
1. Railroads — Arizona — History. 2. Arizona — History. I. Title.
HE2771.A6M94 385'.09791 75-27787
ISBN 0-8310-7111-7 (v. 1)

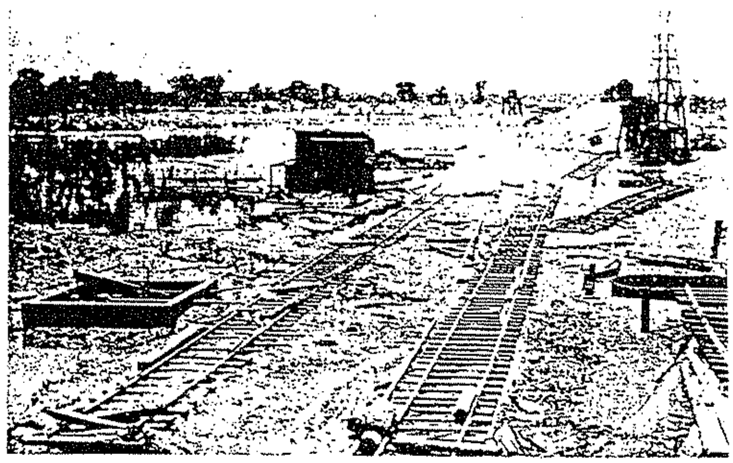
ISBN-0-8310-7118-4

much for the upbuilding of the Southwest and also was interested in the building of this line to Phoenix." A few miles beyond was Coolidge, another new town, started by R. J. Jones, who met the former president five years later at the dedication of the Coolidge Dam.

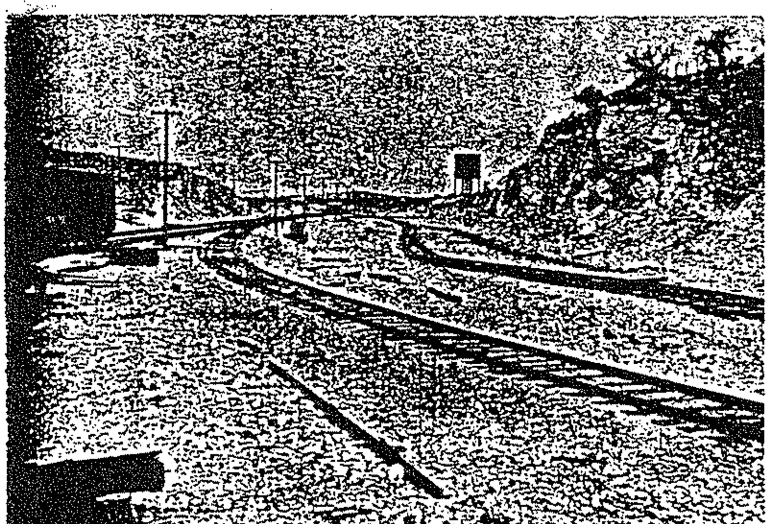
After six weeks of work, eighteen miles of grade were finished and of the eight miles of track laid, half were ballasted. On February 21, Boschke reported the average number of men employed on the several construction jobs at various places on Southern Pacific. On the line from Picacho, 772 men were employed that week, assisted by 700 head of stock and two steam shovels. One hundred and thirty-six men were working on the Florence connection, while 129 men were employed in rehabilitation work on the branch near Pozo Jct. The new Cascade line in Oregon provided jobs for 1,364 men while the second track project over the Sierra Nevada in California had 552 men on the payroll.

By the latter part of August 1925, the Picacho-Pozo Jct. line was completely graded and all but fifteen miles of track were laid. The material for the big bridge across the Gila River had been shipped the month before, but when it arrived in September the Gila was in a continuous flood stage, so erection of the structure was set forward into the next year.

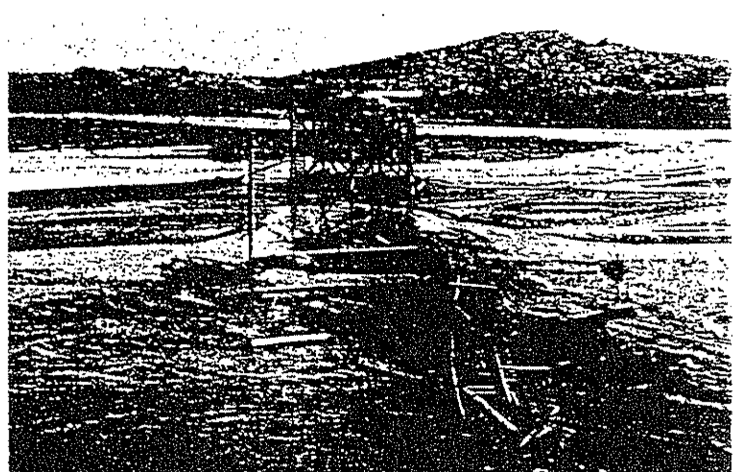




Though Arizona's total rainfall had been sparse for several years, this did not rule out floods in selected areas from time to time. Taken June 28, 1925 at the site of the future Gila River bridge at Cholla Mountain, these photos indicate that there was much clean-up work to be done. Many workers lived in tents on the south side of the Gila River.



At Poston, the station on the north side of the Gila River, substantial excavations were necessary. This scene is looking west.



Another view of the aftermath of the same flood, looking north to Cholla Mountain which rises 235 feet above the valley. The line to Florence Jct. turned to the right on this side of the mountain. The railroad to Pozo and later to Magma (via Poston) goes through the swale on the left (west) side of the mountain.

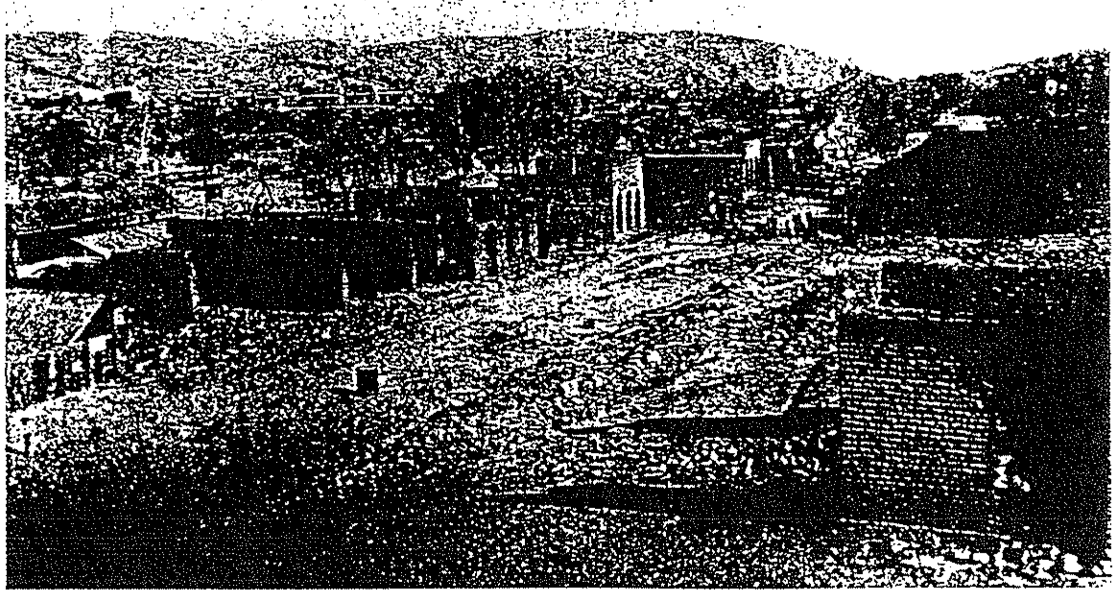
Anticipating approval, Garland had arranged for the Midland Construction Co. to be available to begin work within a few days after receiving the word from Rice. This construction company, like the railroad, was headed by Garland and it was to initiate work at Geronimo, then turn the task over to an outside firm and transfer its work to a section near Globe. In all 57.5 miles had to be built to reach Globe.

Actual work began at Geronimo on Saturday, March 12, 1898, and the camp of the Midland group was established a few miles to the west to care for 50 men and 35 teams. After a week, a mile of grade was ready for ties, and at Geronimo additional side tracks were built to accommodate the ten cars of construction materials arriving almost daily. This activity served to limit the useful life of the business of J. N. Porter, who had established a forwarding business and dealt in general merchandise at Geronimo. A pleasant bit of news was the reducing of the Globe-to-Bowie passenger fare to $9.00. Previously it had been $4.20 for the rail ticket and another $9.00 for the stage connection.

Within two weeks, the Midland Co. had finished three miles of the twelve miles of grade it was to build along the south side of the Gila River. The same firm was to grade the last six miles into Globe, with the intervening mileage being assigned to Ward & Courtney, the El Paso railroad contractors.

With the graders at work, teamsters and stage hands plied back and forth to the railhead, usually without incident. One uninvited adventure took place on April 20 after the stage had left Geronimo and the five passengers were settled into as comfortable as possible positions for the bouncing ride. About four miles out, the driver was ordered to halt by two armed men "with the appearance of cowboys." When they demanded the express box and were told that none was on board, they ordered the passengers to "pungle" their coin. Disappointed again when only $5.00 could be found, the road agents refused to take money from the impoverished passengers and, after accepting two oranges to relieve their parched throats, they graciously permitted the stage to continue.

While these road agents accomplished nothing, some men felt working for the railroad construction contractor was equally unremunerative. Wages were only $1.50 per day and after deducting $5.00 for weekly board there was mighty little left to show for the week. Such low wages were usually scorned by white men, with the result that



Globe suffered from a series of devastating fires in its early days. This is the aftermath of the 1898 fire along Broad Street. *(Arizona State Library)* most of the 75-man force consisted of Mexicans and Indians employed for grading work and cutting brush.

At the end of April, Midland had graded nearly all of its initial 12-mile stretch and Ward & Courtney were also making a good showing. Several carloads of pilings arrived at Geronimo along with the necessary pile driver and, when two trainloads of rail were brought to the end of the line, Globe citizens could afford to be confident that they would soon hear the whistle echoing in the valley.

Track laying was held up until some of the trestle piles were in place, but began May 3; in eight days four miles were down. A few weeks earlier, two locomotives had arrived from Baldwin to take their places on the GVG&N roster; unlike the others, these engines (Nos. 3 and 4) were the only power acquired from the builder. Accompanying the engines from Philadelphia was locomotive messenger William Courtney, who unfortunately picked up diptheritic croup along the way and died.

Working their way along the Gila River were the brush clearers, then the graders, who were followed by the pile driver and its crew, and finally the track layers. Near the confluence of the San Carlos River were important bridges. Here the railroad crossed the Gila, and about a half mile away another smaller bridge carried the rails over the San Carlos River. The railroad survey followed the river northward for almost ten miles before turning west to continue along Gilson's Wash (Aliso Creek) for about the same distance. The railroad soon came to the summit, after which the route dipped down to Globe. Construction problems were minimal, but there were some unusual difficulties. The presence of a small army of railroad workers delighted the county tax collector because each individual suddenly became obligated to pay the poll tax. His sparkling eyes became angry when he was refused the names of the graders and he then dispatched Deputy Sheriff B. W. Olney to arrest H. G. Ross, who was in charge of this segment of the Ward and Courtney payroll. Ross was arrested and fined $75, the amount equal to the poll tax for thirty men. He was then charged another $77.55 for court costs. Ross planned to appeal the decision.

June 21 was an important day, for it marked the inauguration of regular train service to the Gila River crossing over the "Geronimo Division." Here track work had to be suspended pending erection of the two bridges. Meanwhile, beyond the bridges, graders were moving up the San Carlos River.

With fifty men from El Paso augmenting the force of 250 workers, good progress was made the next month despite the excessive heat. One solution used by the Old Dominion people was to change the beginning work day from 5:00 a.m. to 2:30 p.m.

High water in the Gila delayed bridge construction for a few days, but when both bridges were ready, rail laying was resumed August 22. Sylvester Gilson, who lived twelve miles east of Globe, welcomed the railroad graders as customers for his well water. The Midland Construction Co. then moved its grading outfit to the (Pinal) summit a few miles east of Globe, where work had begun on the 1,200-foot cut with a depth of as much as 31 feet. Although the low wage rates had been boosted slightly, to $1.75, they still made it difficult to secure enough laborers. Despite the slow trestle work, the rail gang made good progress — the tracks reached the lower end of Gilson's Wash in the latter part of September. At this juncture, Rice station was established and time card No. 17, effective August 22, 1898, extended train service to that point, 104½ miles from Bowie. No. 12 was scheduled to leave Bowie at 8:30 a.m. and arrive at Rice at 4 p.m. Returning, No. 11 left at 11 a.m. and arrived at Bowie at 6:20 p.m. And, in an effort to meet the competition, C. C. Hackett, proprietor of the Mesa-Florence-Globe stage, lowered the fare to $12.00 for the round trip.

Trains began operating to a place beyond Gilson's on October 11, so that Globe was only eleven miles from the railhead. While one construction camp remained east of the summit, another was moved to Redman's slaughterhouse on the outskirts of Globe. The big cut at the summit was at last finished and Ross' graders were hurrying to close the one remaining gap in the roadbed.

Garland was confident that the GVG&N tracks would be in Globe by the middle of November and offered people in the Gila Valley a free excursion to Globe on Thanksgiving. When that holiday came, no excursion was run because the tracks were still three and one-half miles from further delays because freight trains had to be "doubled." And when the Gila River went on one of its frequent rampages, service on the "Goes Very Slowly and Nervously Railroad" was suspended pending completion of repairs, another factor contributing to the congestion.

To help correct this difficult situation, additional yard tracks were laid in Globe, the Rice siding was extended and more facilities were added at San Carlos, Safford, and Solomonville. A new position was created on the GVG&N when E. E. Servine was appointed trainmaster.

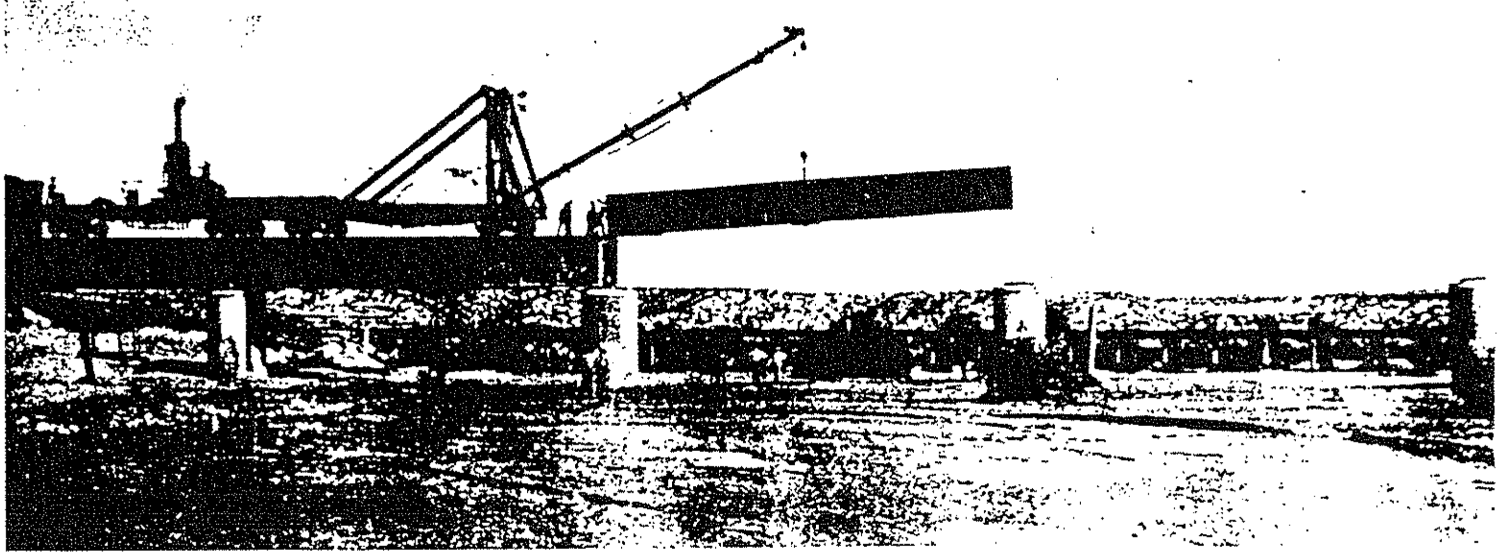
Passenger traffic was booming, particularly in May when the summer excursion rates became effective and people hurried away to escape the warm summer.

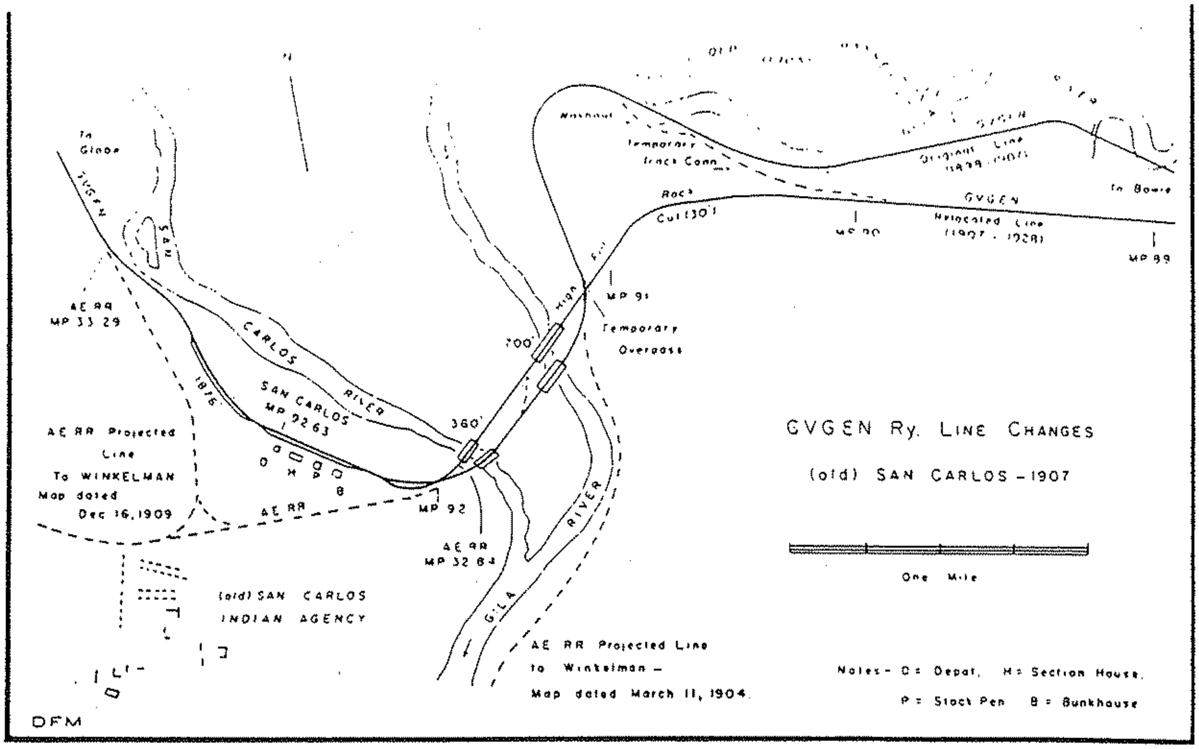
That fall, almost 200 people paid $10 to ride to Cananea in a tourist Pullman sleeping car of the Globe International Excursion train. At Cananea, the Globe team was to meet the Cananea nine for a series of baseball games. After a flourishing exit from Globe, the train stalled at the summit just east of town and nearly two hours elapsed before the trip was resumed with another locomotive. Actually the breakdown was a good thing, as the baseball captain who was also the star player had missed the train. The relief engine brought him out from Globe, but the Cananea boys trounced the Globe team in both games. The band came back a day early, on September 16, to join the parade organized by Mexicans living in Globe to celebrate their Independence Day. Much effort had been expended in decorating parade floats in red, white and green.

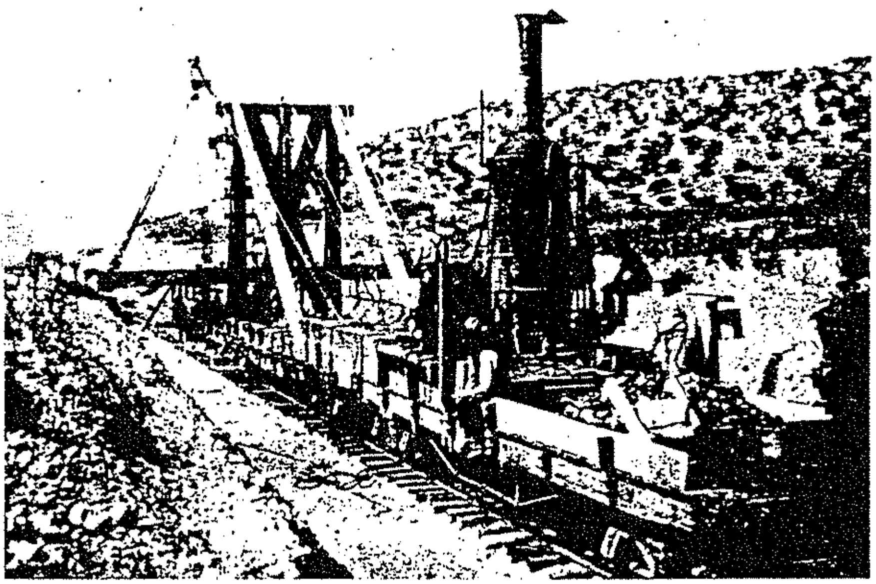
Earlier in the year, the Slavonians had celebrated Christmas on January 6, according to the Russian calendar. Lacking support from others, the 23 Slavonians honored the day with harmless gunfire which disturbed Sheriff J. H. Thompson so much that he proceeded to arrest them. When taken before the judge they learned that the impromptu celebration had cost each of them $30.

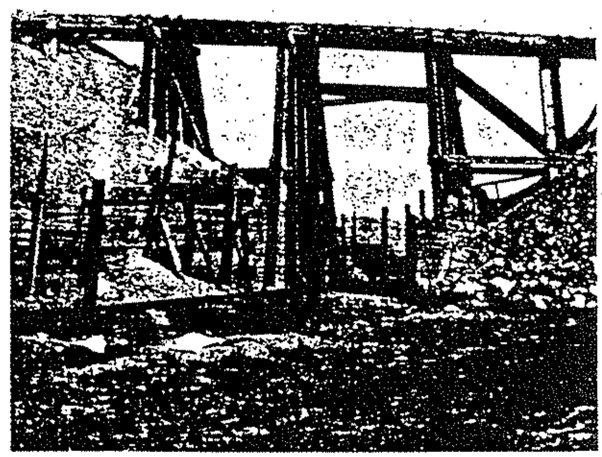
The railroad only seemed to have more than its share of washouts in 1907; actually, it followed the precedent of prior years. In January high water damaged the Gila River bridge near San Carlos for a few days, but the real trouble occurred at the close of August, mostly around Safford. The storm

The San Carlos River bridge was replaced with a substantial structure in 1907. This deck plate girder is being lowered carefully onto the pylons. In the background is the temporary crossing.

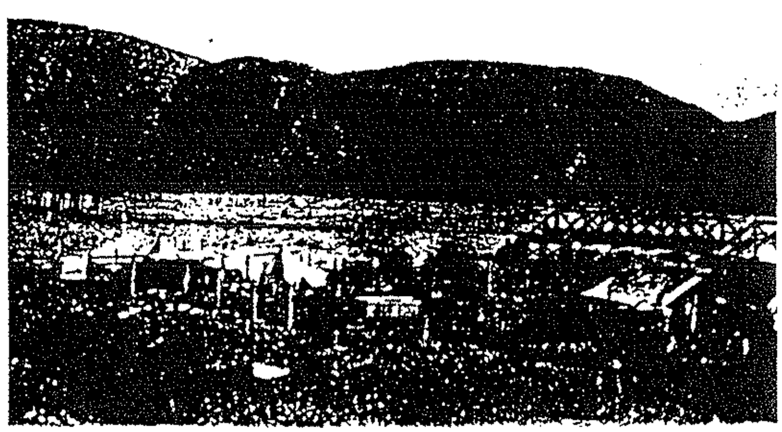


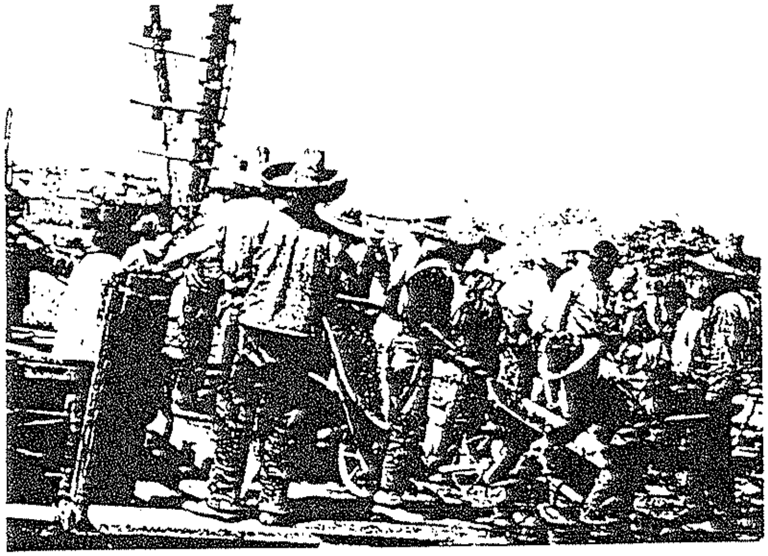


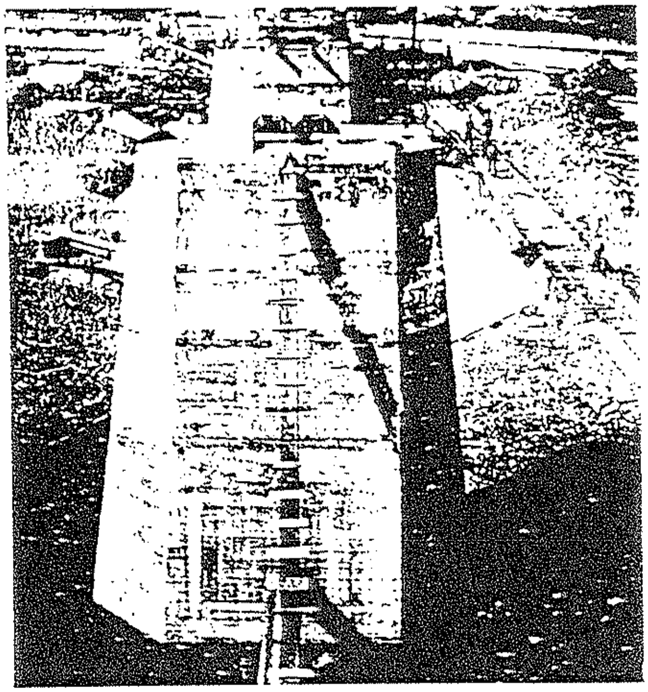


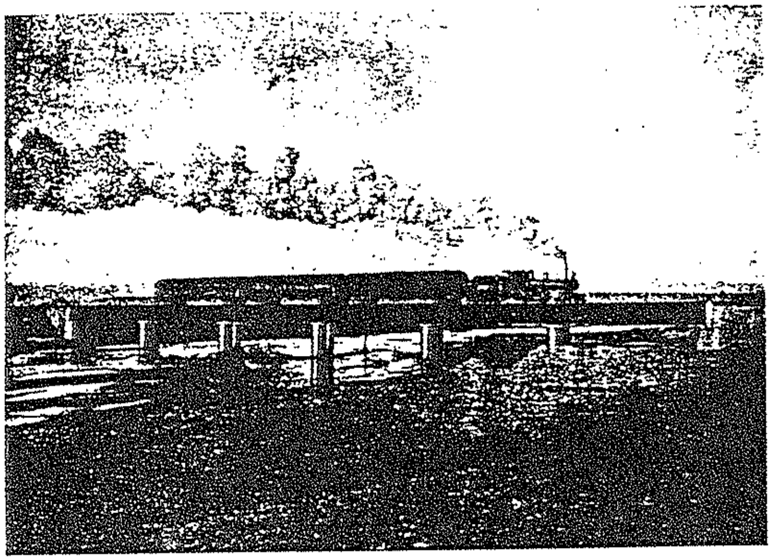


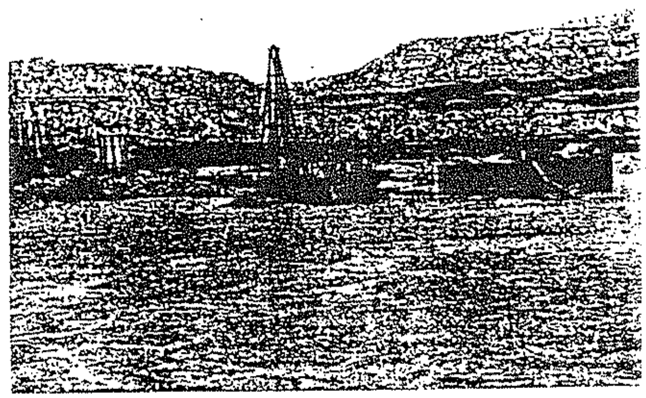
Center left: The bridge derrick and steam engine moved on two flat cars. *Center right:* The railroad grade was moved away from the Gila River to higher ground to reduce interruptions because of high water. To permit continued operation during construction, this temporary overpass was used at MP91, near San Carlos. *Bottom:* This was the scene presented to the construction forces who arrived at the Gila River crossing on December 4, 1906. (*All photos by Percy Jones, Jr.*)

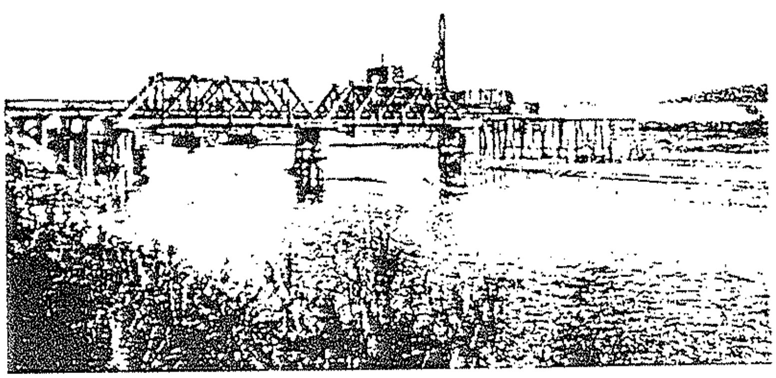












Top left: Replacing the Gila River bridge with a permanent structure required one year. Eleven concrete piers were built for the new crossing; during June 1907 this crew with the varied style of hats was mixing concrete. *Top right:* Looking across the Gila River to the workers' camp on the north bank. The temporary track (right) enabled carloads of materials to be delivered to the construction site.
Center left. After almost a year of construction the San Carlos bridge was finished and the first passenger train crossed it on December 3, 1907. *Center right:* High water in the third week of July 1907 retarded construction efforts. *Bottom:* After the concrete and steel structure was in service (the piers can be seen under the two trusses), the old wood bridge was removed. (*All photos by Percy Jones, Jr.*)

also washed out seven trestles, including one near Gilson that measured 150 feet. In lieu of the passenger train, dubbed *The Gila Valley Monster* or *The Procrastination Flyer* (and not without good reason), a freight train brought a five-day accumulation of mail and passengers from Bowie to MP 53 (near Pima) where all were transferred to the train which came over the hill from Globe. Just about the time normal service was to begin, a big black cloud appeared over the valley and a rainstorm commenced to take out five bents of a bridge near San Carlos.

But the railroad, in spite of some appearances, was really trying. After thirteen months of work, Percy Jones, Sr., and his crew installed the new steel bridge over the Gila River near San Carlos, the only crossing of that river by the GVG&N. A freight train, with No. 566 on the head end, holds the honors as being the first to cross the new structure on the afternoon of December 2, 1907. Sam Clark was at the throttle and in the cupola of the caboose was Conductor W. H. Worden with a camera in his hand. Later in the day, Engineer Arkills and Conductor Haynes brought the first passenger train across the new bridge which, with the line changes, shortened the distance by a half mile.

Changing Times

The United States had been enjoying prosperous times for several years. Not only was industrial production up but new railroad construction, then an important measure of the business activity of the nation, totaled 5,623 miles in 1906, almost half again as much as in 1904, making 1906 one of the peak construction years of all time. But like many things, there was a heavy note of speculation, an example being the promotion of new mining camps in the southwest.

The stock market reflected the unsettled conditions. Copper mining stocks, directly affected by the market price of copper which peaked at 26¾ cents a pound in March, eased downward to 20 cents by August and then plunged to 12½ cents in October. Old Dominion stock, which had been as high as $63 a share, lost $10 in three weeks when it fell to $35. Before the year was out the stock was down to $18, but recovered handsomely the next year. In Arizona, as in Nevada and elsewhere, the ever-accelerating mining boom and railroad expansion came to an abrupt halt when the depression began taking its toll in September 190[illegible] newer mines, as well as those with few assets than a good promoter, were hard hit.

The slump showed no favorites and ma[illegible] road activities had to be contracted. For ex[illegible] when Col. Randolph returned to Tucson i[illegible] tember after conferring with Harriman, t[illegible] man of both the Southern Pacific and Uni[illegible] cific, he had grim news for the *Star* report[illegible] nancial conditions are such that it is [illegible] impossible to secure large sums of money f[illegible] templated extensions," he said. "All pro[illegible] work, which would involve large expendit[illegible] capital, have been set aside until there is a [illegible] for the better," he continued, but "work [illegible] progress will not be suspended."

This was good news for Globe for it mea[illegible] expansion of the yards would go on. Wh[illegible] GVG&N commenced work on the new, s[illegible] roundhouse to replace the one destroyed [illegible] the year before, the *Arizona Silver Belt*, in[illegible] move, ran a headline across the front page i[illegible] letters announcing: "Gila Valley Railway [illegible] pend $100,000 on Improvements in Globe[illegible]

But economic conditions continued t[illegible] worse. The venerable Dr. Douglas of Bisb[illegible] reporters that there were over 200 million [illegible] of surplus copper in the United States a[illegible] production had to be curtailed. Already [illegible] mines were curtailing output; the Old Do[illegible] cut back to a six-day week and other mines [illegible] entirely. Following the long-established tr[illegible] of parity between daily wages and coppe[illegible] whereby the existence of a price of 18 c[illegible] more per pound for a thirty-day period jus[illegible] wage increase (usually initiated by the [illegible] mines) and, conversely, a price decline, w[illegible] copper miners were generally cut. All dur[illegible] tober the price of copper hovered betwee[illegible] 15 cents so, effective November 5, wag[illegible] reduced fifty cents to $3.50.

The Globe National Bank suspended ab[illegible] time and two weeks later a run closed t[illegible] National Bank. The three remaining ban[illegible] pronounced in good shape by the bank e[illegible] and, by raising additional capital, the F[illegible] tional Bank reopened at the end of Februa[illegible]

"The Geronimo Route," as the GVG&[illegible] tised itself, announced a general cut in pa[illegible] fares in October 1907, in the form of 1,[illegible]

DEPARTMENT OF THE INTERIOR

WATER-SUPPLY

AND

RIGATION PAPERS

OF THE

UNITED STATES GEOLOGICAL SURVEY

No. 33

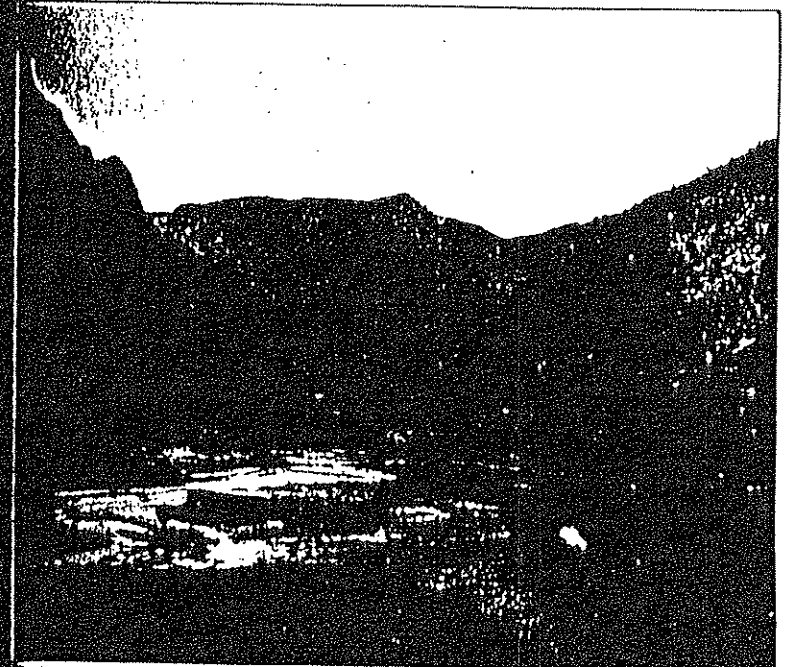
WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

The canyon of the Gila, between the mouth of the San Pedro the San Carlos dam site, was explored and found to be 31 mil length. It is a narrow gorge, as shown on Pl. II, being thus an lent conduit for the passing of the liberated water from the San dam site to the irrigable lands below. A traverse survey was throughout its length. Observations for determining the ev evaporation, the range of temperature, and the volumes of susp silt in the river have been maintained at the Buttes during the of the survey. A canal line has been surveyed from the Butt site past the head of the Florence canal, a distance of 4 miles canal would be used in connection with the Buttes reservoir the purpose of delivering its water to the irrigable lands, and for the development of power, which could be used, if desired settlements that would spring up under this system.

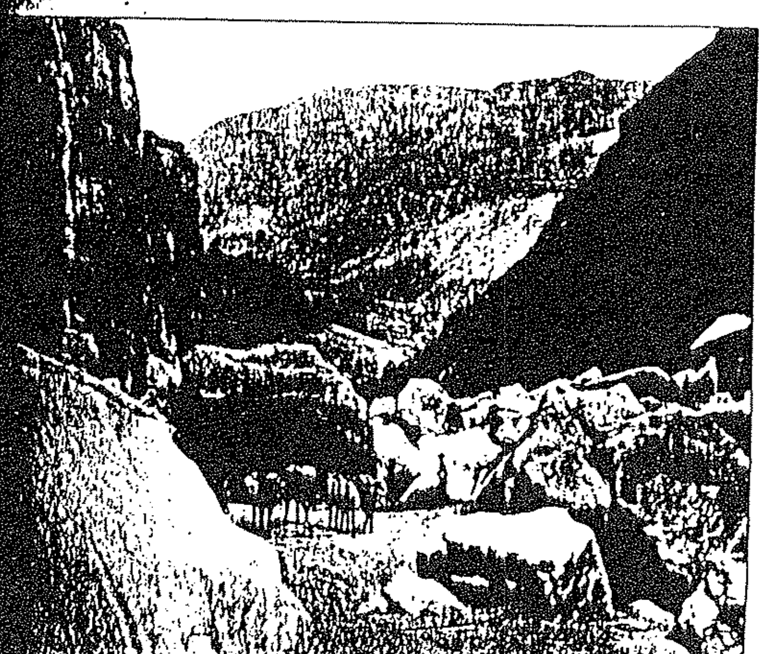
Owing to the questionable character of the rock for buildi Buttes dam site, quarry tests were made, as described fully description of the Buttes dam. Mr. E. Duryee, chemist and expert, of Colton, California, investigated thoroughly the rock the localities in question, in order to determine the feasibility manufacture of a natural hydraulic or a Portland cement. His tigation, as shown in detail on later pages, also determined the bility of using the siliceous rocks of the respective localities for ing with Portland cement in the manufacture of what is kno "sand cement." The extent of public domain in the irrigable di was determined from the land-office records at Tucson, Arizon

Mr. J. H. Quinton was engaged to assist in the designing of th and other engineering works. He visited all the localities in qu and made a careful field examination. Mr. James D. Schuyler w ployed for purposes of consultation in the planning of the work advisory capacity, and for this purpose made detailed exami of the various dam sites on two occasions during the progress field investigation. The service which Mr. Schuyler has rend this capacity has been of prime importance to the work, owin very extended experience in the construction of dams for irr purposes.

The general plans for dams at all points have been matter cussion during a period of months by all the engineers connect this investigation. Each has contributed his share toward the tion of the final plans which Mr. Quinton has prepared. The work for the report has been done in Los Angeles, where the and estimates have been prepared. Numerous laboratory material from the dams and of the sand cements have been Mr. Arthur P. Davis, hydrographer, was in charge of the orga of the field work and of its execution until May 1, 1899, when detailed to assist the Nicaragua Canal Commission in its work



A. GILA RIVER CANYON, 15 MILES BELOW SAN CARLOS DAM SITE.



considering the remarkabl
fine character of the build
avity section of the dam and
lidity of the abutments and
e beyond question.
upper face of the dam, ma
the canyon is but 88 fee
his is apparently an idea
intercept the underflow
e diverted in a flume to
he sand and gravel of th
cement grouting through
the sheet piling and the
cted at various points and
ed to admit of the excava

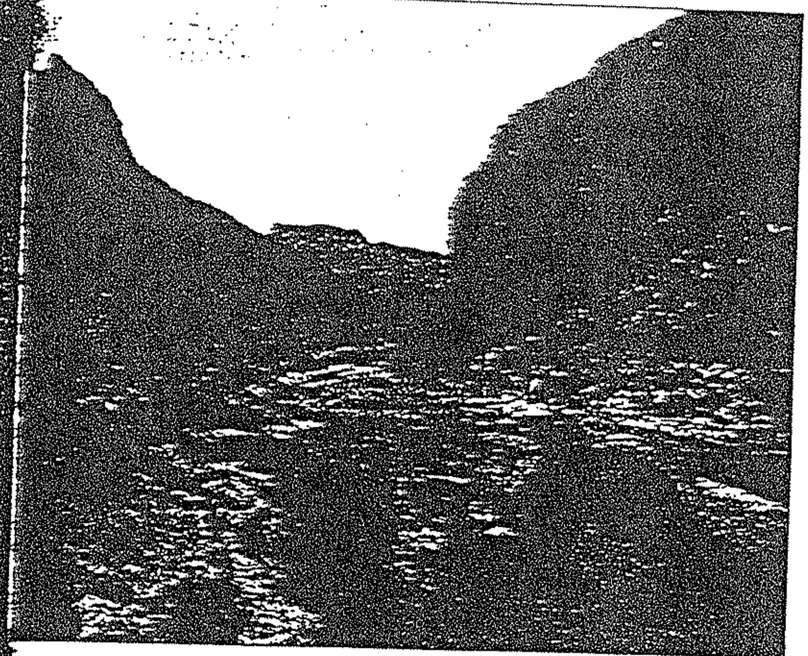
Y AND COST.

os reservoir with the heig
f the reservoir sites that
ey. The elevation of the
d by the surveys as 100 f
feet, as determined from
States Geological Su
the dam site. The
own in the following tabl

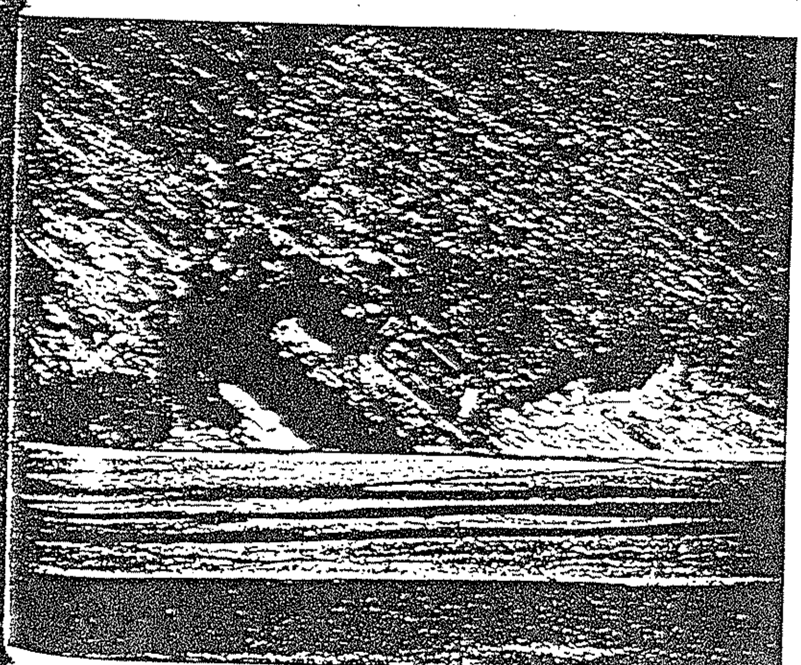
Carlos reservoir site.

[illegible]	Total contents.	Mean depth.	Percent of maximum depth.
	Acre-feet.	*Feet.*	
0	86.0	5.0	50.0
0	376.0	9.2	46.0
0	999.0	12.0	40.0
0	2,488.0	11.3	29.5
5	5,955.5	12.2	24.[illegible]
5	13,069.0	14.0	23.[illegible]
0	25,485.0	16.4	23.[illegible]
0	44,705.0	20.3	25.[illegible]
0	68,801.0	28.0	28.9
0	99,297.0	28.6	28.[illegible]
5	137,414.5	33.1	28.[illegible]
5	184,291.0	35.6	29.[illegible]
0	241,398.0	39.2	30.5
[illegible]	377,176.0	42.1	29.0
	444,000.0		
	512,000.0		
	580,000.0		
	650,000.0		
	700,000.0		

imated.



A. SAN CARLOS DAM SITE, LOOKING DOWNSTREAM



B. LEFT ABUTMENT OF SAN CARLOS DAM SITE

and Irrigation Paper No. 75 Series P, Hydrographic Progress Reports, 19

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

OGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1901

BY

F. H. NEWELL

WASHINGTON
GOVERNMENT PRINTING OFFICE
1903

SALT RIVER.

Estimated monthly discharge of Salt River at reservoir site, Arizona.

[Drainage area, 5,756 square miles.]

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Total in acre-feet.	Run-off. Second-feet per square mile.	Depth in inches.
1901.						
January			454	27,946	0.08	[illegible]
February	4,172	928	2,414	134,047	[illegible]	[illegible]
March	3,468	740	1,423	87,472	[illegible]	[illegible]
April	1,562	740	1,050	62,442	[illegible]	[illegible]
May	1,267	462	735	45,208	[illegible]	[illegible]
June	508	147	288	17,262	[illegible]	[illegible]
July	3,556	71	346	21,296	[illegible]	[illegible]
August	2,221	207	529	32,504	[illegible]	[illegible]
September	670	123	300	17,907	[illegible]	[illegible]
October	215	117	152	9,334	[illegible]	[illegible]
November	215	183	189	10,629	[illegible]	[illegible]
December	195	180	190	11,663	[illegible]	[illegible]
The year			672	477,704	[illegible]	[illegible]

NOTE.—Gage heights and discharge measurements for 1901 are given in Water-Supply [illegible] No. 66, page 90.

Estimated monthly discharge of Tonto Creek near Livingston, Ariz.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Total in acre-feet.	Run-off. Second-feet per square mile.	Depth in inches.
1901.						
April	40	16	27	1,622	[illegible]	[illegible]
May	43	6	14	806	[illegible]	[illegible]
June	9	0	5	201	[illegible]	[illegible]
July	950	2	37	2,255	[illegible]	[illegible]
August	270	0	27	1,680	[illegible]	[illegible]
September	8	2	8	476	[illegible]	[illegible]
October	2	2	2	123	[illegible]	[illegible]
November	3	2	3	178	[illegible]	[illegible]
December	2	2	2	123	[illegible]	[illegible]

NOTE.—Gage heights and discharge measurements for 1901 are given in Water-Supply [illegible] No. 66, page 101.

Estimated monthly discharge of Salt River near McDowell, Ariz.

[Drainage area, 6,260 square miles.]

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Total in acre-feet.	Run-off. Second-feet per square mile.	Depth in inches.
1901.						
[illegible]	3,172	235	582	35,788	0.09	0.10
[illegible]	5,100	1,412	2,422	134,517	.39	.41
[illegible]	3,157	827	1,634	100,491	.26	.30
[illegible]			1,005	37,895	.16	.11
[illegible]	590	128	284	16,972	.05	.06
[illegible]			^{b}152	^{b}9,350	^{b}.02	^{b}.02
[illegible]	1,180	205	^{b}369	^{b}22,711	^{b}.06	^{b}.07
[illegible]	710	121	192	11,420	.03	.03
[illegible]	191	118	143	8,816	.02	.02
[illegible]	200	155	180	11,218	.03	.03
[illegible]	180	157	182	11,185	.03	.03

^{a}No observations made from April 20 to June 1. ^{b}Estimated.

[illegible] Gage heights and discharge measurements for 1901 are given in Water-Supply Paper No. 66, page 102.

GILA RIVER.

Estimated monthly discharge of Gila River at San Carlos, Ariz.

[Drainage area, 13,455 square miles.]

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Total in acre-feet.	Run-off. Second-feet per square mile.	Depth in inches.
1901.						
[illegible]	1,330	110	199	12,236	0.0148	0.0171
[illegible]	2,080	450	1,079	59,925	.0802	.0835
[illegible]	1,070	155	446	27,423	.0332	.0383
[illegible]	155	5	53	3,154	.0039	.0044
[illegible]	8	5	5	307	.0004	.0005
[illegible]	5	0	3	178	.0002	.0002
[illegible]	4,200	0	368	22,627	.0273	.0315
[illegible]	3,050	10	536	32,957	.0398	.0459
[illegible]	8,500	2	250	14,876	.0186	.0208
[illegible]	1,000	2	91	5,595	.0068	.0078
[illegible]	680	125	232	13,805	.0172	.0192
[illegible]	125	100	109	6,702	.0081	.0093

```
# US GEOLOGICAL SURVEY
# DAILY MEAN DISCHARGE DATA
#
# Station name  :  GILA RIVER NEAR CLIFTON, ARIZ.
# Station number:  09442000
# latitude (degrees, minutes, and seconds)...... 325757
# longitude (degrees, minutes, and seconds)..... 1091835
# state code.................................. 04
# district code............................... 04
# county code................................. 011
# hydrologic unit code........................ 15040002
# drainage area (square miles)................  4010.00
# contributing drainage area (square miles).....
# gage datum (feet above NGVD)................  3336.38
# WATSTORE parameter code..................... 00060
# WATSTORE statistic code..................... 00003
# Discharge is listed in the table in cubic feet per second.
#
# Daily mean discharge data were retrieved from the
# National Water Information System files called ADAPS.
# processed into RDB table Fri Mar 22 12:59:18 EST 1996
# filter version 7.2
#
# Format of table is as follows.
# Lines starting with the # character are comment lines describing the data
# included in this file.  The next line is a row of tab-delimited column
# names that are Date and Discharge.  The next line is a row of tab-delimited
# data type codes that describe a 10-character-wide date (10d) and an
# 8-character-wide numeric value for discharge (8n).  All following lines are
# rows of tab-delimited data values of date (year.month.day) and discharge.
#
# NOTE: The header above is from an original file which has
#       has been further processed by IL-SWR web retrieval
#       software on Thu Sep 11 17:41:43 EDT 1997.
#       Dates are now in YYYY.MM.DD format.
#
# ----Date Range In File----
#  1 1910.11.01-1912.02.14
```

Date	Discharge
10s	8n
1910.11.01	54
1910.11.02	54
1910.11.03	54
1910.11.04	54
1910.11.05	54
1910.11.06	54
1910.11.07	54
1910.11.08	77
1910.11.09	65
1910.11.10	65
1910.11.11	59
1910.11.12	59
1910.11.13	59
1910.11.14	77
1910.11.15	92
1910.11.16	110
1910.11.17	110
1910.11.18	101
1910.11.19	92
1910.11.20	90
1910.11.21	76
1910.11.22	81
1910.11.23	68

1910.11.24	62
1910.11.25	62
1910.11.26	62
1910.11.27	72
1910.11.28	72
1910.11.29	71
1910.11.30	71
1910.12.01	58
1910.12.02	58
1910.12.03	58
1910.12.04	68
1910.12.05	68
1910.12.06	67
1910.12.07	67
1910.12.08	66
1910.12.09	78
1910.12.10	78
1910.12.11	77
1910.12.12	77
1910.12.13	76
1910.12.14	64
1910.12.15	63
1910.12.16	63
1910.12.17	63
1910.12.18	63
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1910.12.25	52
1910.12.26	52
1910.12.27	52
1910.12.28	52
1910.12.29	52
1910.12.30	52
1910.12.31	52
1911.01.01	52
1911.01.02	52
1911.01.03	52
1911.01.04	52
1911.01.05	52
1911.01.06	52
1911.01.07	52
1911.01.08	52
1911.01.09	52
1911.01.10	52
1911.01.11	52
1911.01.12	63
1911.01.13	183
1911.01.14	120
1911.01.15	200
1911.01.16	200
1911.01.17	200
1911.01.18	200
1911.01.19	138
1911.01.20	108
1911.01.21	138
1911.01.22	138
1911.01.23	138
1911.01.24	138
1911.01.25	163
1911.01.26	775

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1911.01.28	740
1911.01.29	350
1911.01.30	350
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1911.02.01	130
1911.02.02	225
1911.02.03	225
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1911.02.05	200
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1911.02.07	165
1911.02.08	165
1911.02.09	165
1911.02.10	165
1911.02.11	165
1911.02.12	165
1911.02.13	165
1911.02.14	135
1911.02.15	90
1911.02.16	65
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1911.02.19	145
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1911.02.21	145
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1911.02.28	125
1911.03.01	140
1911.03.02	545
1911.03.03	600
1911.03.04	700
1911.03.05	665
1911.03.06	665
1911.03.07	1160
1911.03.08	1050
1911.03.09	905
1911.03.10	1050
1911.03.11	1050
1911.03.12	575
1911.03.13	575
1911.03.14	575
1911.03.15	413
1911.03.16	390
1911.03.17	280
1911.03.18	280
1911.03.19	320
1911.03.20	280
1911.03.21	222
1911.03.22	205
1911.03.23	240
1911.03.24	280
1911.03.25	465
1911.03.26	710
1911.03.27	700
1911.03.28	690
1911.03.29	610
1911.03.30	540
1911.03.31	450

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1911.04.02	330
1911.04.03	340
1911.04.04	298
1911.04.05	278
1911.04.06	258
1911.04.07	238
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1911.04.09	200
1911.04.10	220
1911.04.11	183
1911.04.12	167
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1911.06.03	25

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1911.07.04	31
1911.07.05	31
1911.07.06	25
1911.07.07	20
1911.07.08	20
1911.07.09	20
1911.07.10	28
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1911.07.12	437
1911.07.13	630
1911.07.14	540
1911.07.15	690
1911.07.16	630
1911.07.17	690
1911.07.18	515
1911.07.19	722
1911.07.20	758
1911.07.21	630
1911.07.22	540
1911.07.23	437
1911.07.24	4500
1911.07.25	6000
1911.07.26	820
1911.07.27	1070
1911.07.28	890
1911.07.29	720
1911.07.30	595
1911.07.31	458
1911.08.01	405
1911.08.02	338
1911.08.03	255
1911.08.04	218
1911.08.05	197
1911.08.06	165

1911.08.07	150
1911.08.08	120
1911.08.09	105
1911.08.10	105
1911.08.11	80
1911.08.12	80
1911.08.13	80
1911.08.14	80
1911.08.15	80
1911.08.16	80
1911.08.17	55
1911.08.18	38
1911.08.19	38
1911.08.20	38
1911.08.21	34
1911.08.22	34
1911.08.23	120
1911.08.24	150
1911.08.25	218
1911.08.26	380
1911.08.27	255
1911.08.28	197
1911.08.29	197
1911.08.30	338
1911.08.31	218
1911.09.01	197
1911.09.02	165
1911.09.03	165
1911.09.04	165
1911.09.05	90
1911.09.06	80
1911.09.07	80
1911.09.08	80
1911.09.09	80
1911.09.10	1860
1911.09.11	760
1911.09.12	385
1911.09.13	195
1911.09.14	165
1911.09.15	275
1911.09.16	149
1911.09.17	108
1911.09.18	90
1911.09.19	80
1911.09.20	860
1911.09.21	570
1911.09.22	165
1911.09.23	135
1911.09.24	135
1911.09.25	135
1911.09.26	135
1911.09.27	195
1911.09.28	195
1911.09.29	165
1911.09.30	195
1911.10.01	710
1911.10.02	640
1911.10.03	640
1911.10.04	580
1911.10.05	640
1911.10.06	1020
1911.10.07	1710
1911.10.08	540
1911.10.09	410

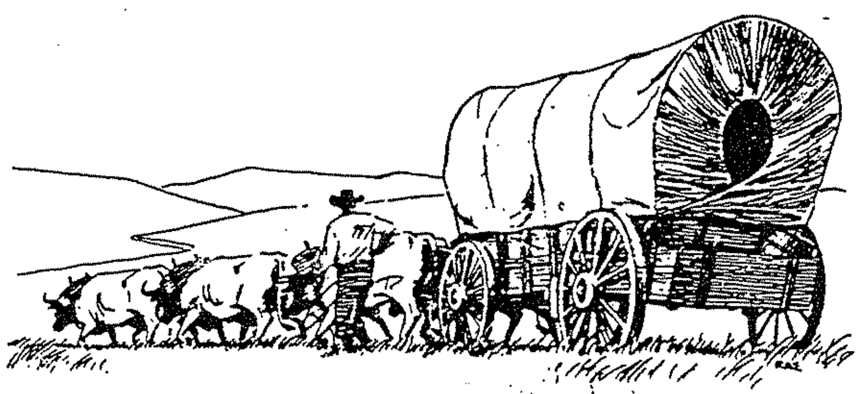
1911.10.10	275
1911.10.11	235
1911.10.12	200
1911.10.13	165
1911.10.14	138
1911.10.15	138
1911.10.16	138
1911.10.17	110
1911.10.18	110
1911.10.19	110
1911.10.20	110
1911.10.21	86
1911.10.22	110
1911.10.23	110
1911.10.24	110
1911.10.25	110
1911.10.26	86
1911.10.27	110
1911.10.28	110
1911.10.29	460
1911.10.30	235
1911.10.31	235
1911.11.01	275
1911.11.02	235
1911.11.03	235
1911.11.04	235
1911.11.05	235
1911.11.06	235
1911.11.07	235
1911.11.08	200
1911.11.09	182
1911.11.10	165
1911.11.11	160
1911.11.12	165
1911.11.13	152
1911.11.14	152
1911.11.15	152
1911.11.16	155
1911.11.17	160
1911.11.18	148
1911.11.19	142
1911.11.20	148
1911.11.21	142
1911.11.22	138
1911.11.23	138
1911.11.24	135
1911.11.25	135
1911.11.26	135
1911.11.27	130
1911.11.28	126
1911.11.29	126
1911.11.30	120
1911.12.01	125
1911.12.02	120
1911.12.03	113
1911.12.04	126
1911.12.05	128
1911.12.06	128
1911.12.07	131
1911.12.08	135
1911.12.09	138
1911.12.10	140
1911.12.11	138
1911.12.12	138

1911.12.13	140
1911.12.14	138
1911.12.15	138
1911.12.16	138
1911.12.17	135
1911.12.18	130
1911.12.19	130
1911.12.20	126
1911.12.21	126
1911.12.22	126
1911.12.23	126
1911.12.24	128
1911.12.25	128
1911.12.26	128
1911.12.27	128
1911.12.28	126
1911.12.29	126
1911.12.30	125
1911.12.31	125
1912.01.01	125
1912.01.02	125
1912.01.03	125
1912.01.04	125
1912.01.05	125
1912.01.06	125
1912.01.07	125
1912.01.08	110
1912.01.09	110
1912.01.10	110
1912.01.11	110
1912.01.12	110
1912.01.13	98
1912.01.14	98
1912.01.15	98
1912.01.16	98
1912.01.17	98
1912.01.18	86
1912.01.19	86
1912.01.20	86
1912.01.21	86
1912.01.22	98
1912.01.23	86
1912.01.24	86
1912.01.25	86
1912.01.26	86
1912.01.27	86
1912.01.28	86
1912.01.29	86
1912.01.30	86
1912.01.31	86
1912.02.01	84
1912.02.02	84
1912.02.03	84
1912.02.04	84
1912.02.05	84
1912.02.06	84
1912.02.07	84
1912.02.08	84
1912.02.09	84
1912.02.10	84
1912.02.11	77
1912.02.12	77
1912.02.13	77
1912.02.14	77

W. TURRENTINE JACKSON

WAGON ROADS WEST

A STUDY OF FEDERAL ROAD SURVEYS AND CONSTRUCTION IN THE TRANS-MISSISSIPPI WEST 1846-1869



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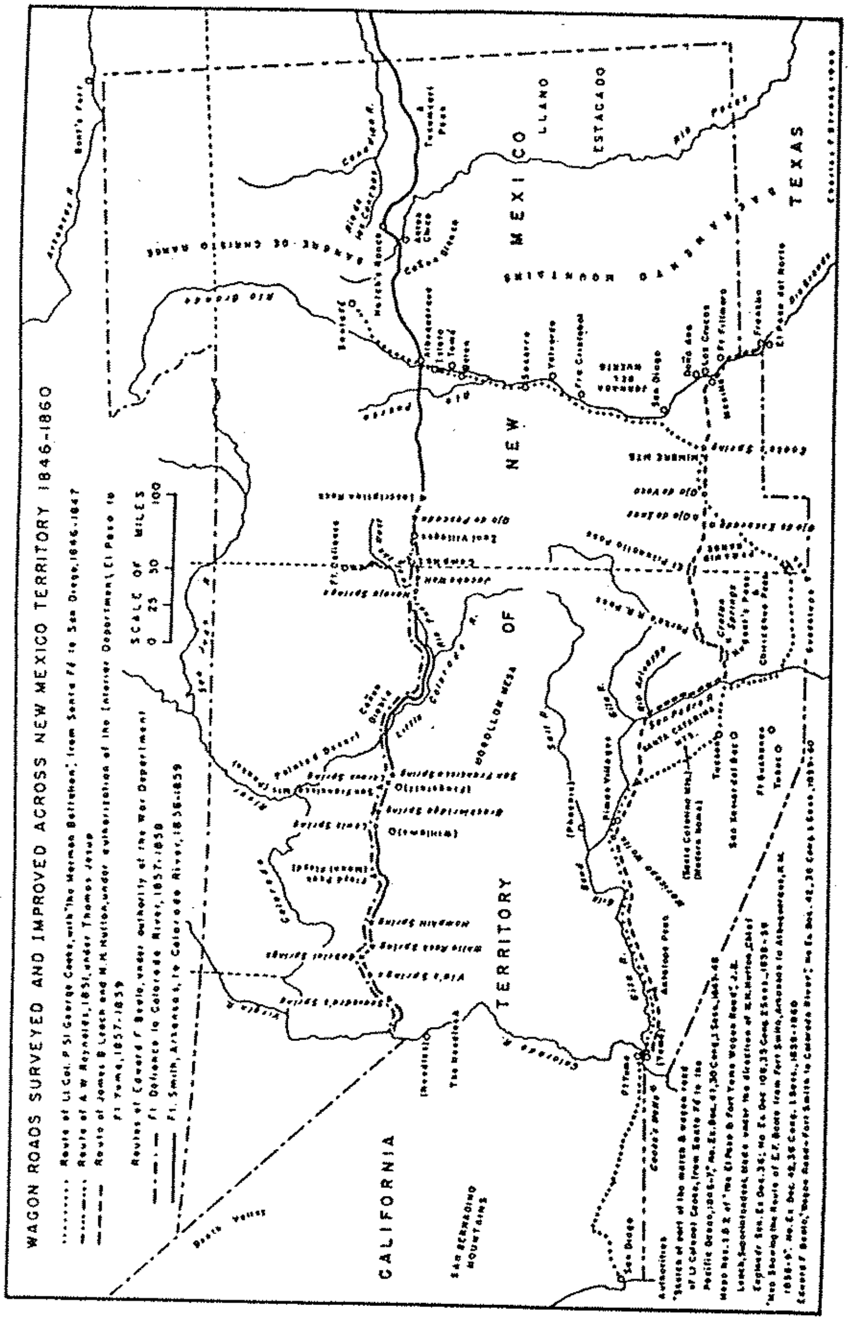
BERKELEY AND LOS ANGELES 1952



Davis. In time their doubt turned to acceptance and finally to enthusiasm. Two weeks after the expedition left Fort Defiance, Beale noticed that the camels were so quiet and gave the party so little trouble that they were forgotten. He recorded that "certainly there never was anything so patient and enduring and so little troublesome as this noble animal.... There is not a man in camp who is not delighted with them."[30] The superintendent's personal zeal mounted to its zenith by the time the westward march was half complete:

My admiration for the camels increases daily with my experience of them. The harder the test they are put to the more fully they seem to justify all that can be said of them. They pack water for others four days under the hot sun and never get a drop; they pack heavy burdens of corn and oats for months and never get a grain;... No one could do justice to their merits or value in expeditions of this kind, and I look forward to the day when every mail route across the continent will be conducted and worked altogether with this economical and noble brute.[31]

When the expedition approached the Colorado River, Beale was firmly convinced that the experiment was a success. He admitted:

I rarely think of mentioning the camels now. It is so universally acknowledged in camp, even by those who were most opposed to them at first, that they are the salt of the party and the noblest brute alive, that to mention them at all would only be to repeat what I have so often said of them before.[32]

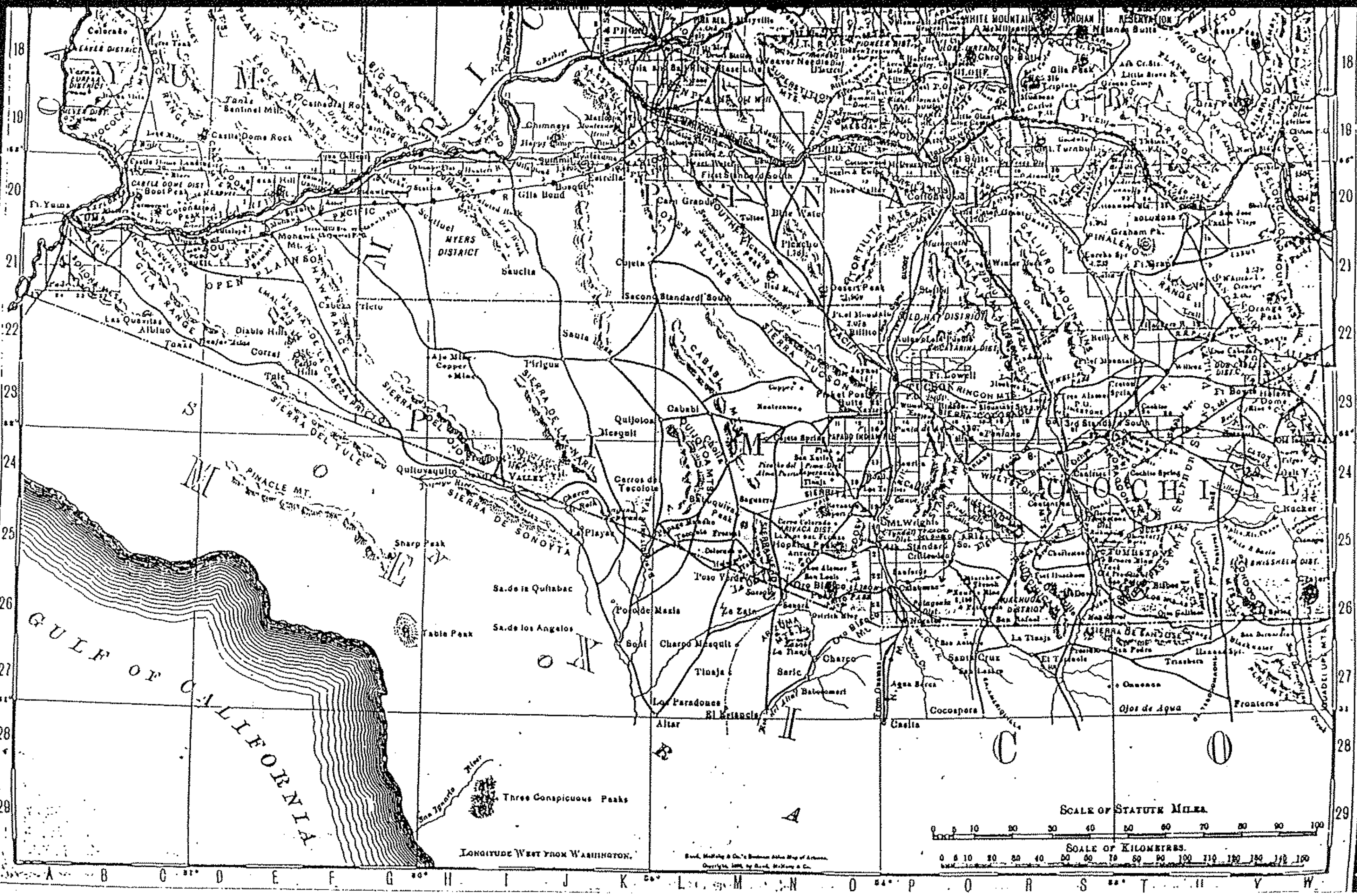
The leader's satisfaction compensated in part for his disappointment and thorough disgust with the guide, Leco. Just west of the Little Colorado River in the San Francisco Mountains, the party became uncertain of its whereabouts and its future course. The guide proved of little assistance and Beale, not a man of patience, exploded:

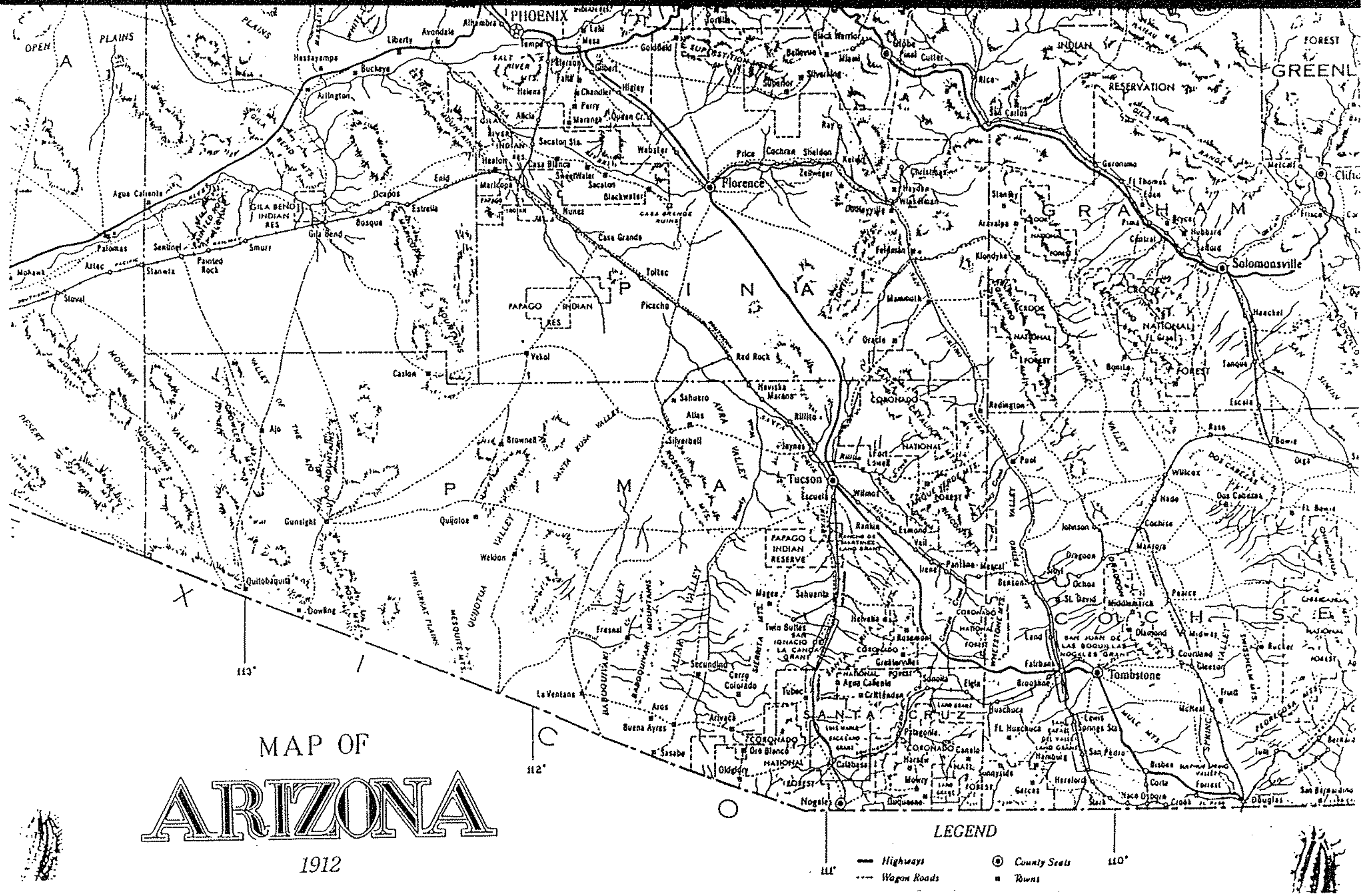
We unfortunately have no guide, the wretch I employed at the urgent request and advice of every one in Albuquerque, and at enormous wages, being the most ignorant and irresolute old ass extant.

This obliges us to do the double duty of road making and exploring, which is very arduous, besides adding infinitely to my anxiety and responsibility.[33]

The man proved so worthless that the commander was finally obliged to send him to the rear of the expedition, and only regretted that he had not done it sooner. A few days later Leco himself strayed from the main party, lost his mule when alighting to make a fire, and, fearful of further punishment, chose to follow the mule rather than to return to camp on foot. Forty-eight hours later a search party brought him in.[34] Henceforth he was known as the "miserable Leco."

For Map of California, see pages 81





MAP OF
ARIZONA
1912
LEGEND
Highways
Wagon Roads
County Seats
Towns
113°
112°
111°
110°
PHOENIX
Florence
Tucson
Tombstone
Solomonsville
Globe
Nogales
Douglas
Bisbee
GRAHAM
PINAL
PIMA
COCHISE
SANTA CRUZ
GREENL
MEXICO
PAPAGO INDIAN RES
PAPAGO INDIAN RESERVE
GILA BEND INDIAN RES
INDIAN RESERVATION
CORONADO NATIONAL FOREST
CROOK NATIONAL FOREST
AVRA VALLEY
THE GREAT PLAINS
MESQUITE MTS.
MOHAWK VALLEY
SULPHUR SPRING VALLEY
Gila Bend
Casa Grande
Red Rock
Picacho
Toltec
Sahuaro
Silverbell
Ajo
Gunsight
Quijotoa
Vekol
Sasabe
Calabasas
Benson
Willcox
Bowie
Mammoth
Oracle
Redington
Winkelman
Hayden
Ray
Superior
Mesa
Tempe
Chandler
Gilbert
Buckeye
Liberty
Avondale
Alhambra
Hassayampa
Arlington
Estrella
Bosque
Sentinel
Painted Rock
Smurr
Mohawk
Aztec
Stanwix
Agua Caliente
Maricopa
Sacaton
Sheldon
Price
Cochran
Kelvin
Dudleyville
Klondyke
Aravaipa
Fort Thomas
Geronimo
San Carlos
Rice
Cutter
Miami
Bellevue
Black Warrior
Fort Lowell
Rillito
Marana
Naviska
Jaynes
Wilmot
Esmond
Vail
Pantano
Mescal
Dragoon
Cochise
Johnson
Pearce
Courtland
Gleeson
Fairbank
Charleston
Huachuca
Ft. Huachuca
Elgin
Sonoita
Patagonia
Tubac
Arivaca
Buena Ayres
Fresnal
La Ventana
Dowling
Quitobaquito
Caslon
Secundino
Carro Colorado
Twin Buttes
Sahuarita
Magee
Helvetia
Rosemont
Greaterville
Crittenden
Pima
Central
Hubbard
Safford
Bonita
Hooker
Hachita
Rucker
Naco
Cross
Stark
Hereford
Lewis Springs
San Pedro
Ochoa
St. David
Sibyl

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ORIGINAL

RECEIVED 4/29/1998

April 29, 1998

96 - 003 - 019
Gila River

HAND-DELIVERED

Ms. Christina Waddell, Executive Director
ANSAC
1700 West Washington, Room 404
Phoenix, AZ 85007

Re: Littlefield Report

Dear Ms. Waddell:

Enclosed are six copies of "Assessment of the Navigability of the Gila River from Its Confluence with the Salt River to Its Mouth on the Colorado River Prior to and on the Date of Arizona's Statehood, February 14, 1912," by Douglas R. Littlefield, Ph.D.

Thank you for your attention.

Very truly yours,

Salmon, Lewis & Weldon, P.L.C.

By Mark A. McGinnis

Mark A. McGinnis

MAM:pv
Encls.

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ORIGINAL

April 30, 1998

RECEIVED 4/30/1998

HAND-DELIVERED

96 - 003 - 019
Gila River

Ms. Christina Waddell, Executive Director
ANSAC
1700 West Washington, Room 404
Phoenix, AZ 85007

Re: Littlefield Report

Dear Ms. Waddell:

Enclosed are an additional two copies of "Assessment of the Navigability of the Gila River from Its Confluence with the Salt River to Its Mouth on the Colorado River Prior to and on the Date of Arizona's Statehood, February 14, 1912," by Douglas R. Littlefield, Ph.D. Six copies were delivered to you yesterday. I apologize for any inconvenience the discrepancy may have caused.

Very truly yours,

Salmon, Lewis & Weldon, P.L.C.

By John B. Weldon, Jr.

JBW:pv
Encls.

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RECEIVED 2-22-99

February 22, 1999

Mr. Tom Vogt
Arizona Navigable Stream Adjudication Commission
1700 West Washington, Room 404
Phoenix, AZ 85007

Re: Littlefield Report

Dear Tom:

Enclosed are three copies of "Assessment of the Navigability of the Gila River from Its Confluence with the Salt River to Its Mouth on the Colorado River Prior to and on the Date of Arizona's Statehood, February 14, 1912," by Douglas R. Littlefield. Should you have questions, please call.

Very truly yours,

Salmon, Lewis & Weldon, P.L.C.

By Mark A. McGinnis

Mark A. McGinnis

MAM:pv
Encls

ASSESSMENT OF THE NAVIGABILITY OF THE GILA RIVER FROM ITS CONFLUENCE WITH THE SALT RIVER TO ITS MOUTH ON THE COLORADO RIVER PRIOR TO AND ON THE DATE OF ARIZONA'S STATEHOOD, FEBRUARY 14, 1912

by

Douglas R. Littlefield, Ph.D.
Littlefield Research Associates
6207 Snake Road
Oakland, California 94611
510-339-1017

April 24, 1998

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LIST OF MAPS AND ILLUSTRATIONS

EXECUTIVE SUMMARY

The purpose of this report is to assess the navigability of the Gila River between its confluence with the Salt River downstream to its juncture with the Colorado River on or before February 14, 1912 -- the date Arizona became a state. In many cases, the types of records consulted to create this report were identical to those used in Littlefield Research Associates' two previous reports submitted to the Arizona Navigable Stream Adjudication Commission. Those reports were: "Assessment of the Salt River's Navigability Prior to and on the Date of Arizona's Statehood, February 14, 1912," dated December 5, 1996, and "Assessment of the Verde River's Navigability Prior to and on the Date of Arizona's Statehood, February 14, 1912," dated October 3, 1997. While the **types** of records may have been the same for all three reports, the geographic **focus** of the records in relation to this report was on the lower Gila River. Therefore, the discussion of the records' general significance is similar to that in the Salt and Verde reports (notably, for example, the discussion about the importance of federal surveying instructions that begins on page 11 below). The final use and disposition of these reports may be different, and therefore, each report stands on its own and includes all relevant material, whether duplicated or not.

To make the evaluation of the Gila River's navigability in 1912, a wide array of published and unpublished documents was consulted (discussed in greater detail in the "Introduction" and listed in the appendices to this report). This survey of hundreds of primary and secondary sources yielded a wide spectrum of historical views of the Gila River, including federal surveys and reports, land settlement records created by the U.S. and Arizona governments, explorers' journals, diaries, early pioneer reminiscences, and many other records.

Taken as a whole, these records overwhelmingly illustrate that prior to and at the time of Arizona's statehood the Gila River was considered **not** navigable or susceptible of navigation by virtually every contemporaneous observer. The historical record amply demonstrates that the Gila River was highly erratic, subject to flooding and major channel changes, blocked by obstacles (both natural and man-made), and diverted for irrigation needs. In short, the Gila River was not navigable on February 14, 1912.

INTRODUCTION

The answer to the question of who is the owner of the bed of a stream or lake bed anywhere in the United States depends on what that waterway was like at the time the region became a state. Historically, this stems from the original thirteen American colonies' relationship with the Crown of England. Over centuries, English common law had evolved to establish that the King owned the beds of commercially navigable waterways in order to protect their accessibility for his subjects. This royal power had evolved in order to prevent parties from building structures such as wharfs, docks, or mill dams that might interfere with commercial boat traffic. The beds of non-navigable waterways where transportation was not an issue, in turn, were owned by adjacent landowners. This principle was well established under English common law long before the American Revolution, and it therefore applied to the American colonies as well as to royal subjects in England. Following the American Revolution, the rights and duties of the Crown passed to the newly independent states, thus making them the owners of the beds of commercially navigable streams and lakes within their boundaries by virtue of their new-found sovereignty. The United States Constitution subsequently mandated that all new states enter the Union on the same footing as the original thirteen. Therefore, as additional states joined they became the owners of the beds of waterways within their borders that were navigable at the time of their statehood.

In Arizona's case, this "same footing" doctrine means that if any stream or lake within the state was navigable on February 14, 1912 -- the date Arizona joined the Union -- its bed was Arizona's sovereign property. If the stream was not navigable, ownership of the bed remained in the United States government's hands until lands adjacent to the body of water were patented or otherwise disposed of. At that time, the bed of the stream or lake became the property of the individual land owners next to the body of water.[1]

PURPOSE AND METHODOLOGY: The purpose of this report is to examine what the Gila River was like at the time of Arizona's statehood on February 14, 1912, and to determine whether the stream prior to or on that date was considered commercially navigable. The chronological time period covered by this report extends from the pre-statehood era to the years shortly after statehood. The geographic range is from the Gila River's confluence with the Salt River downstream to where the Gila flows into the Colorado River.

Littlefield Research Associates utilized a wide variety of published and unpublished sources in creating this study. The vast majority of these documents are primary rather than secondary sources to obtain the most accurate descriptions of the Gila River. To locate all relevant sources, Littlefield Research Associates developed a preliminary list of terms for searching many local, state, and national archives. We also used the list to search

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[1] The fundamental U.S. Supreme Court case confirming this doctrine is The Steamer Daniel Ball v. United States, 77 U.S. 999 (1871).

published primary sources. Littlefield Research Associates supplemented the list as research brought to light new topics related to the Gila River. Since individual archives have different means of listing their holdings, we adapted our list to accommodate specific locations. Some of the terms most commonly used throughout the research were Gila Bend, Yuma, Painted Rocks, and Sentinel.

In addition, individuals' names were used as search terms depending on the time period and archive involved. People whose names were searched include Charles Hayden, General Stephen Kearny, and Lieutenant J.C. Ives.

Littlefield Research Associates searched many Arizona and federal government agencies' names for records they may have generated regarding the Gila River. Agencies (and their predecessors) whose names were searched include the Arizona State Land Department, Maricopa County Water Commissioner's Office, Arizona Attorney General's Office, the U.S. Congress, U.S. Geological Survey, U.S. Bureau of Land Management (originally the General Land Office), U.S. Bureau of Reclamation (originally the Reclamation Service), U.S. Army Corps of Engineers, U.S. Department of Agriculture Office of Experiment Stations, and U.S. Bureau of Indian Affairs (originally the Indian Service), among others.

Research began at Arizona State University. The university's main library houses the Archives and Manuscript Division in the Luhrs Reading Room (which focuses on Arizona and Southwest history) in addition to the privately funded Arizona Historical Foundation.

Both contain excellent collections of source materials (published as well as unpublished) and extensive collections of books focussing on the history of Arizona. At Arizona State University, Littlefield Research Associates first searched the computer on-line manuscript database, which contains file titles from each manuscript collection at the library. Printed finding aids were also reviewed. The preliminary searches yielded over eleven unpublished manuscript collections of prominent citizens and early settlers in the Gila Basin including Phillip A. Bailey, Lloyd C. Henning, and Carl Hayden. The manuscripts in these collections provided eyewitness accounts of the Gila (such as descriptions of floods, the river's channel, and local activities taking place on or near the stream). The manuscript collections also yielded useful insights on the development of irrigation systems along the Gila, including reservoirs, diversion dams, and canals.

Arizona State University was held a complete set of Arizona statutes. The statutes (mostly territorial) were searched for laws relevant to navigability and public land disposal.

Additionally, Littlefield Research Associates examined Arizona newspapers to obtain a sense of the activities occurring on the Gila River and for firsthand accounts of any important events. Many newspapers around the turn of the century provided booster-like stories intended to attract settlers to local communities. Such reports frequently noted transportation, mild weather, and other conveniences. Travel on the Gila River, therefore, certainly would have been celebrated in the area press had it occurred regularly and reliably. Newspapers searched include the Arizona Weekly Gazette (1909-1914), the Yuma Examiner (1909-1913), and the Arizona Sentinel (1909-1915).

Also useful was the Water Resources Center Archives at the University of California, Berkeley. Although located in California, this library is one of the premier depositories for manuscript collections and published government reports relating to water resources in the entire United States (particularly the American West). The Water Resources Center Archives contains manuscript collections of the papers of prominent civil engineers, whose work dealt extensively with irrigation, flood control, and hydroelectric power. Included are some of the papers of Elwood Mead (head of the U.S. Reclamation Service in the 1920s), James Dix Schuyler (a consulting engineering who was active in water resource development throughout the West), and other figures who helped to alleviate the water problems associated with the arid and semi-arid West. The Water Resources Center Archives also holds many published government documents relating to water issues, including a complete set of published U.S. Geological Survey Water Supply Papers and Bulletins (many of which were relevant to the history of the Gila River Valley) as well as the U.S. Reclamation Service Annual Reports.

University of California, Berkeley, was also the site of research on boating around the time of statehood. Littlefield Research Associates reviewed the published reports of the Commissioner of Corporations on Transportation by Water to determine how technology had progressed on shallow watercraft by 1912. Also examined were records about boating on the Colorado River. This river was a catalyst for advances in boating technology because of its swift current, shallow water, and frequently changing channel. Information on watercraft on that river are useful to understand river boating throughout the West -- including on the Gila -- around the turn of the century.

The Bancroft Library, also at Berkeley, is one of the most important depositories for unpublished primary source materials and rare secondary source records on the history of the American West. Collections of unpublished documents at the Bancroft relating to the Gila were reviewed as well as published reports of nineteenth-century explorations of the area. Since many of the individuals who visited the region were there specifically to report on its potential, their reports are especially useful to ascertaining the historical nature of the Gila River.

Following research at the Bancroft Library and the Water Resources Center Archives, reports and studies conducted by U.S. government agencies were reviewed. Most of these reports covered such topics as flood control, irrigation, and the utilization of natural resources in the Gila River Valley. These documents provided descriptions of the Gila at different points in time leading up to and shortly after statehood. Some of the reports are specific to the Gila River, but much of the information found was contained in larger studies on Arizona. In addition, a computer search was done of files compiled by Congressional Information

Services (CIS) to find Congressional documents, hearings, and reports relevant to the Gila River.

In addition to the sources obtained at Arizona State University and the University of California, Berkeley, documents held by the U.S. Bureau of Land Management in Phoenix were reviewed -- records that are some of the most important concerning the Gila River around the time of statehood. The Bureau of Land Management holds the records of the original U.S. General Land Office surveys carried out to prepare the public domain for homesteading; these records include original surveyors' plats and field notes. Since surveyors were required to "meander" all navigable bodies of water and to keep detailed notes of these meanders, survey documents are vital to understand what the river was like at the time of survey. (See the section beginning on page 11 for a more detailed discussion of how surveys and meanders were to be conducted.) Thus, the surveys proved especially useful to an historical study of the Gila River's characteristics.

The Phoenix office of the U.S. Bureau of Land Management also provided copies of U.S. General Land Office Master Title Plats and Historical Indexes. These records were used to determine how the federal government disposed of the public lands in Arizona through which the Gila River flowed. From this material, any U.S. patent that either overlaid or bordered the Gila River was obtained. Federal patents were critical in determining how the U.S. government viewed the public lands in Arizona. If federal officials had considered the Gila River to be navigable, they would not have deeded out land lying in the channel or bed of the river. However, there is no indication in a multitude of federal patents overlying the Gila River from its confluence with the Salt River to where it joins the Colorado River that the U.S. Government hesitated to grant title to the bed and the banks of the river to patent applicants. (See Chapter 2 for a more detailed discussion of the significance of federal patents.) The U.S. National Archives in Washington, D.C., provided supporting paperwork for federal land patents such as applications and affidavits of witnesses. Federal patents and their files, combined with historical maps, were used to create Exhibits 1-5, which illustrate the location of all patents and federal land grants along the Gila River. (See maps folded inside front pocket of this report.)

Additional research at archives in the Phoenix area was carried out. This included contacting various local archives and the Arizona Historical Society to determine their respective holdings. Furthermore, the Arizona State Archives in Phoenix provided more rare state and territorial government documents and manuscript collections. These materials included the unpublished papers of agencies such as the Arizona State Land Department, the Arizona Water Commissioner, the Arizona State Planning Board, and the Arizona Secretary of State. The papers of the State Land Department were particularly useful for historical information on how the state disposed of the lands along the Gila River granted to it by the federal government.

After reviewing the historical records of the Arizona State Land Department at the State Archives, research was also done at the agency's Phoenix office. Although most of the patent information for land along the Gila River was found at the U.S. Bureau of Land Management in Phoenix and the U.S. National Archives in Washington, D.C., the Arizona State Land Department provided copies of patents issued by Arizona in parcels granted to the state by the federal government. Approximately fifty state patents were eventually reviewed. (See folded map 1A in the back pocket of this report for the location of some of these state patents.) Some of the corresponding application files for the state patents were also obtained and reviewed.

The Salt River Project Archives in Tempe was also a critical location for research. The material found at the Salt River Project Archives was useful as a lead-in to research at the U.S. National Archives in Washington, D.C. While at the National Archives, a wide variety of federal agency files, including those of the U.S. Bureau of Indian Affairs, the U.S. Army Corps of Engineers, the U.S. General Land Office, the Office of the Secretary of Interior, and the U.S. Geological Survey, were searched. These records contain unpublished paperwork substantiating the conclusions gleaned from published government documents.

Littlefield Research Associates also visited the Rocky Mountain branch of the National Archives (in Denver) to undertake a more thorough search of Record Group 115, records of the U.S.

Bureau of Reclamation. These records are organized into two chronological periods, with the 1902-1919 group containing material most relevant to this study. These records provided a rich source of information from an agency directly involved with management of the river around the time of statehood.

ORGANIZATION OF REMAINDER OF REPORT: Based on this extensive research, it became evident that the most important records dealing with the Gila River were U.S. General Land Office original surveys and patent records (both federal and state). Therefore, the first two chapters of this report deal with the significance of those documents. Other government documents (both published and unpublished) will be discussed in Chapter 3. Chapter 4 is a review of miscellaneous documents (such as diaries, journals, and accounts of explorations) as well as press accounts. Chapter 5 contains a discussion of boats typically used on western rivers around the turn of the century. Following a general summary and conclusions, there are appendices containing sources consulted as well as the vitae of Douglas R. Littlefield and his associate, Jennifer A. Holweger. An index is also provided at the end.

To facilitate reference throughout the main body of the report, footnotes run continuously rather than starting from number one in each chapter.

CHAPTER 1: U.S. GOVERNMENT HISTORICAL RECORDS -- FEDERAL SURVEYS

One of the largest and most important groups of records created in relation to the Gila River prior to and around the time of Arizona's statehood in 1912 are those of the U.S. government, especially federal surveys done by the U.S. General Land Office. When the United States became the owner of the vast territory acquired from Mexico after the end of the Mexican-American War in 1848, federal officials were anxious to determine the value of what the U.S. had gained. Moreover, they wanted to prepare the region for orderly occupation by American settlers to solidify control. To ready the new lands for homesteading and to record those lands' characteristics, the federal government undertook formal surveys conducted by the U.S. General Land Office -- the predecessor of today's U.S. Bureau of Land Management. Because those surveys were highly detailed, the original plats of the area near the Gila River and the related survey field notes contain a wealth of information about the nature of that stream.

SURVEYORS' MANUALS: Due to the need for accuracy and consistency in carrying out the federal surveys, the U.S. government issued a series of manuals to direct surveyors in their work. To grasp the significance of these manuals in relation to navigability, it is important to understand the books' provisions and how they changed over time.

The 1851 Manual: The 1851 Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations governed how some of the earliest public land surveys were done in the American

West. This manual had been adopted by the U.S. General Land Office to standardize survey work in California and Oregon, which were the most significant areas of western American settlement in the late 1840s. The manual was the first formal surveying handbook issued by the federal government to provide guidance for surveyors mapping the vast public domain acquired from Mexico; previously, the U.S. government had issued directions to surveyors in the field on an individual basis or through Surveyors General assigned to specific territories.[2]

The Instructions to the Surveyor General of Oregon provided that public lands were to be subdivided into a series of ever-smaller grids within grids to allow the precise location of individual tracts. This system would facilitate the disposal of the public domain in an orderly fashion and at the same time record the characteristics of that land in substantial detail. The largest grids were to be six miles square and were to be created by the surveying of township and range lines. The directions in the Instructions to the Surveyor General of Oregon providing for the establishment of these large blocks derived from the same process that had been used in other earlier public land territories and

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[2] The Instructions to the Surveyor General of Oregon is reprinted in C. Albert White's A History of the Rectangular Survey System on pages 433-456. White's book was published by the U.S. government in 1983 as a review of all practices used by federal surveyors on public domain lands since the initial surveys of the Old Northwest (today, Ohio and other parts of the upper Midwest) were undertaken in the late 1700s. Aside from a detailed history of those procedures, White's book reprints many of the original surveying instructions. See C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983).

states, and the size of the blocks was based on Thomas Jefferson's original estimate that each block, composed of many small farms, would be the proper size to support a town at its center. Jefferson's ideas were first enacted into law in the Land Ordinance of 1785, and the first surveys under this legislation were done what is today Ohio. The grid procedure was used in most new territories added to the United States in the years that followed.

To establish township and range lines, a base line and meridian were chosen within the state or territory to be surveyed. In Arizona, the initial base line and meridian intersected at a point on a hill just south of the junction of the Salt and Gila rivers. That location had been chosen in 1865 by John A. Clark, Surveyor General of New Mexico Territory, to begin the Arizona surveys. The beginning marker originally had been established by the Mexican Boundary Commission in 1851 as a point on the U.S.-Mexico border prior to the Gadsden Purchase of 1853, which created the present boundary between the United States and Mexico.[3]

Using the Gila and Salt River Base and Meridian to start, federal surveyors ran township and range lines in Arizona by working their way gradually north and south to create township lines and east and west to establish ranges. The 36 one-square-mile blocks that resulted were called townships (as distinct from township lines). Surveyors numbered the townships on the basis of how far north or south and east or west of the initial base and

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[3] C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), pp. 137, 147.

meridian they lay. For example, the first township to the north and east of the intersection of the Gila and Salt River Base and Meridian was identified as township 1 north, range 1 east. The township directly north of that was township 2 north, range 1 east, and the township to the east of that point was township 2 north, range 2 east. All townships to the south and west of the initial base and meridian were identified in a similar fashion. In the region of concern to this report -- the area along the Gila River from its confluence with the Salt River downstream to its juncture with the Colorado River near Yuma, Arizona -- the lands examined lie between township 1 north, range 1 west, and township 8 south, range 23 west. These townships and ranges in relation to the Gila River can be easily located on the portion of any of the folded maps in the front pocket of this report labelled "Area of Study."

With exterior township and range lines established, federal surveyors subsequently divided each township into thirty-six sub-blocks called "sections," most of which were 640 acres, or one mile square. Due to the curvature of the earth and other factors, surveyors sometimes had to slightly adjust the sections along the western and northern edges of each township to be more or less than a square mile. The sections were numbered within each township in an "S" fashion beginning with the northeast square and heading west for sections one through six. Section seven then appeared immediately south of section six, and sections then went east through section twelve. The remaining sections were numbered in the same "S" fashion until section thirty-six was reached in the southeastern most part of the township.

Surveyors laying out the township, range, and section lines were provided with very precise instructions for measuring these lines because accuracy was critical for these lands to be transferred out of the public domain in a reliable manner. In addition, for those areas remaining in the public domain, the precise rules for surveying and for noting the characteristics of the land gave the U.S. government an extremely valuable record of what it owned through the field notes that surveyors were required to make. The field notes were to include any notable features of the land such as streams, rivers, lakes, roads, irrigation ditches, or other prominent landmarks. Using their field notes, surveyors were then to draw and forward original survey maps to the Surveyor General of the respective state or territory along with the accompanying field notes for final approval.

The Instructions to the Surveyor General of Oregon contained several provisions that are relevant to navigable bodies of water and other obstructions and therefore are important in relation to any consideration of the Gila River's navigability or non-navigability. First, the instructions provided that when surveyors encountered "impassable obstacles, such as ponds, swamps, marshes, lakes, rivers, creeks, &c.," they were to extend the survey line from the opposite side of the obstacle using triangulation or other surveying techniques. In addition, the surveyors were to "state all the particulars in relation thereto in your field book." Moreover, the instructions continued,

> at the intersection of lines with both margins of impassable obstacles, you will establish a Witness Point, (for the purpose of perpetuating the intersections therewith) by setting a post, and giving in your field book the course and distance therefrom, to two trees on opposite sides of the line, each of which trees you will mark with a blaze and notch facing the post; but on the margins of navigable water courses, or navigable lakes, you will mark the trees with the proper number of the fractional section, township, and range.[4]

The Instructions to the Surveyor General of Oregon also provided that when surveyors encountered navigable bodies of water, special survey markers called "meander corner posts" were to be "planted at all those points where the township or section lines intersect the banks of such rivers, bayous, lakes, or islands, as are by law directed to be meandered."[5] (Federal legislation directing that navigable bodies of water be meandered was first passed in 1796, but that law did not specify what constituted navigability. Nonetheless, the 1796 law is now codified in 43 U.S.C. 931.) Therefore, where township, range, section, or fractional section lines encountered bodies of water, witness posts were to be established if those watercourses were **not** navigable,

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[4] Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations (1851), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 438.

[5] Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations (1851), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 439. On the federal legislation mandating meanders of navigable bodies of water, see White, A History of the Rectangular Survey System, p. 30.

but meander corner posts were to be placed where the lines intersected navigable bodies of water. As the instructions explained, surveyors were to note:

> [i]ntersections by line of **water objects**. All rivers, creeks, and smaller streams of water which the [survey] line crosses; the distance on line at the [witness] points of intersection, and their **widths on line.**" [Emphases in original.]

Surveying lines that intersected navigable bodies of water were to be done as follows:

> In cases of **navigable streams**, their width will be ascertained between **meander corners**, as set forth under the proper heading. [Emphases in original.][6]

Aside from these general directions, surveyors were also given precise instructions for measuring the sinuosities of navigable bodies of water, including rivers, streams, lakes, ponds, or bayous. Between the meander corner posts, the edges of the banks were to be measured going downstream by recording degree bearings. The details of this meander surveying were to be recorded in the surveyor's field book as a separate set of records from the surveys of township, range, and section lines.[7]

Finally, as if these instructions were not specific enough, the 1851 Instructions to the Surveyor General of Oregon contained detailed examples of surveying notes so that field surveyors would

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[6] Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations (1851), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 444.

[7] Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations (1851), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 442.

understand virtually any type of circumstance they might encounter.[8]

The 1855 Manual: Between 1851 and 1864, the U.S. General Land Office published only one revised version of the 1851 work. The 1855 manual (bearing the lengthy title Instructions to the Surveyors General of Public Lands of the United States, for Those Surveying Districts Established in and Since the Year 1850; Containing Also, A Manual of Instructions to Regulate the Field Operations of Deputy Surveyors, Illustrated by Diagrams) contained more detail than the 1851 instructions. Nevertheless, it remained virtually identical in substance with regard to recording navigable and non-navigable bodies of water.[9]

The 1864 Instructions: Nine years after the 1855 manual had appeared, the U.S. General Land Office began to modify its instructions for how surveyors dealt with navigable and non-navigable bodies of water. In 1864, the 1855 surveyors' manual was amended by Instructions to the Surveyors General of the United States, Relating to Their Duties and to the Field Operations of Deputy Surveyors. Because surveys in Arizona began in 1868, it was

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[8] C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), passim.

[9] For the 1855 discussion of how bodies of water were to be recorded, see Instructions to the Surveyors General of Public Lands of the United States, for Those Surveying Districts Established in and Since the Year 1850; Containing Also, A Manual of Instructions to Regulate the Field Operations of Deputy Surveyors, Illustrated by Diagrams (1855), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), pp. 458, 461, 464-465.

this set of instructions that governed how bodies of water in the territory were recorded.

The 1864 revision made no changes to the section of the 1855 manual that dealt with "insuperable objects on line." In fact, the 1864 amendments did not discuss these instructions at all, presumably leaving this part of the 1855 manual intact.

Regarding meanders and navigable streams, the 1864 amendments added some important criteria to which streams would be meandered:

> Rivers not embraced in the class denominated "navigable" under the statute [see page 16 regarding this law], but which are well-defined natural arteries of internal communication, and have a uniform width, will be meandered on **one bank.** [Emphasis added.]

The instructions added that for the sake of consistency, one-bank meanders were to be done on the right side (looking downstream) unless obstacles made it necessary to switch to the left bank. If a change to the left were made, it was to be done at a point where a survey line crossed the stream and recorded in the field notes.[10]

The 1881 Instructions: On May 3, 1881, the U.S. General Land Office once again updated its directions to federal surveyors by issuing Instructions of the Commissioner of the General Land Office to the Surveyors General of the United States Relative to the Survey of the Public Lands and Private Claims. In this manual, much of the instructions remained the same as in the 1855 manual as amended in 1864, including, for example, how surveyors were to

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[10] Instructions to the Surveyors General of the United States, Relating to Their Duties and to the Field Operations of Deputy Surveyors (1864), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 504.

establish witness posts at intersections with non-navigable "insuperable objects on line." Here, as in 1851 and 1855, the manual told surveyors to use triangulation to establish the distance across non-navigable obstacles on line. Also as in the 1851 and 1855 manuals, surveyors were to set a witness post on the line on each side of obstacle, and they were to measure to two trees on opposite sides of the line for each post. Each tree was to be marked with a notch and blaze facing the post, and the degree bearing and distance from the trees to their respective witness posts on line were to be noted in the field notes.[11]

For navigable bodies of water, as had been the case in the 1851 and 1855 manuals (as amended in 1864), the surveyors were told that "on the margins of navigable water-courses, or navigable lakes, you will mark the trees with the proper number of the fractional section, township and range." And similar to the 1851 and 1855 instructions, the 1881 manual provided that "[m]eander corners are established at all those points where the lines of the public surveys intersect the banks of such rivers, bayous, lakes, or islands as are by law directed to be meandered."[12] (See page

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[11] Instructions of the Commissioner of the General Land Office to the Surveyors General of the United States Relative to the Survey of the Public Lands and Private Claims (1881), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 516.

[12] Instructions of the Commissioner of the General Land Office to the Surveyors General of the United States Relative to the Survey of the Public Lands and Private Claims (1881), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), pp. 516-517.

16 above for the meaning of the phrase "as are by law directed to be meandered.")

In terms of how meanders were to be carried out, the 1881 manual repeated the information from the 1855 manual as well as the 1864 addition that rivers that were not navigable "under the statute" but that were "well-defined natural arteries of internal communication" were to be meandered on one bank only. The balance of the instructions for meandering was also drawn from either the 1855 instructions or the 1864 amendments.[13]

The 1890 Manual: Nine more years elapsed before the U.S. General Land Office revised its surveying instructions. On January 1, 1890, the agency issued its Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims. Many of the surveying instructions were identical or nearly identical to the previous work, including those for recording major obstacles. For example, the 1890 instructions about how to chronicle "insuperable objects on line" continued to provide that surveyors were to use triangulation to measure across the obstruction. Surveyors were still also instructed to set a witness post on line at the edge of the non-navigable obstacle, and to give the course and direction to two nearby trees on opposite sides of the line, each of which were to be notched and marked with

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[13] Instructions of the Commissioner of the General Land Office to the Surveyors General of the United States Relative to the Survey of the Public Lands and Private Claims (1881), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), pp. 523-524.

a blaze facing the witness post. And, as had been the case in the 1855, 1864, and 1881 manuals, the 1890 directions also stated that for navigable bodies of water, meander posts were to be set where lines intersected these obstacles, and meanders were to be run following the course of the river.[14]

A significant change had been made to the instructions for what bodies of water were to be meandered, however. Whereas in 1881, surveyors were to meander navigable streams (both sides) and any non-navigable body of water used for "internal communication" (on one side only), the 1890 manual deleted the instructions to meander non-navigable bodies of water that were used for "internal communication." In addition, the 1890 manual no longer told surveyors to meander streams that were considered navigable, as the 1881 manual had provided "under the statute." Instead, the 1890 instructions stated:

> Both banks of **navigable** rivers, as well as of all rivers not embraced in the class denominated as "navigable," the right angle width of which is **three chains** and upwards, will be meandered on **both** banks by taking the general courses and distances of their sinuosities, and the same are to be entered in the field book. Rivers not classed as navigable will not be meandered above the point where the average right-angle width is less than three chains. [Emphases in original.][15]

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[14] Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims (1890), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 560.

[15] Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims (1890), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 568.

In short, there had been two changes to what should be meandered: 1) navigable bodies of water (1881 -- "as are by law directed to be meandered" and "under the statute"; 1890 -- "embraced in the class denominated as 'navigable'"), and 2) non-navigable streams (1881 -- used for "internal communication," one bank to be meandered; 1890 -- no reference to use for "internal communication," but more than three chains wide, both banks to be meandered).

The 1894 Manual: On June 30, 1894, the U.S. General Land Office issued its <u>1894 Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims</u>. In relation to directions for meandering, the 1894 manual had major changes in what bodies of water were to be meandered. The new instructions still called for bodies of water "embraced in the class denominated 'navigable'" to be meandered. In addition, as had been the case in the 1890 manual, all non-navigable bodies of water that were more than three chains wide were to be meandered, but here the 1894 manual added another instruction. Both navigable and non-navigable streams (more than three chains wide) were to be meandered "at the ordinary **mean high water mark**" (emphasis in original), and their general courses and sinuosities were to be recorded in the appropriate field notebook. Furthermore, in another significant change, the 1894 manual provided that "[s]hallow streams, without any well-defined channel or permanent banks **will not be meandered**; except tide-water steams, whether more or less than three chains wide, which should be meandered at ordinary high-water mark, as far as tide-water extends." (Emphasis in original.)[16]

The 1902 Manual: Shortly after the turn of the century, the U.S. General Land Office once again revised its surveying handbook, releasing Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims on January 1, 1902. There were significant differences between the 1902 manual and its 1894 predecessor regarding meandering. First, the 1902 manual observed that the term "meander" had frequently been misapplied in the past by surveyors, which had important implications for lands adjoining the meander lines. The 1902 manual stated:

> The running of meander lines has always been authorized in the survey of public lands fronting on large streams and other bodies of water, but does not appear to have been proper in other cases. The mere fact that an irregular or sinuous line must be run, **as in the case of a reservation boundary**, does not entitle it to be called a meander line except where it closely follows a stream or lake shore. The legal riparian rights connected with meandered lines do not apply in case of other irregular lines, as the latter are strict boundaries. [Emphasis added.][17]

What the manual meant was that the beds and banks of bodies of water that were navigable (and thus meandered) were held by the

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[16] 1894 Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims (1894), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 621.

[17] Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims (1902), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 717.

states whereas the beds and banks of non-navigable bodies of water were held by the adjoining riparian land owners. Therefore, meander lines needed to be clearly identified and had to be distinct from other irregular survey lines, such as those utilized for marking the edges of Indian and other federal land reservations.

Regarding which bodies of water were to be meandered, the 1902 manual had one addition to the 1894 instructions. The new direction provided that streams less than three chains wide were not to be meandered:

> except that streams which are less than three chains wide and which are so deep, swift and dangerous as to be impassable through the agricultural season, may be meandered, where good agricultural lands along the shores require their separation into fractional lots for the benefit of settlers. But such meander surveys shall be subject to rejection if proved unnecessary by field inspection.[18]

The 1902 manual also retained the instruction that shallow streams "without any well-defined channel or permanent banks, will not be meandered; except tide-water streams, whether more or less than three chains wide, which should be meandered at ordinary high-water mark, as far as tide-water extends."[19]

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[18] Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims (1902), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 718.

[19] Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims (1902), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 718.

SUMMARY AND CONCLUSIONS REGARDING SURVEYORS' MANUALS AND MEANDERING: In short, by the time Arizona entered the Union on February 14, 1912, there had been substantial revisions and alterations to the instructions to federal surveyors concerning how they were to mark and record the intersection of survey lines with non-navigable and navigable bodies of water. Although initially, only navigable bodies of water were to be meandered, that direction had been expanded over the years to include some non-navigable bodies of water. In addition, as the 1902 instructions illustrated, surveyors also used the term "meander" (frequently incorrectly) to identify irregular survey lines along reservation boundaries.

U.S. GOVERNMENT SURVEYS IN THE GILA RIVER AREA: Prior to Arizona's statehood in 1912, various areas along the Gila River were surveyed and in some cases resurveyed, both in relation to exterior township and range lines as well as for interior section and subsection lines. Because surveyors whose work involved marking only exterior lines generally did not have the responsibility to undertake meanders where necessary (unless their contracts covered both interior and exterior surveys, which was true in many cases), the field notes of the exterior surveys are of limited value to this report. Therefore, exterior surveys will not be discussed here. Instead, the field notes of interior surveys and resulting plats will be examined in detail for information regarding those surveyors' judgments and descriptions regarding the Gila River's navigability or non-navigability.

The interiors of the townships through which the Gila River flows between the confluence with the Salt River and the juncture with the Colorado River were surveyed initially over a wide range of years, most of which were prior to statehood. Those surveys took place in 1868, 1871, 1874, 1877, 1878, 1882, 1883, 1890, 1910, and 1911. A resurvey of a part of one township was also undertaken in 1907. In addition, several townships were not surveyed until after Arizona's statehood on February 14, 1912. Those surveys took place in late 1912, 1915, and 1936. Because of the large number of different survey dates, cumulatively they were done according to the instructions of many of the survey manuals discussed above. Significantly, while there were nine federal surveyors who mapped the Gila between the Salt and Colorado rivers prior to 1912 and while those surveys were done under the instructions of many different survey manuals, all surveyors indicated in their field notes and plats that they did not consider the Gila River to be navigable.

Because of the importance of these initial federal surveys in relation to establishing the nature of the Gila River, they will be discussed in detail here. In general, the discussion will be in a down-river manner. In addition, while the field notes and plats for all townships along the Gila below the Salt River have been reviewed, most of the examples discussed in this report will be drawn from field notes and plats for areas covered by the detailed sample maps created for this report. Due to the length of the Gila involved in this study, representative sampling was necessary to keep the discussion in manageable proportions. The sample areas can be seen on Exhibits 1-5, which are folded inside the front pocket of this report. Nothing in the field notes and plats for townships outside the sample areas, however, contradicts findings from the sample areas. Within individual townships discussion will also be downriver. In terms of the field notes and resulting township plats, since surveyors' notes were compiled in the field and plats were later drawn based on the notes, the notes for each township survey will be discussed first followed by the corresponding plats.

U.S. GOVERNMENT SURVEYS OF LANDS ALONG THE GILA RIVER ON EXHIBIT TWO: The first sample area covers parts of township 1 north, township 1 south, and ranges 1 and 2 west, and is detailed on Exhibit Two in the front pocket of this report. (Exhibit One is a general location map of Exhibits 1-4 in relation to the entire Gila River between the Salt and the Colorado.)

1868 Interior Survey of Township 1 North, Range 1 West (Field Notes): On June 22, 1868, G.P. Ingalls surveyed the interior subdivision lines of township 1 north, range 1 west. His field notes indicate that he encountered the Gila River on lines between sections 30 and 31, 31 and 32, 32 and 33, 33 and 34, and 34 and 35. As he crossed the Gila at each of these places, he set no meander corners (as he would have been required to do under the 1864 surveying instructions had he considered the stream to be navigable). Aside from mentioning a rapid current and sandy bottom, he offered no other characterizations of the Gila other than to state "[i]t is a fine stream."[20]

1868 Interior Survey of Township 1 North, Range 1 West (Plat): Ingalls's plat of township 1 north, range 1 west (see page 47), further confirmed that he did not consider the Gila to be navigable. There were no meander lines on the plat, and in the box at the bottom of the plat identifying which surveyor had conducted various parts of the survey, there was no indication that anyone had undertaken meander surveys. Moreover, there was no survey data recorded in the margin of the plat, as there would have been had meanders been done.[21]

1883 Interior Survey of Township 1 North, Range 2 West (Field Notes): When R.C. Powers surveyed the interior subdivision lines of township 1 north, range 2 west, in 1883, he gave no indication in the field notes that he considered the Gila River to be navigable. The Gila ran through the southeast corner of this township. When Powers crossed the river on the line between sections 25 and 26, he set no meander corners, but he indicated that the stream was characterized by "shallow water & rapid current." He made a similar observation about the river on the line between sections 34 and 35, but again set no meander corners.

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[20] "Field Notes of the Survey of Township 1 North, Range 1 West, Gila and Salt River Meridian," 1868, vol. R1, pp. 375-376, 387, 398, 408-409, 423, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 35/13].

[21] Survey Plat of Township 1 North, Range 1 West, 1868, Gila and Salt River Meridian, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 35/13].

Finally, on the line between sections 26 and 35, he set no meander corners, but offered the description that the stream there had "deep water and low banks." In his general description of the township, Powers wrote: "This township is mostly good land and if the waters of the Gila River would be conducted in a ditch to the land for irrigation (which could be done with some expense) the land could be made very valuable and productive."[22]

1883 Interior Survey of Township 1 North, Range 2 West (Plat): Like the field notes, the plat of township 1 north, range 2 west (see page 48), drawn by Powers, gave no suggestion that he thought the Gila was navigable. There were no meander lines run along the Gila. No surveyor was identified as having done meanders, and the box in the right margin labelled "meanders of" had no entries for meander data. The plat did indicate, however, that roads ran parallel to the stream on both banks, suggesting that commerce was carried on in the valley by land and not by water.[23]

1907 Interior Resurvey of Township 1 North, Range 2 West (Field Notes): Between May 29 and June 16, 1907, John F. Hesse resurveyed township 1 north, range 2 west. Nowhere in the field notes did he record any meander data. Hesse did, however, indicate that the stream was eighteen inches to two feet deep.

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[22] "Survey Field Notes of Township 1 North, Range 2 West, Gila and Salt River Meridian," 1883, vol. R1006, pp. 7, 22-24, 92, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 35/14].

[23] Survey Plat of Township 1 North, Range 2 West, Gila and Salt River Meridian, 1883, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 35/14].

In his general description of the township, Hesse wrote that the soil was generally "1st. rate, and if supplied with water would raise abundant crops. . . . The southwestern cor. of the township is settled and is well watered by the Buckeye canal which runs through the township."[24]

1907 Interior Resurvey of Township 1 North, Range 2 West (Plat): On the plat of the 1907 resurvey of this township (see page 49), Hesse drew no meander lines, and no surveyor was identified as having done meanders. Moreover, no meander data appeared in the margins of the plat. Roads appeared paralleling the river, and several irrigation ditches are shown, including the Buckeye Canal.[25]

1883 Interior Survey of Township 1 South, Range 2 West (Field Notes): Moving down the Gila, R.C. Powers undertook the survey of the interior section lines for township 1 south, range 2 west, between January 11 and 15, 1883. In each encounter with the Gila River in this township, Powers treated the stream in his field notes as a non-navigable body of water. He set no meander posts at the edges of the stream where section lines intersected it, and he ran no meander lines along the stream. His only comment on the river was in the general description of the township at the end of

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[24] "Resurvey Field Notes of Township 1 North, Range 2 West, Gila and Salt River Meridian," 1907, vol. R2055, pp. 105, 109, 133, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 35/14].

[25] Resurvey Plat of Township 1 North, Range 2 West, Gila and Salt River Meridian, 1907, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 35/14].

the notes, where he indicated that there was "plenty of water in the Gila River for irrigation."[26]

1883 Interior Survey of Township 1 South, Range 2 West (Plat): On February 21, 1883, Surveyor General J.W. Robbins approved the survey plat filed with his office of township 1 south, range 2 west (see page 50). Suggesting that surveyor R.C. Powers did not consider the Gila to be navigable is the fact that no meander lines appeared on the plat. Furthermore in the right hand margin there is a blank table to record meander bearings of any navigable bodies of water, but no data were filled in. Other indicators on the plat that further suggested that the Gila was not navigable include a dam across the river and the presence of irrigation ditches. Moreover, a road roughly paralleled the river on the south side.[27]

U.S. GOVERNMENT SURVEYS OF LANDS ALONG THE GILA RIVER ON EXHIBIT THREE: Moving downstream, the next sample area encompasses parts of townships 3, 4, and 5 south, ranges 4 and 5 west.

1871 Interior Survey of Township 4 South, Range 4 West (Field Notes and Plat): Solomon W. Foreman surveyed the interior subdivision lines of townships 4 and 5 south, range 4 west, between March 21 and April 15, 1871. In township 4 south, range 4 west, the Gila River, in several channels, flowed from north to south

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[26] "Field Notes of the Survey of Subdivision Lines of Township 1 South, Range 2 West, Gila and Salt River Meridian," 1883, vol. R1166, pp. 50, 65, 67, 89, and 97, with quotation at 97, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 19/1].

[27] Survey Plat of Township 1 South, Range 2 West, Gila and Salt River Meridian, 1883, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 19/1].

through sections 5, 8, 17, 20, 29, and 32, while in township 5 south, range 4 west, the Gila coursed through sections 5, 7, 8, and 18.

It is important to note here that the surveys of these two townships were done under instructions contained in the 1864 surveying manual (see page 18 above), which provided that "rivers not embraced in the class denominated 'navigable' under the statute, but which are well-defined natural arteries of internal communication, and have a uniform width, will be meandered on one bank."[28] This instruction is relevant to Foreman's assessment of the navigability of the Gila River because he set meander corners on portions of the stream in both townships, but the purpose of those meander corners only becomes clear when considering both townships. For example, in part of township 4 south, range 4 east, Foreman set meander corners on the outermost banks of the Gila (which flowed in several channels in this township). Nevertheless, he set no meander corners in the sections through which the stream flowed in the southern part of the township.[29]

The inconsistency in Foreman's treatment of the Gila River in township 4 south, range 4 west, is further complicated by the fact

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[28] Instructions to the Surveyors General of the United States, Relating to Their Duties and to the Field Operations of Deputy Surveyors (1864), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), p. 504.

[29] "Field Notes of the Survey of the Sub-division Lines in Township No. 4 South, Range No. 4 West, of Gila and Salt River Meridian," 1871, vol. 1161, pp. 45-47, 49-50, 51-52, 54-55, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 19/7].

that he recorded no meander bearings in the volume of field notes containing the details of this township's survey. Moreover, no meander data appear on the plat of the survey and in the box on the plat identifying which surveyors accomplished various parts of the township's survey, there is no entry for a meander surveyor.[30]

Although this survey information for township 4 south, range 4 west, is confusing, perhaps shedding some light on Foreman's opinion of the Gila River's navigability in the township is the fact that he noted the presence of a road running parallel to the stream. Moreover, in his general description of the township, he observed that there was ample water in the Gila for irrigation of adjacent lands.[31]

1871 Interior Survey of Township 5 South, Range 4 West (Field Notes): Foreman's observations of the Gila River in relation to its possible navigability may have been ambiguous for township 4 south, range 4 west, but his opinion on that matter is clarified by how he treated the river in the field notes and plat of his survey of township 5 south, range 4 west (the next downstream township). Foreman surveyed the interior subdivision lines of this township between March 21 and 28, 1871. In each encounter with the Gila as he ran lines between sections 5 and 8, 8 and 7, and 7 and 18,

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[30] Survey Plat of Township 4 South, Range 4 West, Gila and Salt River Meridian, 1871, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 19/7].

[31] "Field Notes of the Survey of the Sub-division Lines in Township No. 4 South, Range No. 4 West, of Gila and Salt River Meridian," 1871, vol. 1161, pp. 49-52, 61-62, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 19/7].

Foreman set meander corners only on the left edges of the Gila. Even though setting meander corners on the right banks of "rivers not embraced in the class denominated 'navigable' under the statute, but which are well-defined natural arteries of internal communication, and have a uniform width" was required under the provisions of the 1864 surveying manual, Foreman explained in the meander section of the field notes for this township that "the reason for selecting the left bank for meanders is that all the lands of value are on the left bank[.]" He added that the lands on the right bank soon "pinched out" due to the proximity of mountains, and again he observed the presence of a road running parallel to the river.[32]

1871 Interior Survey of Township 5 South, Range 4 West (Plat): The plat of township 5 south, range 4 west (see page 51 below), was approved by the Surveyor General on May 1, 1871, and although it contained no meander data, the rigid turns in the river's sinuosities indicated that meanders had been run in accordance with the instructions of the 1864 surveying manual for non-navigable streams that served as arteries for internal communication. The presence of the road on the plat confirms this conclusion.[33]

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[32] "Field Notes of the Survey of the Subdivision Lines of Township 5 S., Range 4 W., Gila and Salt River Meridian," 1871, pp. 56, 58, 60, 64-65, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 20/4].

[33] Survey Plat of Township 5 South, Range 4 West, Gila and Salt River Meridian, 1871, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 20/4].

U.S. GOVERNMENT SURVEYS OF LANDS ALONG THE GILA RIVER ON EXHIBIT FOUR: The next sample area downstream encompasses parts of townships 7 and 8 south, and parts of ranges 16 to 18 west.

1878 Interior Survey of Township 8 South, Range 16 West (Field Notes): The interior subdivision lines of townships 7 and 8 south, range 16 west, were surveyed by John L. Harris between January 21 and 31, 1878. Because Gila River cut through only a small part of township 7 south, range 16 west, that township's survey will not be discussed here. Nevertheless, Harris's treatment of the Gila in both townships was similar and indicated a non-navigable river.

The field notes of Harris's survey of township 8 south, range 16 west, were approved by the Surveyor General on April 1, 1878. This survey was done under the terms of the 1864 federal surveying manual (see page 18 above).

The Gila River cut through parts of sections 1, 2, 3, 4, 5, 9, 7, 8, and 18, and at each of these places, Harris set no meander posts. Instead, he measured across on line as the directions provided for non-navigable bodies of water. Moreover, Harris wrote no meander survey data in his field notes, and he also observed the presence of an old bank of the river -- suggesting channel changes -- along the south side of the stream. Finally, like surveyor Foreman, Harris also recorded the presence of the road from Yuma to Tucson running roughly parallel to and south of the stream. His general description of the township indicated that lands along the Gila could be irrigated with the river's water.[34]

1878 Interior Survey of Township 8 South, Range 16 West (Plat): Harris's plat (see page 52) of township 8 south, range 16 west (which was approved by the Surveyor General on the same day as his field notes of the township) also indicated that Harris did not consider the Gila River to be navigable for several reasons. First, no meander data appeared in the right margin, as it would have had Harris thought the river was navigable. Second, in the box at the bottom of the plat where surveyors and their respective surveys were listed, there were no entries for meander surveys. Third, the plat, like the field notes, clearly indicated that the road from Yuma to Tucson ran roughly parallel to the stream on its south side. Finally, Harris had drawn the "old bank" in at least five places where that feature crossed a section line. The presence of the old bank suggested that the stream had recently changed channel, suggesting its unreliability for commercial transport.[35]

1878 Interior Survey of Township 8 South, Range 17 West (Field Notes): Harris also surveyed the interior subdivision lines of township 8 south, range 17 west. The field notes of this survey,

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[34] "Field Notes of the Subdivision Lines of Township 8 South, Range 16 West, Gila and Salt River Meridian," 1878, vol. 1171, pp. 11, 22, 33, 43, 44, 56-58, 61, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 21/7].

[35] Survey Plat of Township 8 South, Range 16 West, Gila and Salt River Meridian, 1878, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 21/7].

which was done between February 7 and 11, 1878, were approved by the Surveyor General on April 1, 1878.

The Gila River crossed sections 13, 14, 11, 15, 22, 21, 20, and 19. At the lines between each of these sections, Harris set no meander posts. In addition, he wrote in his general description of the township that the Gila River's waters could be useful for irrigation. He gave no similar indication that shipping could be accomplished on the stream: "With the exception of some poor soil immediately along the river, and along a sand bank extending across the township just S. of the river, this entire township presents a surface of very rich soil, while the Gila river flowing through the center of the township contains an abundance of water which can be used for the irrigation of the lands in this township."[36]

1878 Interior Survey of Township 8 South, Range 17 West (Plat): Like the field notes of township 8 south, range 17 west, several features of the plat of that township (see page 53 below) indicate that Harris did not consider the Gila to be navigable. First, there were no meander data in the right margin of the plat as there would have been had he considered the stream to be navigable. Second, there was no entry for any surveyor having done meander lines in the box recording who undertook what portion of the surveys of the township. Finally, the presence of two roads roughly paralleling the river -- one to the north and the other to

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[36] "Field Notes of the Subdivision Lines of Township 8 South, Range 17 West, Gila and Salt River Meridian," 1878, vol. 1172, pp. 1, 18, 19, 27, 28, 38, 51, and 61 (with quotation at 61), U.S. Bureau of Land Management, Phoenix [LRA Box/File: 21/8].

the south -- suggested that the river was not used to carry commerce or people.[37]

U.S. GOVERNMENT SURVEYS OF LANDS ALONG THE GILA RIVER ON EXHIBIT FIVE: Exhibit Five covers parts of township 8 south, ranges 21 and 22 west.

1890 Interior Survey of Township 8 South, Range 21 West (Field Notes): The next sample area downstream is township 8 south, range 21 west. The initial subdivision survey of this township was done between September 18 and October 4, 1890, by James H. Martineau using the new manual for surveying instructions that had been issued on January 1, 1890 (see page 21 above). The field notes of the survey were approved on December 19, 1890, by the Surveyor General.

The Gila River ran from east to west through parts of sections 1, 2, 3, 4, 9, 8, 17, 18, and 19, and at each place where Martineau encountered the Gila River on lines between these sections, he set meander corners on both banks. He observed that the Gila was in some places over well over five chains wide, and in some places it was so deep that he was forced to swim to the other bank to continue running section lines. Despite these statements, Martineau clearly did not consider the Gila River to be navigable because he explained in his field notes that his setting of meander corners on both banks was consistent with the new January 1890 instructions directing surveyors to meander both banks of

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[37] Survey Plat of Township 8 South, Range 17 West, Gila and Salt River Meridian, 1878, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 21/8].

non-navigable bodies of water if on average they were more than three chains wide. Confirming the lack of navigability of the Gila, Martineau also noted the presence of the road from Yuma to Gila City and the Southern Pacific Railroad, both of which paralleled the stream.[38]

Martineau's general description of the township added the following characterization of the Gila River: "The only water in the township is that in the Gila river, which is sometimes dry for three months in summer, but at the date of this survey and during all [the past] summer a large stream has constantly flowed into the Colorado near Yuma."[39]

1890 Interior Survey of Township 8 South, Range 21 West (Plat): The plat of this township (see page 54 below), which was approved by the Surveyor General on December 18, 1890, clearly indicated that the Gila River had been meandered. Meander notes appeared in the right margin of the plat labeled "Meanders of Gila River," and Martineau was identified as the meander surveyor in the box listing surveyors and the parts of the township survey they had undertaken. Moreover, meander lines were apparent on the plat

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[38] "Field Notes of the Subdivision Lines and Meanders of Township 8 South, Range 21 West, Gila and Salt River Meridian," 1890, vol. 1213, pp. 34-35, 38-39, 44-46, 47, 49-54; vol. 1214, pp. 56-59, 62-64, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 22/2].

[39] "Field Notes of the Subdivision Lines and Meanders of Township 8 South, Range 21 West, Gila and Salt River Meridian," 1890, vol. 1214, pp. 91-92, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 22/2].

itself. In addition, immediately below the plat was the notation that water surface area amounted to 368.58 acres.

Nevertheless, confirming that Martineau determined the river to be non-navigable, the road from Yuma to Gila City recorded in the field notes was portrayed as running parallel to the river on its north side, while the Southern Pacific Railroad was shown parallel to the river on the south side.[40]

1874 Interior Survey of Township 8 South, Range 22 West (Field Notes): The field notes of the 1874 survey of the next township downstream (township 8 south, range 22 west) corroborate that Martineau's meanders of the Gila had been done because the stream was non-navigable and over three chains wide. Between February 26 and March 4, 1874, Theodore F. White surveyed the interior subdivision lines in township 8 south, range 22 west, and the field notes of that survey were approved on May 9, 1874, by the Surveyor General. The Gila River ran through the township from east to west, crossing parts of sections 13, 24, 23, 22, 15, 21, 20, 29, and 30.

In addition to running section lines, White meandered the Gila River, but not because he deemed it navigable. White's surveying instructions were those found in the 1864 manual (see page 18 above), which called for meandering only one bank of non-navigable streams that served as routes for internal communication. Following those instructions, White had meandered the right bank in

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[40] Survey Plat of Township 8 South, Range 21 West, Gila and Salt River Meridian, 1890, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 22/2].

sections 21, 20, 29, and 30, and the left bank in sections 22, 23, 24, and 13. He indicated in his notes that he shifted from one bank to the other as the surveying instructions provided because of the difficulty in finishing the one-bank meander on the right bank.[41]

1874 Interior Survey of Township 8 South, Range 22 West (Plat): White's plat of township 8 south, range 22 west (see page 55), was approved on May 10, 1874, by the Surveyor General. Several features of this plat are noteworthy in relation to the question of the navigability of the Gila River. First and most obviously are the presence of meander data in the right margin of the plat and identification of White as the surveyor who had done meanders at the bottom of the plat. The meander data illustrated that only one bank was meandered in each section. The drawing of the river itself showed more rigid angular bends in the river's bank on one side where the meanders were conducted. In addition, a road ran paralleling the Gila to the south.[42]

U.S. GOVERNMENT SURVEYS OF LANDS ALONG THE GILA RIVER OUTSIDE EXHIBITS TWO TO FIVE: The survey field notes and plats of the sample areas discussed above clearly indicate that multiple surveyors -- undertaking their surveys in different years and at

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[41] "Field Notes of the Survey of the Subdivision Lines of Township 8 South, Range 22 West, Gila and Salt River Meridian," 1874, vol. 1174, pp. 5, 6, 16, 27-28, 38, 48-49, 60-62, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 22/3].

[42] Survey Plat of Township 8 South, Range 22 West, Gila and Salt River Meridian, 1874, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 22/3].

disparate times of year -- all reached the same conclusion that the Gila River was not navigable. Nothing in survey data from other townships along the Gila between the Salt and Colorado rivers contradicts these findings. Nevertheless, a few other examples from field notes and plats not on Exhibits 2-5 will underscore the unanimity among federal surveyors, whose work was done over many years and at differing times of year, that the Gila was not navigable. These will be discussed in a down-river fashion.

1871 Interior Survey of Township 5 South, Range 5 West (Field Notes): Between March 4 and 11, 1871, Solomon W. Foreman surveyed the interior subdivision lines of township 5 south, range 5 west. The Gila River flowed westward through sections 13, 14, 15, 16, 9, 8, and 7 of this township.

As Foreman ran the line north between sections 13 and 14, he first crossed the road to Yuma, running parallel to the Gila River. He then encountered the Gila at 67.80 chains, and he set a meander post on the left (south) bank of that stream. In addition, he observed that the "river runs west & has a smooth lively current. Water not too deep to cross on line." Reaching the right bank, Foreman set another corner, noting that the bank was "low on n. side & land subject to overflow."[43] He made similar observations and set posts (sometimes calling them meander posts and sometimes not) while running the lines between sections 14 and 15, 15 and 16,

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[43] "Field Notes of the Survey of Township 5 South, Range 5 West, Gila and Salt River Base and Meridian," 1871, vol. 1164, p. 7, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 20/5].

16 and 9, 9 and 8, and 8 and 7. Foreman subsequently listed the meanders of the Gila in this township.[44]

Following the meander data, Foreman added what he called "explanations and description" for the township. In this part of the field notes, he observed that while he had set meander corners on both banks of the stream throughout the township where section lines crossed the Gila, he had only actually meandered the left bank. This was consistent with the 1864 surveying manual, which provided that non-navigable bodies of water were to be meandered if they were more than three chains wide and were well-defined routes for internal communication. He explained:

> The lands north of the Gila River being almost worthless, on account of the low bottom land & the near approach of the mountains to the river & the banks on the south side being high & the lands superior quality, I deemed it best to meander the left bank of the river. The Gila is at times subject to very high freshets, and at all times even at a low stage of water as at present runs a volume of water equal to about 100,000 inches. It has a fall of about 20 feet to the mile in this township and flows over a sandy bottom and is fordable at nearly all points except in time of high water, when it becomes almost impassable for boats [to cross the river], which precludes men from owning farms lying on both sides of the river -- hence the necessity for meandering the stream. The lands in this township south of the Gila is [sic] of very superior quality for agricultural purposes and can mostly be irigated [sic] from the river. A company is almost organized to construct an immense canal, beginning 20 miles above here and leading the

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[44] "Field Notes of the Survey of Township 5 South, Range 5 West, Gila and Salt River Base and Meridian," 1871, vol. 1164, pp. 16, 26, 39, 41, 56, 61-63, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 20/5].

water down & parallel to the river to a point some 12 miles below this township.[45]

1871 Interior Survey of Township 5 South, Range 6 West (Field Notes): Foreman also surveyed the subdivision lines of township 5 south, range 6 west, in 1871. The Gila River flowed through parts of sections 1 and 2 of this township, and as he had in his field notes of township 5 south, range 5 west, Foreman recorded meanders of the left bank of the stream in this township. He offered this explanation for meandering only the left bank: "Note: The left bank of the river is taken by me in preference to the right bank because the lands north of the Gila in this township are worthless."[46]

1910 Interior Survey of Township 5 South, Range 8 West (Field Notes): On December 14 and 15, 1910, John F. Hesse surveyed part of the interior subdivision lines of township 5 south, range 8 west. This was the first survey of any subdivision lines in this township, and it covered only sections 3 to 6. The Gila River ran through parts of sections 5, 6, and through a corner of unsurveyed section 7. The survey field notes were approved by the Surveyor General on April 12, 1911.

Hesse's notes indicated that while most of the Gila was dry, a small stream ran through its bed about seven inches deep. No

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[45] "Field Notes of the Survey of Township 5 South, Range 5 West, Gila and Salt River Base and Meridian," 1871, vol. 1164, pp. 60-61, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 20/5].

[46] "Field Notes of the Survey of the Subdivision Lines of Township 5 South, Range 6 West, Gila and Salt River Base and Meridian," 1871, vol. 1156, p. 62, U.S. Bureau of Land Management, Phoenix [LRA Box/File: 20/6].

meander notes appeared in these field notes, and the index diagram page, which showed where notes for various lines were in the volume, had a blank line where a meander note page would be listed. Hesse wrote in his general description of the township: "The Gila River runs through secs. 5 and 6, a small stream of water which sinks in the sand and rises again all along its course through these secs. The water is very brackish and not good for domestic purposes."[47]

SUMMARY AND CONCLUSIONS REGARDING U.S. GOVERNMENT SURVEYS ALONG THE GILA RIVER: Federal government surveyors were specifically charged with the task of identifying navigable streams as part of their surveying duties, and the manuals and instructions under which they carried out their work were very precise about how navigable bodies of water were to be distinguished from non-navigable ones. As part of the U.S. government's surveying efforts, the areas along the Gila River were surveyed and resurveyed many times. Significantly, while those surveys were done at varying times of year, in different years, and by several individuals, all of the descriptions and plats that resulted from this work consistently portrayed the Gila River as being a non-navigable stream.

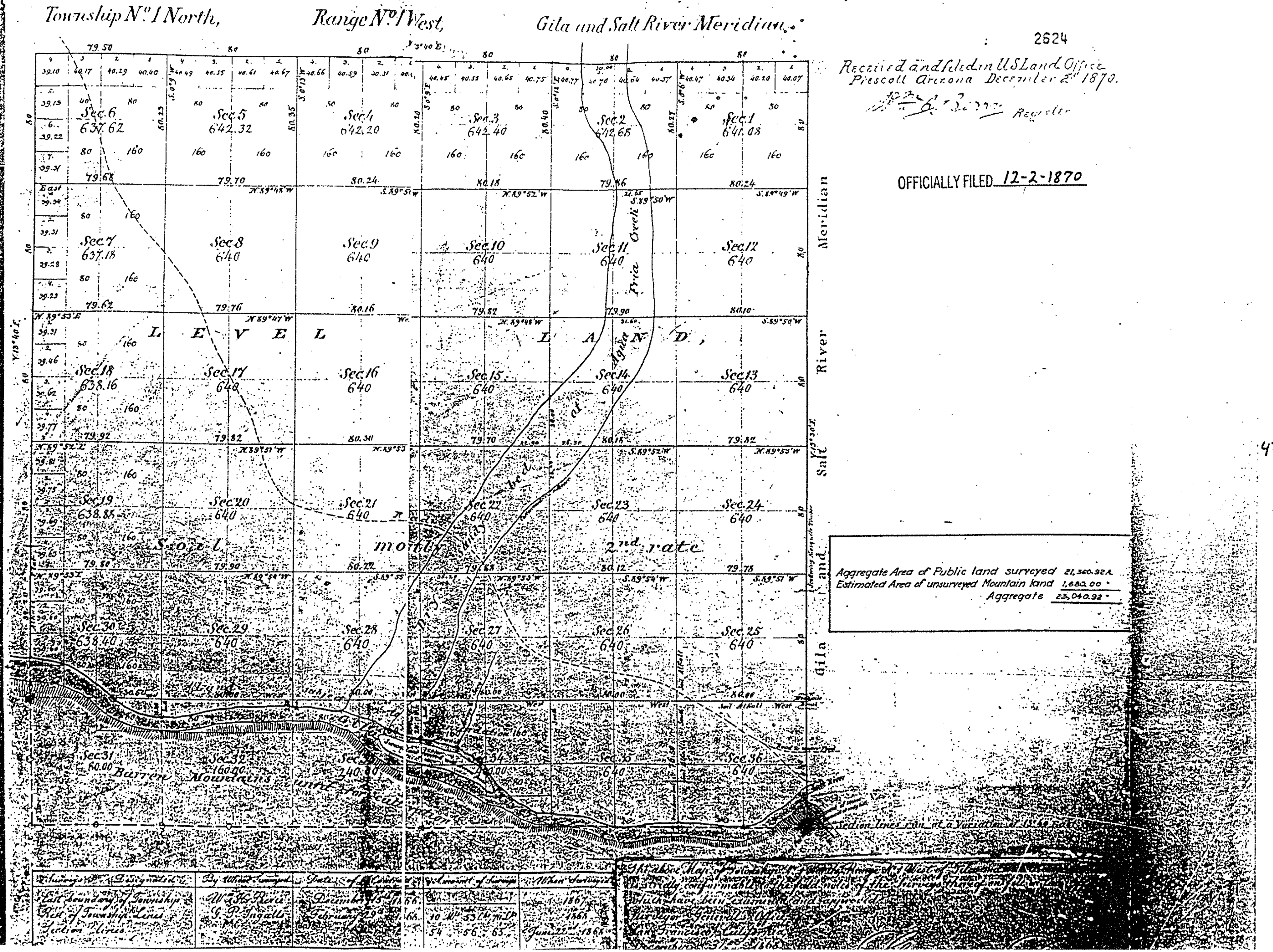
[47] "Field Notes of the Survey of the Subdivision Lines of Township 5 South, Range 8 West," 1911, vol. 2233, pp. 1-2, 60 (with quotation at 60), U.S. Bureau of Land Management, Phoenix, 04/12/1911) [LRA Box/File: 20/8].

2624

Received and filed in U S Land Office Prescott Arizona December 2nd 1870.

Register

OFFICIALLY FILED 12-2-1870

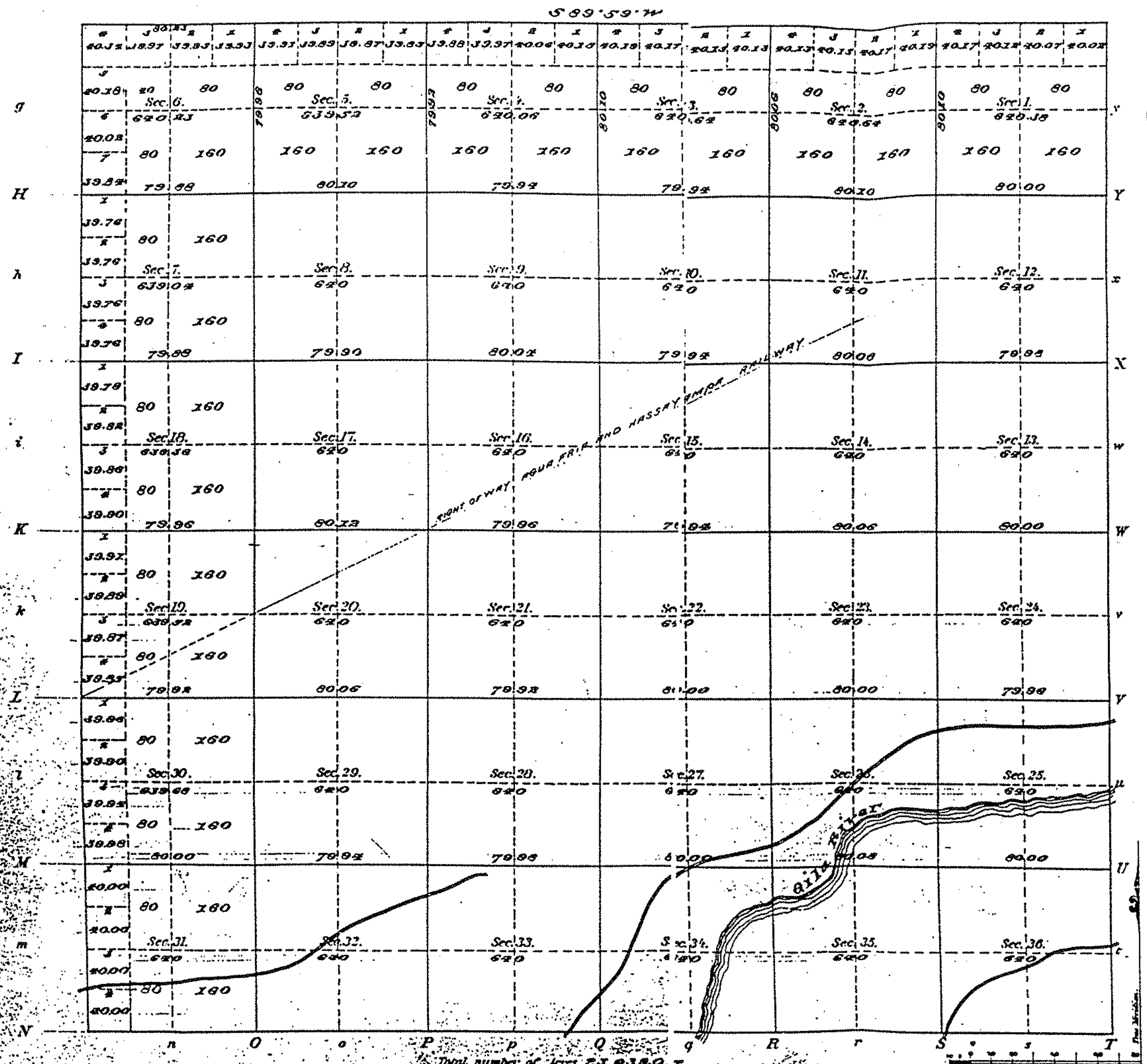


47

Township No. 1 North Range No. 2 West, Gila and Salt River Meridian Ariz.

2627

OFFICIALLY FILED 4-23-1883



Total number of Acres 23,038.0

Surveys Designated.	By Whom Surveyed.	Date of Contract.	Amount of Surveys M. Ch. L.	When Surveyed.
Township lines	B.C. Powers	Oct. 22, 1882	16 00 23	[illegible]
Subdivisions	" "	" " "	59 78 60	[illegible]
BASE LINE.	" "	" " "	6 00 00	Dec. 5-6, 1882

The above Map of Township No. 1 North of Range No. 2 West Gila & S.R. Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

Surveyor General's Office.
Tucson, Feb. 21, 1883.

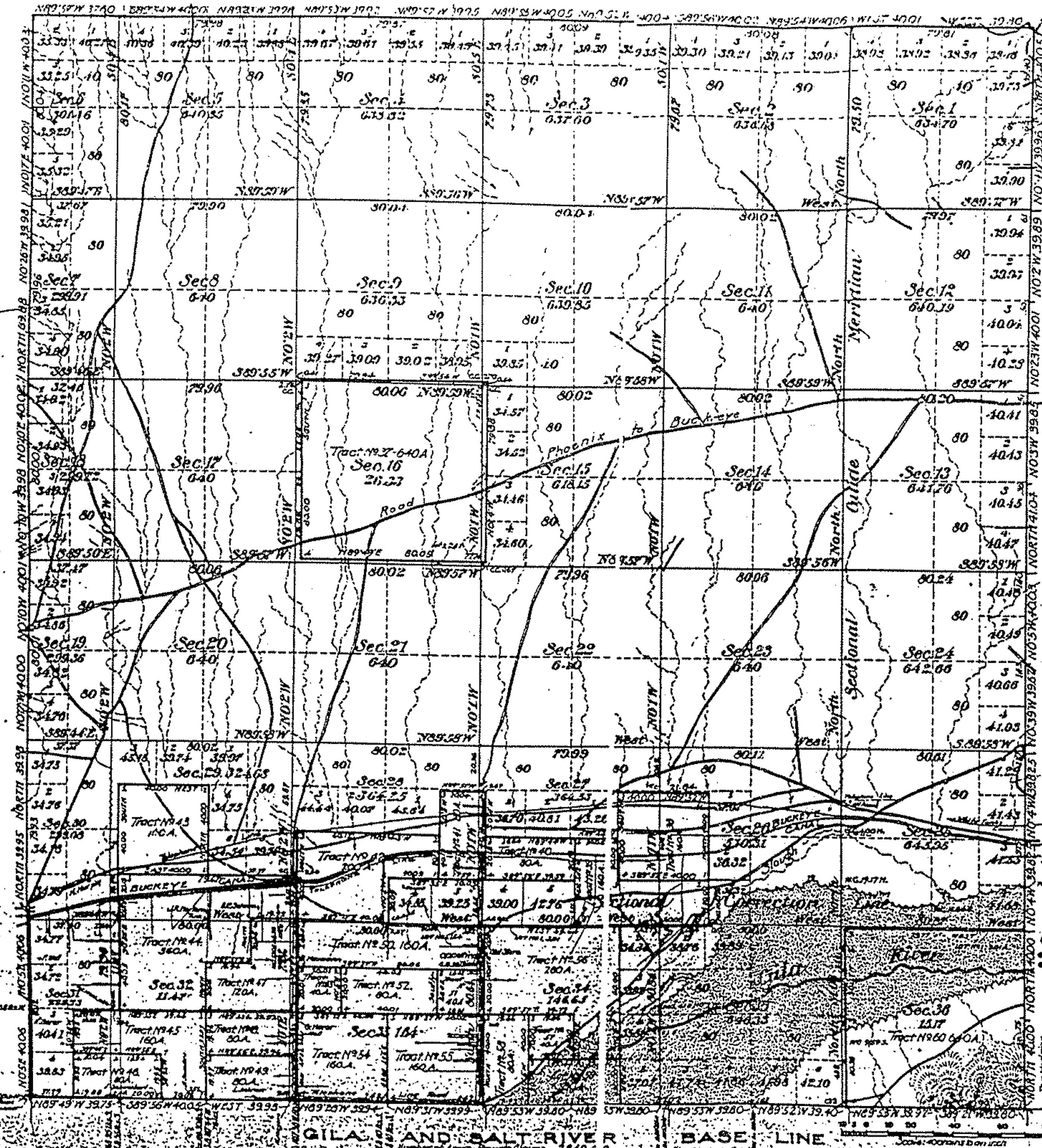
J.W. Robbins
Sur. Gen.

Copied From L.O. Plat May 23 1883

p. 4

Plat of the Resurvey of Township No. 1 North, Range No. 2 West, Gila and Salt River Meridian, Arizona.

OFFICIALLY FILED



Number of Acres, Private Claims 2840.00
School Sections 1280.00
Public Land
Total number of acres

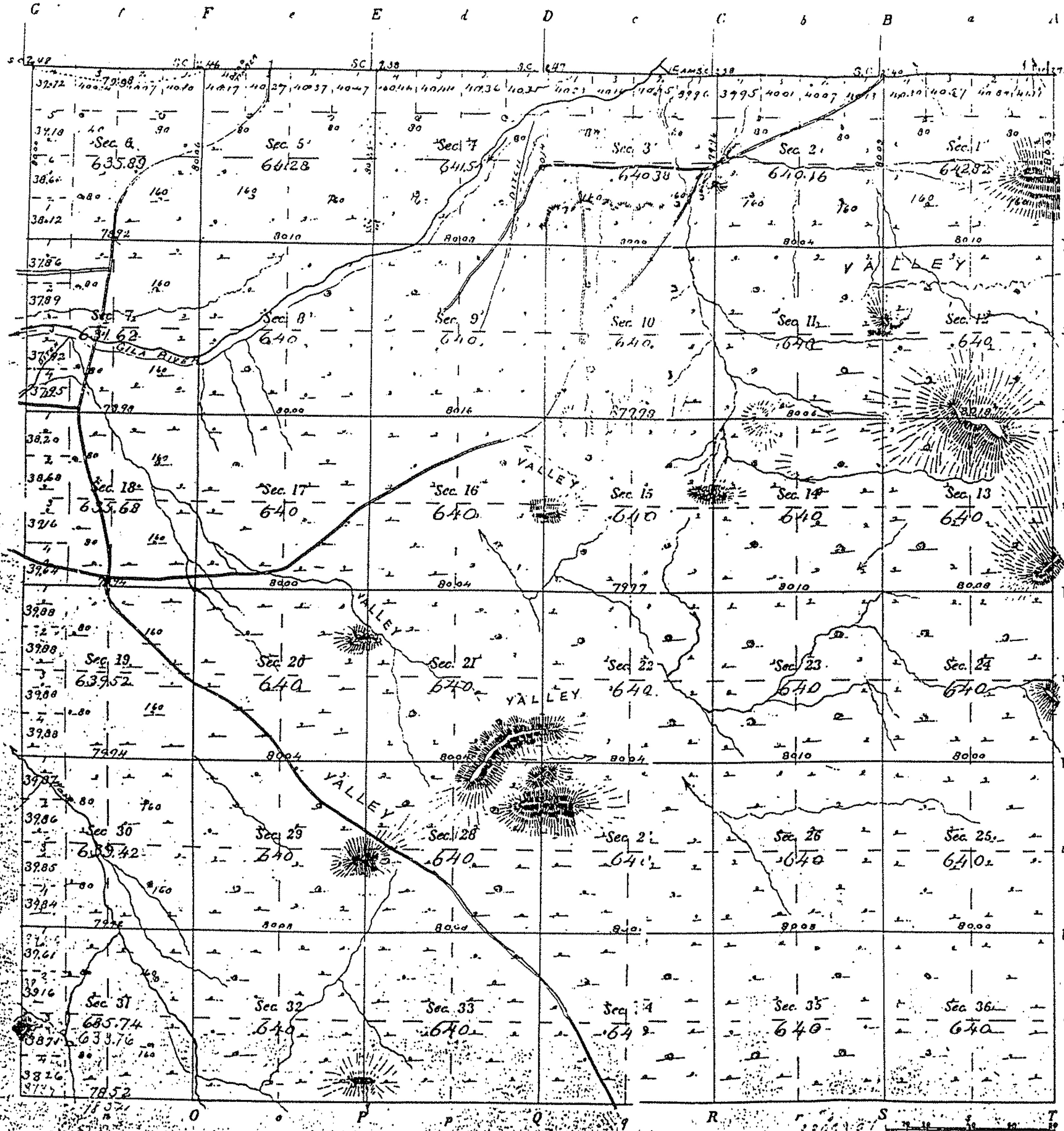
Latitude 33° 22' 40" N.
Longitude 112° 11' 11" W.
Mag. Decl. 14° 05' E.

Surveys Designated	By whom surveyed	Date of Contract	Amount of Surveys	Chs.	Lks.	When Surveyed
Base Line	John F. Hesse	November 10, 1906	[illegible]	38	28	May 16-23 1907
Township Lines			17	37	64	18-28
Subdivisions			57	30	86	29-June 16
(Land Entries)			30	78	88	June 16-26
Connections			[illegible]	17	26	

The above Map of Township No. 1, North, Range No. 2 West, G & S.R. Meridian, Arizona, is strictly conformable to the field notes of the survey thereof on file in this office, which have been examined and approved.
U.S. Surveyor General's Office
Phoenix, Ariz. Dec. 16, 1907.

49

OFFICIALLY FILED 4-23-1883



Meanders of

Posts	Courses	Ch's Lk's	Posts	Courses	Ch's Lk's	Posts	Courses	Ch's Lk's

Total number of Acres 23024.05

Scale 40 Chains to an inch

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed	Mean Declination
Township Lines	R.C. Powers	Oct 24th 1882	17 79 15	Dec. ... to 14th 1882	13°54' E
Subdivisions			538 79 54	Jan ... to 15th 1883	
Base			6 00 25	... 1882	

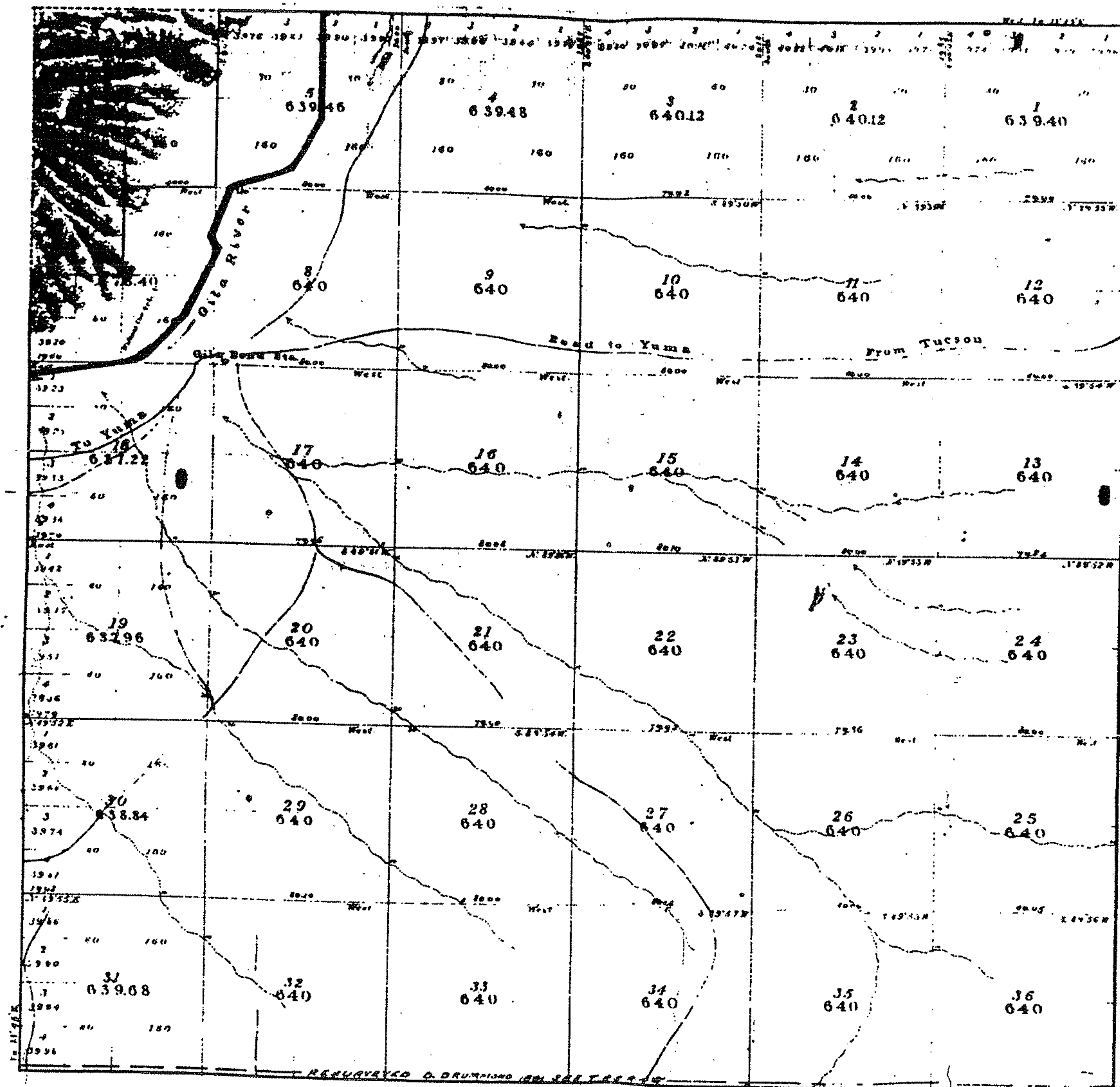
The above Map of Township No 1 South of Range No 9 West Gila & Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office which have been examined and approved.

Surveyor General's Office
Tucson February ... 1883

J.W. Robbins
Surveyor General

TOWNSHIP Nº 5 SOUTH RANGE Nº 4 WEST
GILA AND SALT RIVER MERIDIAN

OFFICIALLY FILED 4-1-1972



Aggregate area of Public Land surveyed 22,390.63 Acres.
Estimated " " " unsurveyed 636.00 "
Total 23,026.63 "

Surveys Designated	By Whom Surveyed	Amount of Survey	When Surveyed	Date of Contract
Township lines.	J. H. Farman	21 m. 40 chs 00 lk	Feb 22-27. 1871	Feb 11. 1871
Subdivisions.	do	59 " 39 " 00 "	March 21-30 "	" " "

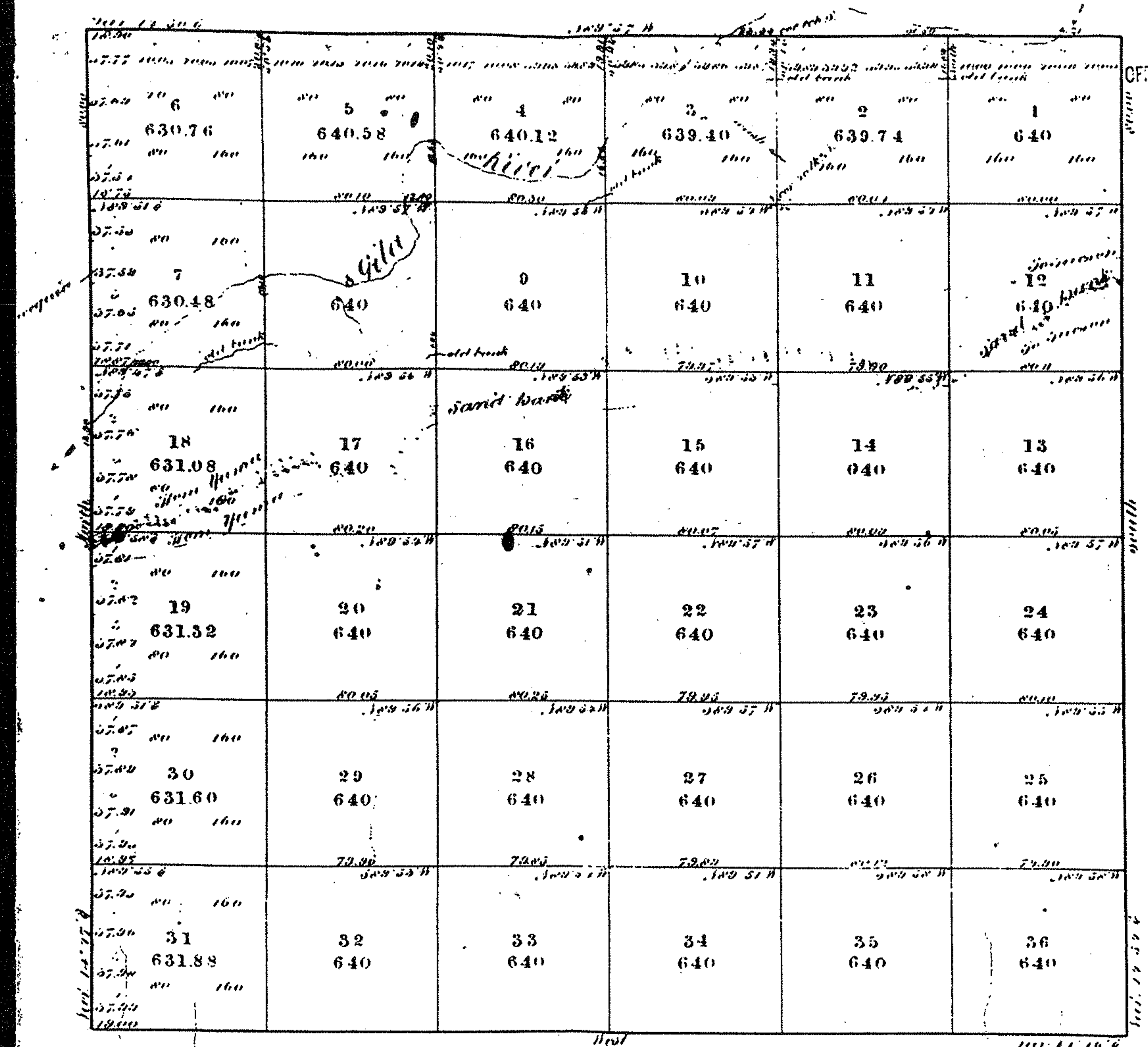
The above Map of Township No. 5 South Range No. 4 West of the Gila and Salt River Meridian is strictly conformable to the field notes of the survey thereof on file in this Office which have been examined and approved.

Surveyor General's Office
Tucson Arizona May 1. 1871

John Wasson

TOWNSHIP No. 8 SOUTH RANGE No. 16 WEST GILA AND SALT RIVER MERIDIAN.

OFFICIALLY FILED 5-14-1878



Subdivision lines run at a variation of 14° 46' East. Area 22986.96 acres

Surveys Designated.	By Whom Surveyed.	Date of Contract.	Amount of Surveys. Ms. Chs. Lks.	When Surveyed.
Township Lines	[illegible]	Dec 20 1870	6.00.00	Mar 28 29 77
do	[illegible]	Sep 20 1877	17.77.90	Jan 15 21 78
Subdivisions	do	do	59.75.69	Jan 21 25 78

The above Map of Township No. [illegible] South of Range No. 16 West Gila and Salt River Meridian, Arizona, is strictly conformable to the field notes of the survey thereof on file in this office, which have been examined and approved.

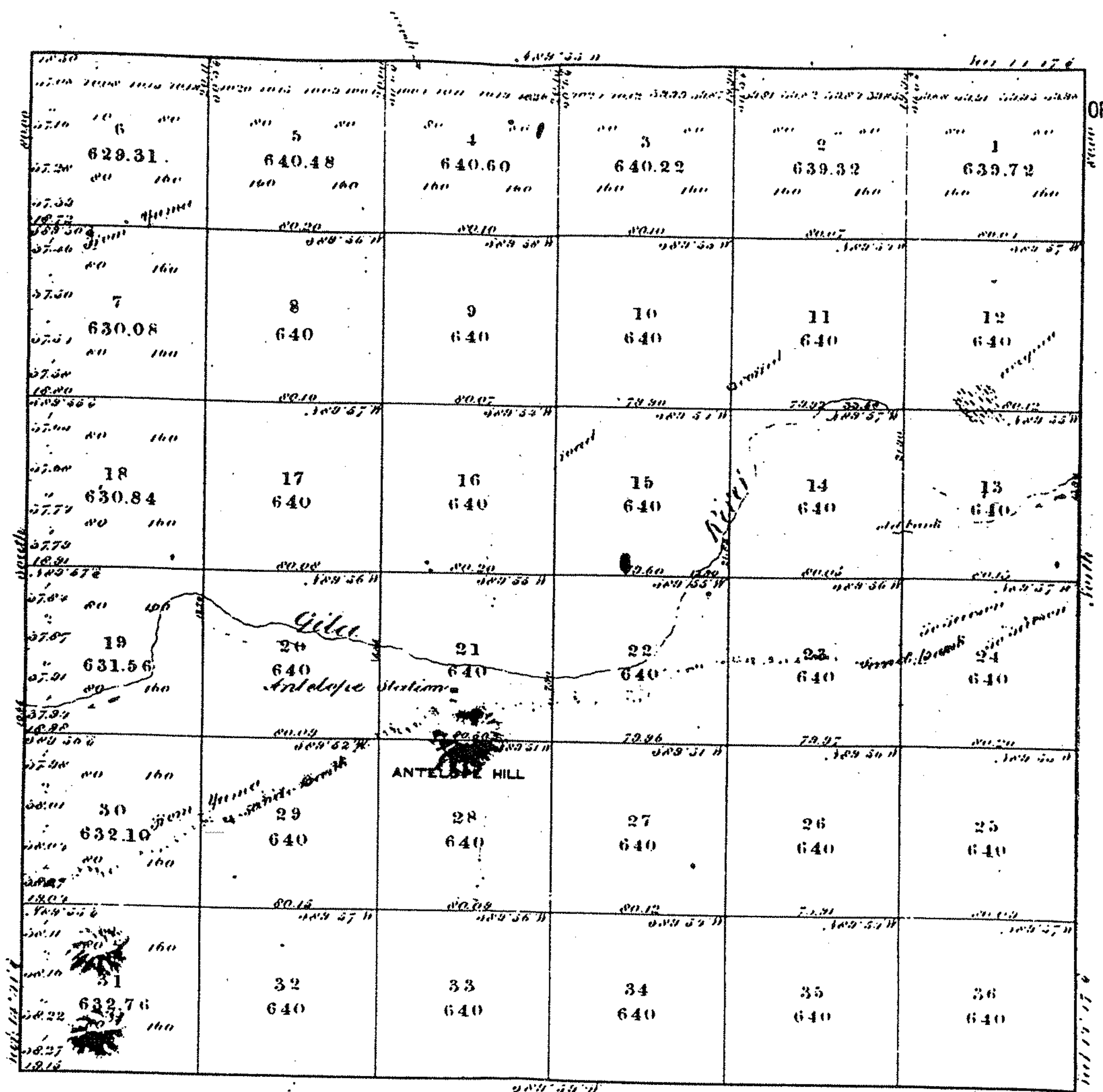
Surveyor General's Office,
Tucson, Arizona, 1st [illegible] 187[illegible]

Sur. Gen.

TOWNSHIP No. 8 SOUTH RANGE No. 17 WEST GILA AND SALT RIVER MERIDIAN.

3338

OFFICIALLY FILED



Subdivision lines run at a variation of 14° 27' East.

Area 22,986.99 acres

Surveys Designated.	By Whom Surveyed.	Date of Contract.	Amount of Surveys. Ms. Chs. Lks.	When Surveyed. 1878
Township Lines	J. L. Harris	Sep. 20 1877	23. 77. 03	Jan 12 Feb 7
Subdivisions.	do	do	59. 76. 36	Feb. 7 "

The above Map of Township No. 8 South of Range No. 17 West Gila and Salt River Meridian, Arizona, is strictly conformable to the field notes of the survey thereof on file in this office, which have been examined and approved.

Surveyor General's Office,
Tucson, Arizona, 1st April 1878.

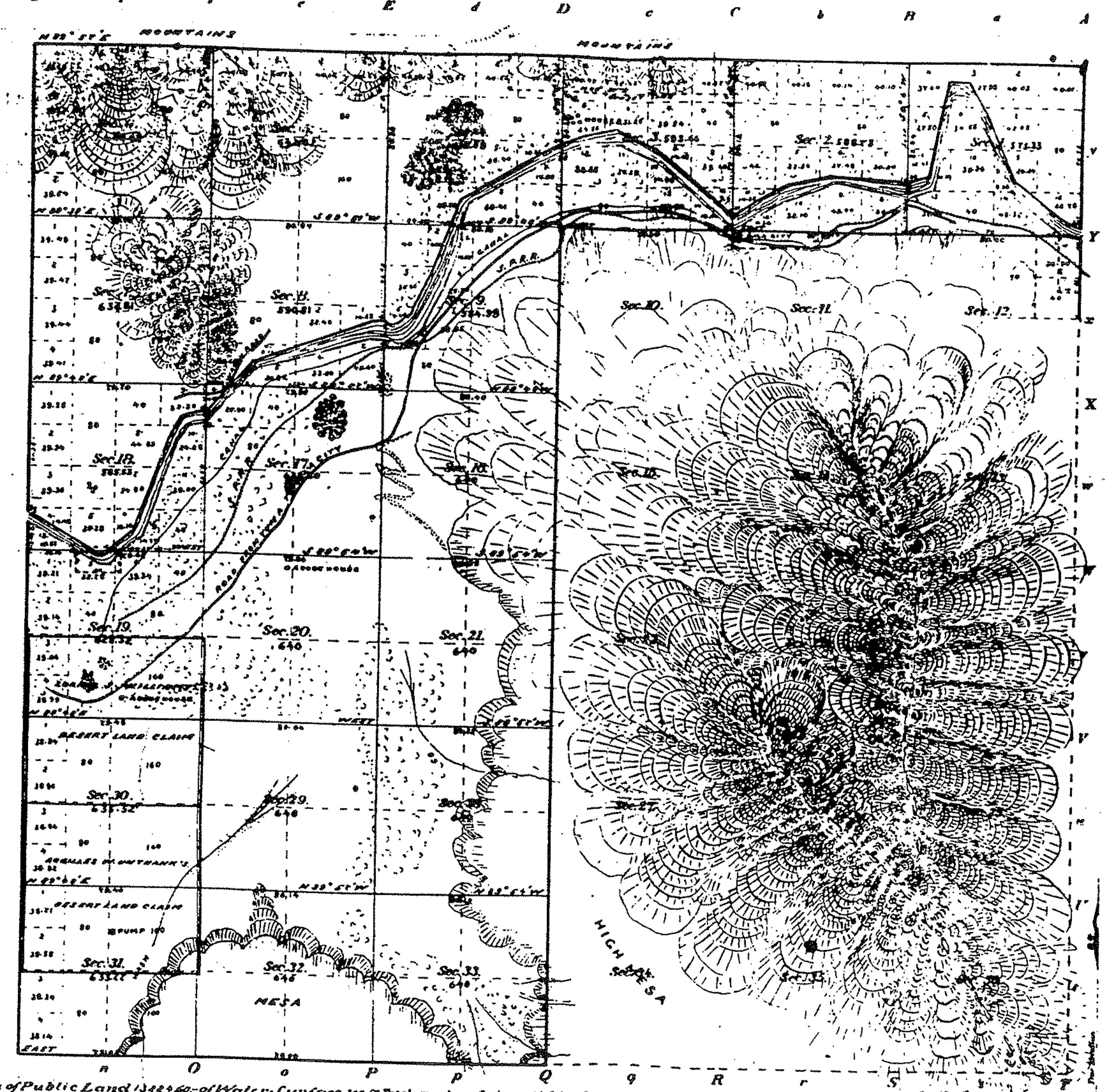
Sur. Gen.

0.53

Filed in Gila Land Office Feby 26. 1891

3911

Township No 8 South Range No 21 West, Gila & Salt River Meridian



Area of Public Land 13424.60, of Water Surface 368.53 Total number of Acres 13593.13

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys M.	Ch.	Lk.	When Surveyed	Mean Declination
Township lines	James H. Martineau	June 20. 1880	18	38	87	Sept. 10 - Oct. 4. 1880	13°12' East
Subdivisions	"	"	30	—	7		
Meanders	"		11	8	20	"	
Township lines	T. F. White	July 7. 1873	6	—	—	Jany 14. 1874	

OFFICIALLY FILED 3-2-1891

Meanders of Gila River

Posts	Courses	Ch. Lk.	Posts	Courses	Ch. Lk.	Posts	Courses	Ch. Lk.
LEFT BANK			Sec. 12 Contd			Sec. 2		
Sec. 12				S 32° W	8.00	11	N 88° E	10.00
				S 18° W	42.00		N 40° E	16.00
			10	S 67° W	12.50		N 22° E	30.00
1 to 2	N 16°37' W	16.00	10 to 11	N 55° W	25.00	22	S 85° E	25.00
Sec. 1			Sec. 13			Sec. 1		
2	N 54° W	6.00	10	S 50° W	2.40	22	N 69° E	10.40
	N 60° W	23.00		WEST	4.40		N 84°15' E	26.00
	N 25° W	32.00	11	N 62° W	10.40		S 86°20' E	10.00
	N 31° W	17.00					S 30° E	13.00
	N 64° W	7.00	RIGHT BANK				S 24° E	32.00
	S 10° W	42.00					S 69° E	20.00
3	S 20° W	13.00	Sec. 18				S 52° E	10.00
						23	S 63° E	7.90
Sec. 2			10 to 11	S 58° E	35.50	TOTAL MEANDERS 17 MI 3 CHS 80 LKS		
3	N 87° W	32.00	15	N 50° E	16.00			
	S 78° W	26.00		N 19° E	50.00			
	S 60° W	10.00		N 30° E	10.00			
4	S 62° W	15.30	16	N 80° E	7.00			
				EAST	4.40			
Sec. 3			Sec. 19					
4	N 87° W	40.00	14	S 53° E	2.00			
	N 62° W	12.00		EAST	1.00			
	S 72° W	13.00	15	N 50° E	1.50			
5	S 48° W	10.00						
Sec. 4			Sec. 17					
			16 to 17	N 39° E	16.00			
5	S 61° W	42.00						
6	S 12° W	11.00						
			Sec. 8					
Sec. 9			17	N 39° E	15.00			
6	SOUTH	6.70		N 62° E	58.00			
	S 10° W	25.00	18	EAST	4.80			
	S 40° W	32.00						
	S 49° W	10.00	Sec. 9					
	S 80° W	3.50						
	N 87° W	3.00	18	S 60° E	3.70			
7	N 62° W	4.00		N 80° E	8.00			
				N 49° E	8.50			
				N 42° E	20.00			
Sec. 8			19	N 18° E	26.00			
7	WEST	7.30						
	S 72° W	12.00	Sec. 4					
8	S 43° W	10.00						
			19	N 16° E	13.00			
Sec. 17				N 60° E	58.00			
			20	N 62° E	3.50			
8 to 9	S 39° W	23.70						
			Sec. 3					
Sec. 18			20	N 87° E	11.00			
				N 70° E	16.00			
9	WEST	2.00		S 65° E	20.00			
	S 87° W	6.00	21	S 49° E	17.60			

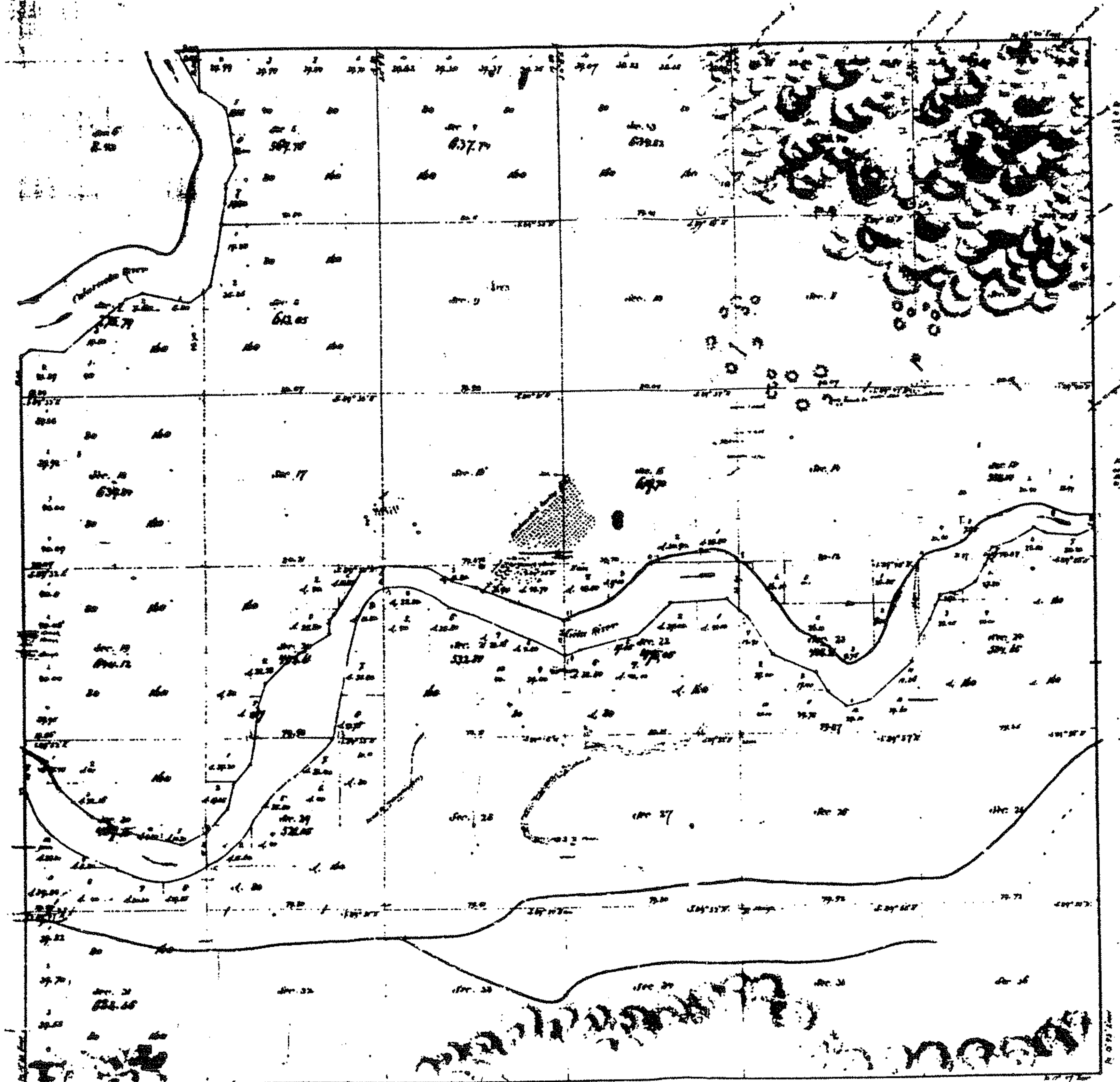
The above Map of Township No 8 South of Range No 21 West, Gila & Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

Surveyor General's Office.
Tucson, Arizona. Dec. 18. 1890

Royal A Johnson
Sur. Gen.

TOWNSHIP No 8 SOUTH RANGE No 22 WEST GILA AND SALT RIVER MERIDIAN

OFFICIALLY FILED 1-11-1875



Aggregate Area of Public lands 20820.89 Acres
Estimated Area of river 1107.10

Aggregate 21927.99 Acres

Subdivision lines run at a Variation of 13° 45' East

Surveys designated	By whom surveyed	Date of Contract	Amount of Surveys	When Surveyed
Township lines	T. F. White	July 7th 1873	21 - 37 - 70	Jany 15th - Jany 29th 1874
Subdivisions	do.	August 25th 1873	67 - 14 - 55	Feby 26th - March 3rd 1874
Meanders	do.	do	10 - 68 - 95	March 4th 1874

The above Map of Township No 8 South of Range No 22 West of the Gila and Salt River Meridian and Baseline is strictly conformable to the field notes of the survey thereof on file in this office, which have been examined and approved.
Surveyor General's Office.
Tucson A. T. May 12th 1874

Sur Genl

CHAPTER 2: LAND PATENTS AND STATE GRANTS

The U.S. Congress passed a variety of homestead laws in the middle-to-late nineteenth century designed to facilitate the settlement of newly acquired lands in the West. The laws resulted in thousands of federal patents being issued to eager settlers determined to establish homes and farms in the arid West. Yet before discussing federal land patents in relation to the Gila River, a few words need to be said about the stream's location as portrayed on various maps since this bears on related patent positions.

MAPS OF THE GILA RIVER REGION: The U.S. Geological Survey did not begin mapping the Gila River Basin until after Arizona's admission to the Union in 1912. Prior to this, however, other maps were made. As noted in Chapter One, the U.S. General Land Office had conducted original surveys along the Gila beginning in 1868 to facilitate homesteading and to create accurate legal descriptions of property. Other mapping of the region was done by county engineers and county surveyors beginning in 1913. The oldest historical maps discovered for areas along the Gila River include a "Map of Maricopa County" by the County Engineer (1917 -- see page 85 below), a "Map of Yuma County" by the County Surveyor (1913 -- see page 86 below), and a "Map of the Salt River Valley" by Dwight B. Heard (1915 -- unavailable for copying at the time this report was drafted). These three maps were used to locate the Gila River as close to 1912 as possible. Comparing the federal survey maps' location of the Gila to that of the 1913, 1915, and 1917 maps indicates a significant amount of channel change occurred over the years that would almost certainly have hindered navigation.

To locate homestead patents in relation to the Gila, the U.S. Bureau of Land Management's Master Title Plats and Historical Indices were used (see pages 87 and 88 for examples of these documents). These are cartographic records of how the U.S. government has disposed of (or otherwise encumbered) the public domain. The Master Title Plats and Historical Indexes also show land grants made to the State of Arizona.

The 1913, 1915, and 1917 historical maps, the U.S. General Land Office original survey plats, and the Bureau of Land Management's Master Title Plats were used to create Exhibits 1-5 which are located in the front pocket of this report. The river as shown on the historical maps was digitized by Salt River Project Cartographics using a GIS computer system. With this product, Littlefield Research Associates consulted the U.S. Bureau of Land Management's Master Title Plats and Historical Indices to place the federal patents upon the newly created maps. (For Exhibit 1A, which shows state patents, the same process was used, using state plats created by the Arizona State Land Department -- see page 78 below regarding state acquisition and disposition of federally-granted lands. See page 89 for an example of a state plat.) Because of the length of the lower Gila River, Exhibits 1-5 show only portions of the stream. However, the patents which appear on these exhibits are representative of settlement patterns throughout the basin.

BACKGROUND INFORMATION ON HOMESTEADING AND FEDERAL LAND PATENTS: With U.S. General Land Office surveys having provided an orderly system for the federal government to dispose of the public domain in the Territory of Arizona, settlers began to acquire parcels of land through homesteading. The various homestead laws passed by the U.S. Congress in the late nineteenth century generally required a settler to file an application and make a small payment for a given parcel of land with the nearby federal land office.[48] The application would describe the land by township, range, and section, and within each six-hundred-forty-acre section by a fractional identification. For example, a typical one-hundred-sixty-acre parcel might be described as the northeast quarter of section 21, township 1 north, range 1 west, Gila and Salt River Base and Meridian. A forty-acre parcel might be the northwest quarter of the southeast quarter, and a twenty-acre parcel might be the west half of the southwest quarter of the southwest quarter.

Once the application had been filed, the settler was required to live on the land for a number of years and make various improvements. When the necessary time had elapsed, he or she could return to the land office with witnesses to file affidavits stating that homesteading requirements had been met. There, the settler would also complete any remaining paperwork and make final payments. The affidavits and paperwork created a patent file that

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[48] The most important of these laws was "An Act to Secure Homesteads to Actual Settlers on the Public Domain," 37th Cong., 2nd Sess., ch. 75 (1862), generally known as the Homestead Act.

contained a great deal of information about the settler and the land he or she wanted to acquire.

These patent files are available at the National Archives in Washington, D.C., and those relating to the Gila River were used in the preparation of this report, together with the actual patents themselves (obtained from the Bureau of Land Management in Phoenix). The applicant and witness affidavits typically described the parcel in question, the number of acres, the crops farmed, the improvements made, as well as other pertinent information (such as, for example, irrigation canals and diversion points). Depending on the parcel, the type of patent, and whether there was any controversy involved, the patent file might also contain other information such as court documents.

In relation to the Gila River, there were many patent applications filed for parcels in sections overlapping the stream between the eastern boundary of township 1 north, range 1 west, and the western boundary of township 8 south, range 22 west.

Significance of Patents to Gila River's Potential Navigability: Federal patents to private parties and the supporting files are important for several reasons in ascertaining the potential navigability of the Gila River around the time of statehood. First, the patents indicate the total amount of land awarded by the United States. The acreage is significant because if the Gila River had been considered navigable, federal officials would not have granted title to any land through which the river flowed. Instead, Arizona would have owned such land due to state sovereignty. As a result, a patent to a quarter section through which the stream ran would have been recorded as somewhat less than one-hundred-sixty acres (a full section is six-hundred-forty acres). In other words, land would have been removed from the total acreage because of the stream's navigability. Moreover, if the river had been considered navigable, an irregularly-shaped parcel next to the river would have been identified as a "government lot" instead of an even division of a six-hundred-forty-acre section. Thus, a patent to a small parcel of land lying next to a navigable body of water would have a reference to, hypothetically, "government lot 3, consisting of 27.4 acres."[49] While there are some government lots lying next to meandered portions of the very lowest reaches of the Gila, those lots were not created due to the stream's navigability. Instead, the lots were formed because of surveying instructions pertaining to meanders of non-navigable bodies of water (see Chapter One above).

Importantly, none of the federal patents that overlay the Gila River (regardless of their respective dates) contain any provisions for reserving the bed of the river to Arizona. There is also no evidence that Arizona, upon statehood, chose lands in lieu of those

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[49] For details on how federal surveyors were to handle creating government lots next to navigable bodies of water, see Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations (Washington, D.C.: Gideon and Co., 1851), reprinted in C. Albert White, A History of the Rectangular Survey System (Washington, D.C.: U.S. Department of the Interior, 1983), pp. 434, 436-437. See also for examples of how government lots were established, Instructions to Deputy Surveyors of the United States for the District of Illinois and Missouri (St. Louis: N.p., 1856), reprinted in ibid., pp. 425, 430.

previously patented upon the river bed -- which the state would have been entitled to do had the river been navigable. (In-lieu, or indemnity, selections were public domain lands chosen by a state or railroad to compensate for overlapping claims to state or railroad ownership elsewhere.)

Another reason why patents are important to help determine whether the Gila River was navigable at the time of statehood relates to their supporting files. Since a settler had to sign an affidavit regarding improvements and similar documents had to be secured from eyewitnesses, a patent file not only reiterates acreage being assigned, but it also can convey details such as whether the farmer built an irrigation ditch from the Gila River or whether he used the river for other purposes. Again, nothing in the supporting files suggests that the Gila River was navigable or that settlers used the stream for conveying commerce.

FEDERAL PATENTS TO PRIVATE PARTIES ON EXHIBIT TWO: This report will discuss representative federal patents along the Gila River between township 1 north, range 1 west. downstream to township 8 south, range 22 west. Exhibit One is simply an index map to exhibits two through five. While this section of the report does not include every township or every patent within the Gila River watershed to keep the discussion to manageable proportions, **all** patents in all townships for the watershed have, in fact, been reviewed. None contradicts the evidence presented here.

Most of the Gila River patents considered in the following discussion are displayed on Exhibits one through five included in the front pocket of this report. For the purposes of this discussion, representative patents and their files will be reviewed going downstream. The following patents appear on Exhibit Two, which represents patented land in township 1 south, range 1 west, township 1 north, range 1 west, township 1 north, range 2 west, and township 1 south, range 2 west.

Federal Patents on the Gila River in Township 1 North, Range 1 West: This township lies directly west of the confluence of the Gila and Salt Rivers. The land in the area was quite fertile and therefore attracted many early homesteaders, among them Earl A. Watts. Watts applied for a homestead patent on December 17, 1929, for land lying in section 34. A favorable government report written on March 5, 1934, stated that the character of land was "[r]iver bottom alluvial soil seamed and hummocked throughout and covered with a dense growth of brush, and **along the many water courses**, with iron wood." (Emphasis added.) Those water courses included the Gila River. One of Watts' witnesses wrote on his final proof that the land was "[r]**olling, river running through.**" (Emphasis added.) Despite the fact that the river flowed through the land, Watts nonetheless received title to the entire tract, suggesting that the river was not considered navigable because none of the land was set aside due the State of Arizona's sovereignty.[50]

Thomas D. Taylor also applied for a homestead patent in section 34 on December 16, 1918. On his final proof, Taylor wrote

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[50] Homestead Entry Patent File for 1070902, 1929, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/19].

that only about thirty acres of the claim were capable of being farmed and that the "**[b]alance of the land [was] in the river.**" (Emphasis added.) This information was repeated in the witness's affidavits, leaving no doubt that the claim lay in the river bed. Nonetheless, no acreage was reserved for the State of Arizona because of its sovereign rights.[51]

Federal Patents on the Gila River in Township 1 North, Range 2 West: Further downstream, the land along the Gila River became more densely settled. On June 11, 1919, Robert O. Gruwell applied for a homestead patent for land lying in sections 25 and 26 of township 1 north, range 2 west. On his final proof, Gruwell reported that only one hundred acres of the claim was cultivable and that the "**balance [was] river bed.**" (Emphasis added.) This information was repeated throughout the patent file, leaving no doubt that part of the parcel was indeed in the river bed. However, no land was reserved for the State of Arizona's sovereign rights to the bed and the banks of navigable streams.[52]

Other patented parcels through which the river flows exist in this township. However, because some of these patents were acquired under the Desert Land Act of 1877 and because that law had unique requirements that relate to the issue of navigability, they are discussed below at page 71.

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[51] Homestead Entry Patent File for 762971, 1918, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/26].

[52] Homestead Entry Patent File for 814694, 1919, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/27].

Federal Patents on the Gila River in Township 1 South, Range 2 West: In 1931 a substantial dispute over land occurred in section 8 of township 1 south, range 2 west. Walter R. Ford filed a homestead entry for land claimed by another individual. Though a controversy erupted over title to these lands (through which the Gila flowed), the State of Arizona was never a party to the dispute and never filed any protest over the fact that the U.S. was granting title to land that lay in the river bed. On July 25, 1931, the Chief of the field division of the U.S. General Land Office wrote to the Commissioner that "[t]he land involved being located about a mile and one-half south of Liberty, Arisona [sic], is situated, with the exception of the SE1/4NE1/4, **in the bed of the Gila River.**" (Emphasis added.) He continued that "[t]he tract in dispute, namely -- the SW1/4NW1/4 Sec. 8, with the exception of about ten acres thereof, is strictly speaking bottom land **situated in the bed of the Gila River** and does not show any evidence of having been cultivated within recent years." (Emphasis added.)[53] Not only did the U.S. General Land Office acknowledge the presence of the river in the disputed parcel, but so tool did Walter Ford's proof. It stated that the "surface is practically level except the river bottom. The river bottom is washed . . . 100 acres out of the 160 could be plowed -- would be subject, of course, to the overflow of the river when it got up." While the title dispute was eventually settled in favor of Ford, no mention was ever made by

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[53] Homestead Entry Patent File for 1071855, 1926, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 25/15].

the State of Arizona about the lands located in the river bed. Instead, Ford was granted title to the entire parcel, without any lands removed for the state, suggesting that the river was considered non-navigable.[54]

FEDERAL PATENTS TO PRIVATE PARTIES IN EXHIBIT THREE: Exhibit 3 covers township 4 south, range 4 west, and township 5 south, range 4 west.

Federal Patents on the Gila River in Township 4 South, Range 4 West: Nestled against the Painted Rock and Gila Bend mountains to the west, settlers in township 4 south, range 4 west, created one of the few settlements along the lower stretch of this meandering desert river -- the farming community of Gila Bend. As part of this settlement, Miller F. Woods filed a homestead entry for land lying in section 20 on October 7, 1929. On May 15, 1933, a special agent from the Division of Investigations submitted a report of the land in question. This report is in Woods's patent file. The agent wrote that "[t]he Gila River forms the approximate east boundary of the entry, and practically all the land in this entry, with the exception of a narrow strip of higher land along the west line of the entry is river bottom land, fairly well covered with a growth of arrow weed." The remainder of the patent

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[54] Homestead Entry Patent File for 1071855, 1926, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 25/15].

file underscores that the land was located in the river bottom, yet no land was reserved for the State of Arizona.[55]

Ben Harrelson came to Gila Bend much later than Woods had. Settling just south of Woods, Harrelson's patent file shows that he did not purchase the land until a public sale around 1952. Furthermore, documentation in the file makes it clear that all parties involved considered the Gila River to be non-navigable. The land classification report filed by Eugene H. Newell for the Bureau of Land Management indicated that of the 160 acres in Harrelson's parcel, "135 acres **lies in the dry Gila River bed** and consists of rocky sand bars which makes the lands totally unsuitable for cultivation." The topography, Newell wrote, was "[f]lat along west boundary, **dry river bed covers greater portion,**" and in response to a question regarding the type and extent of erosion, he stated that "**Gila River Bed occupies greater portion.**" (Emphasis added throughout.) Harrelson's own application for the land underscored Newell's report. When asked to describe the character of the parcel, Harrelson said that "small portion on west edge is cultivable -- **balance in Gila River channel.**" (Emphasis added.) He also wrote that the "**Gila River flows through east part** during rainy seasons." (Emphasis added.) It was undoubtedly clear to officials that the river flowed directly through and occupied a large percentage of this tract of land. However, no acreage was withheld due to Arizona's sovereign rights to the bed and banks of

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[55] Homestead Entry Patent File for 1066811, 1929, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/18].

navigable rivers, nor were any in lieu selections made by the state.[56]

FEDERAL PATENTS TO PRIVATE PARTIES IN EXHIBIT FOUR: Exhibit Four covers the western edge of township 7 south, range 16 west, township 8 south, range 16 west, township 8 south, range 17 west, and the eastern edge of township 8 south, range 18 west.

Federal Patents on the Gila River in Township 8 South, Range 16 West: Further downstream, Chesterton Dennis Norton filed for a homestead patent on December 21, 1928, for land lying in section 9 of township 8 south, range 16 west. It is clear that the Gila River ran very close to or through this land, because many references are made to the river's overflow in his patent file. For instance, the claimant wrote on his final proof that in 1931, he had "[p]lanted and cultivated 60 acres to barley and what -- crops being washed away by flood in Gila river," and that in 1932, he had "[p]lanted and cultivated 60 acres to barley and wheat -- Gila washing it away." Norton described the same circumstances again for 1933. All of his witnesses testified to the same. Importantly, none of the land was reserved for Arizona's sovereign rights. Furthermore, the regular flooding of the river, which is noted in this patent file, suggests the river's erratic nature.[57]

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[56] Public Sale Patent File for 1140493, 1952, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 25/2].

[57] Homestead Entry Patent File for 1073385, 1928, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/20].

There are also desert land entries in this township, but they are discussed in the section dealing with the Desert Land Act beginning on page 71.

Federal Patents on the Gila River in Township 8 South, Range 17 West: Norton Marshall, an immigrant from Canada, set out to homestead land in township 8 south, range 17 west, near Yuma, Arizona, in 1890. His land was quite close to the Gila, however, and according to documents in his patent file, he had to contend with the fickle nature of that river. Specifically, in 1890, Marshall noted in his affidavit that he was absent due to "floods in the valley, and he could not return to the land for several weeks, and when the flood subsided the canal was so damaged water could not be gotten [unreadable] to irrigate." This type of erratic behavior suggests that the river was probably not susceptible of navigation.[58]

FEDERAL PATENTS TO PRIVATE PARTIES IN EXHIBIT FIVE: Exhibit five covers patents located in Township 8 South, Range 21 West, and Township 8 South, Range 22 West.

Federal Patents on the Gila River in Township 8 South, Range 22 West: In spite of the extremely dry nature of the land, homesteaders settled just east of the Gila River's confluence with the Colorado. On April 9, 1903, Clarence Maddox filed a homestead entry on land in sections 29 and 30, township 8 south, range 22 west. Maddox's patent file makes it clear that the Gila River ran

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[58] Cash Entry Patent File for 869, 1891, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 24/46].

through the tract. In a February 26, 1912, letter from a special agent of the General Land Office to the Commissioner, the unnamed author wrote that "[t]he land is agricultural bottom land of the Gila river and is subject to annual overflows by that river, and is covered with a growth of arrow weeds and some cottonwood trees." In another letter, written on June 21, 1909, the special agent said that:

> the only time [the Maddox's] were absent from said land up until June, 1908, was at such times as it was unsafe to live thereon by reason of the overflow of the Gila River. . . . Maddox claims that at one time to have had about 40 acres cleared and planted, but that the river washed away all of said cultivation, and that the Gila River has changed its course three or four times during the period he has lived on said land and that at the present time **most of said entry is in the bed of said river**, there being only about 20 acres left; that his other houses were built on the north side of the Gila River, while his present house is on the south side; that the channel of the river has so changed during the past five or six years that while at the time he made his entry all his entry was on the north side of the river that most of it is now on the south side of the river. [Emphasis added.][59]

Another document in Maddox's file, written by his wife on February 21, 1912, stated that:

> the first big flood came about a year after establishing residence. The Gila River overflowed its natural course and washed over our land. . . . We returned to the land about three months subsequent thereto and again lived in the house, until about a year when the Gila & Colorado Rivers again overflowed and drove us from the land, absolutely destroying the adobe house, pumps and all traces of our residence. About six months thereafter we built a small house, and continuously resided therein until a couple of months afterward when the river again rose, washed away our second house, and driving us from

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[59] Homestead Entry Patent File for 1034203, 1903, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/21].

> the land. . . . I have exercised the utmost good faith in endeavoring to maintain residence on the land during the above period often-times at the risk of my life, and that of my child, the river oftertimes [sic] rising to a depth of seven or eight feet and forming a stream a mile wide in a single night.[60]

When Maddox deserted his wife in July 1909, she became the sole claimant, and on her final proof even more information about the land and river became apparent. She wrote that "**80 acres of said land practically now lies in the Gila River Bottom which at the present time is dry.**" (Emphasis added.) However, during one of the numerous floods which occurred on this river, Kate Maddox had to be rescued from the land. On an affidavit sworn to on June 24, 1911, she stated that "on one occasion I was held there by the flood and was rescued by Mr. W.E. Lynch, who came in after me with a boat and that the house in which I was then living and its total contents, furniture, clothing provisions and household supplies were washed away and totally destroyed within twenty four hours after Mr. Lynch rescued me."[61]

Kate Maddox was issued a patent to the entire amount of land requested in her application even though the Gila flowed through it. None was reserved for the sovereign rights of the State of Arizona. Furthermore, the vivid descriptions of the violent and

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[60] Homestead Entry Patent File for 1034203, 1903, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/21].

[61] Homestead Entry Patent File for 1034203, 1903, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/21].

erratic river suggest it could not be depended upon for navigation on a regular and reliable basis.[62]

THE DESERT LAND ACT OF 1877 AND ITS RELEVANCE TO THE GILA RIVER'S NAVIGABILITY: In addition to patented lands already discussed, other parcels along the Gila River were claimed under the Desert Land Act. While the various other homestead acts allowed a maximum of 160 acres per individual, the Desert Land Act was intended to allow larger blocks to be settled. Passed by Congress on March 3, 1877, lawmakers understood that desert lands were less productive (from an agricultural perspective) than non-arid lands, and therefore, the legislators provided that patents attained under the act could be as large as 640 acres. The relevance of the Desert Land Act to the question of the Gila River's navigability lies in the law's requirement that the land be irrigated before the final patent was awarded. Importantly, the water to be used had to be taken from a non-navigable stream:

> Provided however that the right to the use of water by the person so conducting the same, on or to any tract of desert land of six hundred and forty acres shall depend upon bona fid^ prior appropriation: and such right shall not exceed the amount of water actually appropriated, and necessarily used for the purpose of irrigation and reclamation: and all surplus water over and above such actual appropriation and use, together with the water of all, lakes, rivers and other sources of water supply upon the public lands and **not navigable**, shall remain and be held free for the appropriation and use of the public for

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[62] Homestead Entry Patent File for 1034203, 1903, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/21].

irrigation, mining and manufacturing purposes subject to existing rights. [Emphasis added.][63]

There were over twenty patents adjacent to the Gila River awarded under the Desert Land Act, many of which cited that stream as their source of water. The logical conclusion from these applications is that the Gila River must have been considered non-navigable by the applicants as well as by the administrators of the U.S. General Land Office.

The following discussion is not limited to desert land entries located in the sample sections although most are, in fact, located there.

Desert Land Entries Along the Gila River in Township 1 South, Range 2 West: On August 2, 1886, James H. Brown applied for a claim under the Desert Land Act of 1877 in section 4 of township 1 south, range 2 west. Malie Jackson, one of Brown's witnesses, gave a deposition in 1889 in which he asserted that the "Gila River crosses the SE corner of the northwest 1/4 of the SE1/4 but does not once flow the land, the banks of the river are high." The deposition of Brown himself confirmed this same testimony. Additionally, Jackson and Brown both noted that the source for irrigation of the land would be the Gila River through the Buckeye Canal. Brown was awarded patent 1033448.[64]

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[63] Desert Land Act, 19 U.S. Stat. 377 (1877) [LRA Box/File: 9/15].

[64] Desert Land Entry Patent File for 1033448, 1886, Serial Land Patents Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 25/13].

Desert Land Entries Along the Gila River in Township 1 South, Range 3 West: Just downstream, David R. Hefley applied for land lying in section 7 of township 1 south, ranges 2 and 3 west, declaring his intent to reclaim this tract in 1945. He filed his intention to make final proof on the desert land entry in 1951. According to the patent file, the land was clearly crossed by the Gila River on the north side.

Hefley's patent file contains a report filed by Field Examiner James W. Neal for the Bureau of Land Management. Describing his findings on October 7, 1946, Neal wrote that "[t]he land lies in the bottoms adjacent to the Gila River, on the south side of the river." Although Neal's characterization was somewhat vague, the land classification filed on June 27, 1946, stated specifically that **"[t]he land is crossed by the Gila River."** (Emphasis added.) On another classification report, submitted on June 11, 1946, for the Department of Interior's Grazing Service, Examiner Morris A. Iragstad recorded that the topography of the land was **"[b]ank and bed of Gila River**, round rocks in sand on flat bottom land." (Emphasis added.) In describing the soil, Iragstad wrote that there was **"[s]and and gravel in bed**; rocky near bank and sandy loam on flat." (Emphasis added.) Perhaps most telling about the documentation in Hefley's file is that, according to Examiner Iragstad, an old channel of the river was also present upon the land that Hefley was attempting to patent: **"The non-tillable portion is part of the present river bed** and the old river bed is composed of bare sandy wash with a predominance of salt cedar and arrowweed on the old channel portion." (Emphasis added.)[65] All affidavits submitted on behalf of this desert land entry also noted the presence of the river, including that of Hefley himself. Ultimately, no acreage was removed from the final patent -- number 1134685 -- and no mention was made of Arizona's sovereign right to the bed and banks of the Gila.[66]

The patent file for another settler in this township, Howard William Bourland, also contains documentation which describes in detail the 120 acres of land he wished to patent. The 1953 report that was filed by Appraiser Eugene H. Newell for the Bureau of Land Management clearly stated that "[w]ater for irrigation [for Bourland's land] is obtained from a dug well located under the flood-plain bluff of the Gila River which traverses the southern half of the entry. . . . **Due to the location of the well in the river bed**, shallow and an unlimited supply of irrigation water is available." (Emphasis added.) This was the first indication that Bourland's land lay in the river bed. The remainder of the documents in Bourland's file underscore this conclusion. For instance, another report, filed by Field Examiner Paul F. Cutter, stated that "[t]he Gila River (high water) flows westerly through the southeast corner of the land. The East-West flood-plain bluff of the Gila River is situated just north of the center of S1/2NE1/4

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[65] Desert Land Entry Patent File for 1134685, 1945, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 25/1].

[66] Desert Land Entry Patent File for 1134685, 1945, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 25/1].

section 11 and then drops off to the southwest in SE1/4NW1/4." Lastly, each affidavit submitted on behalf of Bourland's desert land entry noted that the Gila River passed through the land. However, Bourland received patent number 1141999 for all 120 acres, suggesting strongly that contemporaries did not believe the Gila River was navigable.[67]

Desert Land Entries Along the Gila River in Township 4 South, Range 4 West: Further downstream, other applicants filed desert land entries along the Gila River. On April 24, 1920, U.L. Logan applied for a desert land patent to 240 acres of land lying in sections 8 and 9 of township 4 south, range 4 west. Logan declared that his irrigation supply would be coming from the Gila Water Company, which obtained water from the Gila River. In addition to the source of water, there were many documents in Logan's file which state that a portion of the claim lay in the river bed. For example, an "Affidavit Outlining Proposed Irrigation Project" stated that "[a]bout 2/3 of the west side of the E1/2 NE1/4 Sec. 8 are non-cultivable, nonreclamable [sic] **because the Gila River often covers this portion which is mostly river sand."** (Emphasis added.) In May 1924, Logan himself swore to a statement that "**20 acres of each of two 40 acre tracts in my said claim, are in the Gila River**, and not irrigable." (Emphasis added.) This information was repeated on the claimant's final proof as well as those of his witnesses. Moreover, an inspector from the Department

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[67] Desert Land Entry Patent File for 1141999, 1953, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 25/3].

of the Interior submitted a report stating that "[o]n the west side [of the parcel] floods in the Gila River have cut away and partly destroyed approximately forty acres." These numerous references to the Gila River upon this tract indicate that all parties were aware of its presence. Nonetheless, when patent 1001597 was awarded to Logan, no acreage was reserved for the State of Arizona's sovereign rights to the bed and banks of navigable streams.[68]

Desert Land Entries Along the Gila River in Township 8 South, Range 16 West: On July 13, 1925, James D. Forest filed for a desert land entry patent on land lying in section 8 of township 8 south, range 16 west. As noted in a letter contained in Forest's patent file, "[t]he land in question is situated 16 miles northeast of the town of Welton, Arizona and is located on the north side of the Gila River. **This river passes through the extreme southeast portion of this entry** in a general northeast and southwest direction." (Emphasis added.) The same information was reiterated on Forest's own Final Proof. In response to a question regarding the "streams, springs, or bodies of water" upon the land, Forest wrote that "Gila river is adjoining this land, the stream being dry the greater potion [sic] of the year; stream does not afford natural irrigation." Despite the presence of the Gila, patent

[68] Desert Land Entry Patent File for 1001597, 1920, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/33].

987760 was awarded to Forest without reservation of land for the State of Arizona.[69]

Desert Land Entries Along the Gila River in Township 8 South, Range 17 West: In January 1924, William C. Lacy applied for a desert land patent on a parcel lying in section 14 of township 8 south, range 17 west. On Lacy's final proof, he noted that "**[t]he Gila River passes along and cuts off about 30 acres on the east end of this entry.**" (Emphasis added.) Lacy's witnesses also testified to this fact. H.S. Price, for instance, wrote to the Commissioner of the General Land Office that "[t]he Gila River is situated about one-eighth of a mile to the east and when the highwaters occur, the entire Sec. 14 is subject to inundation." Importantly, when patent number 1028040 was awarded to Lacy, no land was reserved for the State of Arizona despite the river's obvious presence in the parcel.[70]

Also in section 14 of township 8 south, range 17 west, Allen B. Ming applied for a desert land patent in 1924. On May 24, 1927, an inspector from the Department of the Interior submitted a report finding that "[t]his tract is located in the Gila River bottoms, one mile south of Rolls. . . . **The Gila River, dry during the greater part of the year, touches the land in the southeast corner,** but does not naturally irrigate any part." (Emphasis added.) On

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69 Desert Land Entry Patent File for 987760, 1925, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/2].

70 Desert Land Entry Patent File for 1028040, 1924, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/13].

the claimant's final proof, he repeated that **"the Gila River touches the SE corner of said land**, which stream is dry the greater portion of the year." (Emphasis added.) This same information was repeated on the witnesses' final proofs.[71]

The history of Desert Land Act entries along the Gila supports the evidence from homestead and cash entry patents that the river was not considered navigable by contemporaneous observers. No mention was made in the Desert Land Act applications of reserving the bed and the banks of the Gila for Arizona due to the sovereign rights of the state. Moreover, the fact that over twenty desert land patents were awarded indicates that many individuals thought the stream not to be navigable. In fact, the evidence indicates that all contemporaneous observers considered the Gila to be non-navigable.

FEDERAL LAND GRANTS TO ARIZONA: Arizona, like other public domain states, obtained land by Congressional grants to support certain public interest objectives prior to and following statehood. Historically, such grants to new states had started with Ohio's admission to the Union in 1802, although over the years the types and sizes of the grants varied from state to state. Grants to Arizona covered a variety of purposes. For example, prior to statehood, Congress reserved for Arizona all sections 16 and 36 for the purpose of supporting public schools. At statehood, sections 2 and 32 were added (also for schools), with all four

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[71] Desert Land Entry Patent File for 1009161, 1924, Serial Land Patents, Record Group 49, U.S. General Land Office, U.S. National Archives, Washington, D.C. [LRA Box/File: 28/38].

sections totaling 8,093,156 acres throughout the state. In addition to this land, 1,446,000 more acres were given to Arizona instead of the internal improvement, swamp, saline, and agricultural college grants provided to earlier states. Moreover, an additional one million acres were granted to pay for bonds issued by certain Arizona counties.

Aside from sovereign lands (which were determined by navigability and not by an act of Congress) and lands in sections 2, 16, 32, and 36, Arizona was allowed considerable leeway in selecting the other federally granted lands. In addition, Arizona had flexibility in selecting in-lieu, or indemnity, acreage if mineral lands (which were denied to the state), Indian reservations, or other conflicting claims overlay any section 2, 16, 32, or 36. Likewise, if a navigable body of water overlay any of these four sections, the state could take lands elsewhere equal in size to the total area of the bed of the body of water. Significantly, Arizona made no in-lieu selections to compensate for the area covered by the Gila River's bed in sections 2, 16, 32, and 36 or in other federal lands granted to the state where they overlay the Gila.

STATE DISPOSITION OF FEDERALLY-GRANTED LANDS: In the years following statehood in 1912, Arizona's officials confronted the daunting task of disposing of the millions of acres given to the state. To do this, the Arizona State Legislature created an initial version of the Public Land Code in a special 1915 session laying out the manner in which the state would dispose of its public land. The basic procedure established was to advertise the proposed sale of state land for at least ten consecutive weeks in a newspaper regularly circulated in Phoenix, send an appraiser to the land to make a report and set a minimum price, and then sell the land to the highest bidder. The purchaser would receive a certificate of purchase, indicating his or her promise to pay any balance in addition to state taxes. Once full payment had been received, an Arizona state patent was issued.

This section of the report demonstrates that Arizona officials did not consider the Gila River to be navigable when granting title to parcels through which the stream flowed. The discussion centers around the land in township 1 north, range 1 west. (For the location of state patents discussed here, see Exhibit 1A in the back pocket of this report.) Information about state patents is derived from the state patents themselves and related state patent files at the Arizona State Land Department. Although this report only discusses in detail the state patents in this one township, all state patents overlaying the river were reviewed for the purposes of this report. None contain any information which disputes the conclusions set forth below.

State Patents in Township 1 North, Range 1 West: The land lying directly west of the confluence of the Gila and Salt rivers drew many settlers. Those unable to homestead on land obtained directly from the federal government had the option of purchasing land from the State of Arizona, which owned at least four sections of land in this township. Importantly, the Gila River ran through two of the four, sections 32 and 36. In addition, Arizona obtained land in sections 31 and 33 of the same township in lieu of lands located elsewhere in the state. The land in all of these sections -- 31, 32, 33, and 36 -- was eventually sold by the state to individuals.

In section 36, Arizona sold seventy-nine acres of the northwest quarter in the form of patent number 986 to Bruno Ramirez on August 18, 1926. The river bordered the southern edge of Ramirez's land, yet no land was reserved for the state. The acreage directly to the west of Ramirez's land, also in the northwest quarter, was sold to L.J. Holzwarth just one year later, on September 16, 1927. As on Ramirez's land, the Gila river ran along the south edge of this parcel, but no acreage was withheld. The same was true for the land to the east of Ramirez's, patent 2739 lying in the northeast quarter of section 36. Here, the land was patented to L.W. and Irma J. Hudson on May 1, 1943. No mention was made in any of these three patents about the sovereign rights of Arizona to the land overlying navigable streams.[72]

In the south half of the section, the State of Arizona sold forty acres to Elgie L. Burleson on March 11, 1944, without any mention of reserving the river's bed in the interest of the state. The land directly to the east of Burleson's parcel was also patented without mention of the state's rights. Lloyd C. Lakin and George T. Peter, co-partners in the Lakin-Peter Cattle Company,

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[72] State Patent 986, 1926; State Patent 1124, 1927; State Patent 2739, 1943, Arizona State Lands Department, Phoenix, Arizona.

purchased eighty acres of land in the southeast quarter of section 36 on November 30, 1944. Their patent, number 3166, mentioned nothing about the bed of the Gila River. The other two patents in the section, 6980 and 6981, both sold in 1984, also gave no indication of Arizona's interest in the bed of the Gila River.[73]

Downstream in section 33, patent 1514, sold to the Chula Vista Ranch Company on November 20, 1929, had the Gila River coursing directly through it. Yet 81.62 acres were sold without reserving any of the river's bed to the State of Arizona. The same company also patented the land directly to the north on the same day. This patent, number 1513, totalled 120 acres, again with no reservation for the bed of the river. Patent 54-98972-01, also in section 33, also did not reserve any land for the state.[74]

State patents in section 32 support the conclusion that the Gila River was not considered navigable. Lying in the northeast quarter of the northeast quarter, patent 219 was sold to the Buckeye Irrigation Company on September 24, 1918. The appraisers' report stated that "the intake and sand gates of the Buckeye Irrigation Co's canal lie upon this tract." The application to purchase state lands contained a comment that the "grazing land is in river bottom," and that "**Gila River flows over south part of forty.**" (Emphasis added.) These comments make it clear that the

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[73] State Patent 2946, 1944; State Patent 3166, 1944; State Patent 6980, 1984; State Patent 6981, 1984, Arizona State Lands Department, Phoenix, Arizona.

[74] State Patent 1514, 1929; State Patent 1513, 1929; State Patent 54-98972-01, 1991, Arizona State Lands Department, Phoenix, Arizona.

Gila river ran through this parcel of land. Nonetheless, the state did not reserve any of the acreage for its sovereign rights, patenting the entire forty acre tract to the company. Patent 6353, south of the Buckeye Irrigation Company's land, also did not have any of its acreage reserved for the state's sovereign rights.[75]

Lastly, the sole patent overlying the river in section 31 was granted by Arizona to James L. King on March 30, 1978. King received 159.66 acres lying in the north half of the northeast quarter. The Gila River flowed directly through this parcel of land, yet none of its acreage was reserved for the sovereign rights of the State of Arizona.[76]

CONCLUSIONS REGARDING FEDERAL LAND PATENTS TO PRIVATE PARTIES, GRANTS TO THE STATE OF ARIZONA, AND STATE PATENTS: In conclusion, the federal government granted over ninety-five separate patents that touched or overlay the Gila River to private individuals. In not one case did any of these patents or the supporting patent files indicate that acreage was being withheld due to possible ownership of the bed of the Gila by the State of Arizona. In each case where patents were applied for, several parties expressed implicit opinions on the navigability of the Gila through the request for and award of lands through which the river flowed. These included the patentee, his witnesses, and officials of the U.S. General Land Office. It is significant that cumulatively,

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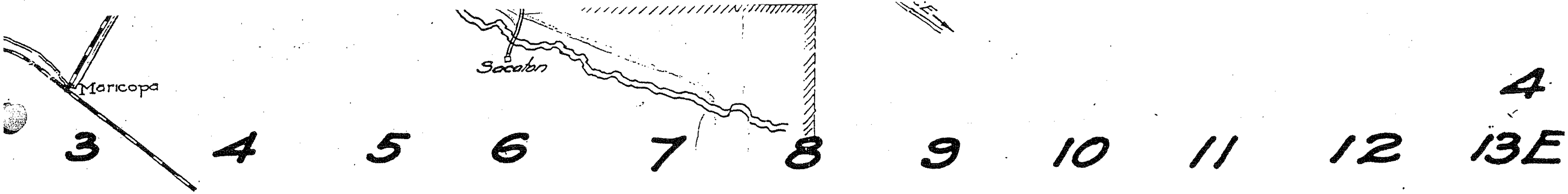
75 State Patent 219, 1918; State Patent 6353, 1976, Arizona State Lands Department, Phoenix, Arizona.

76 State Patent 6566, 1978, Arizona State Lands Department, Phoenix, Arizona.

literally hundreds of people made judgments concerning the Gila River's navigability in this manner -- opinions spread chronologically over many years, throughout different seasons, and over a large geographic area.

The patents issued by the state to private parties for land through which the river ran provided another perspective. If the state believed it owned the bed and banks of the river, it certainly would have considered the stream's navigability in disposing of those lands. Yet there are over sixty instances in which the state chose to sell lands which lay in the river bed. Collectively, therefore, federal patents, Congressional grants to Arizona, and state patents strongly suggest that both federal and state officials did not perceive the Gila River to be navigable.



MAP
OF
MARICOPA COUNTY ARIZONA

COUNTY ENGINEER'S OFFICE

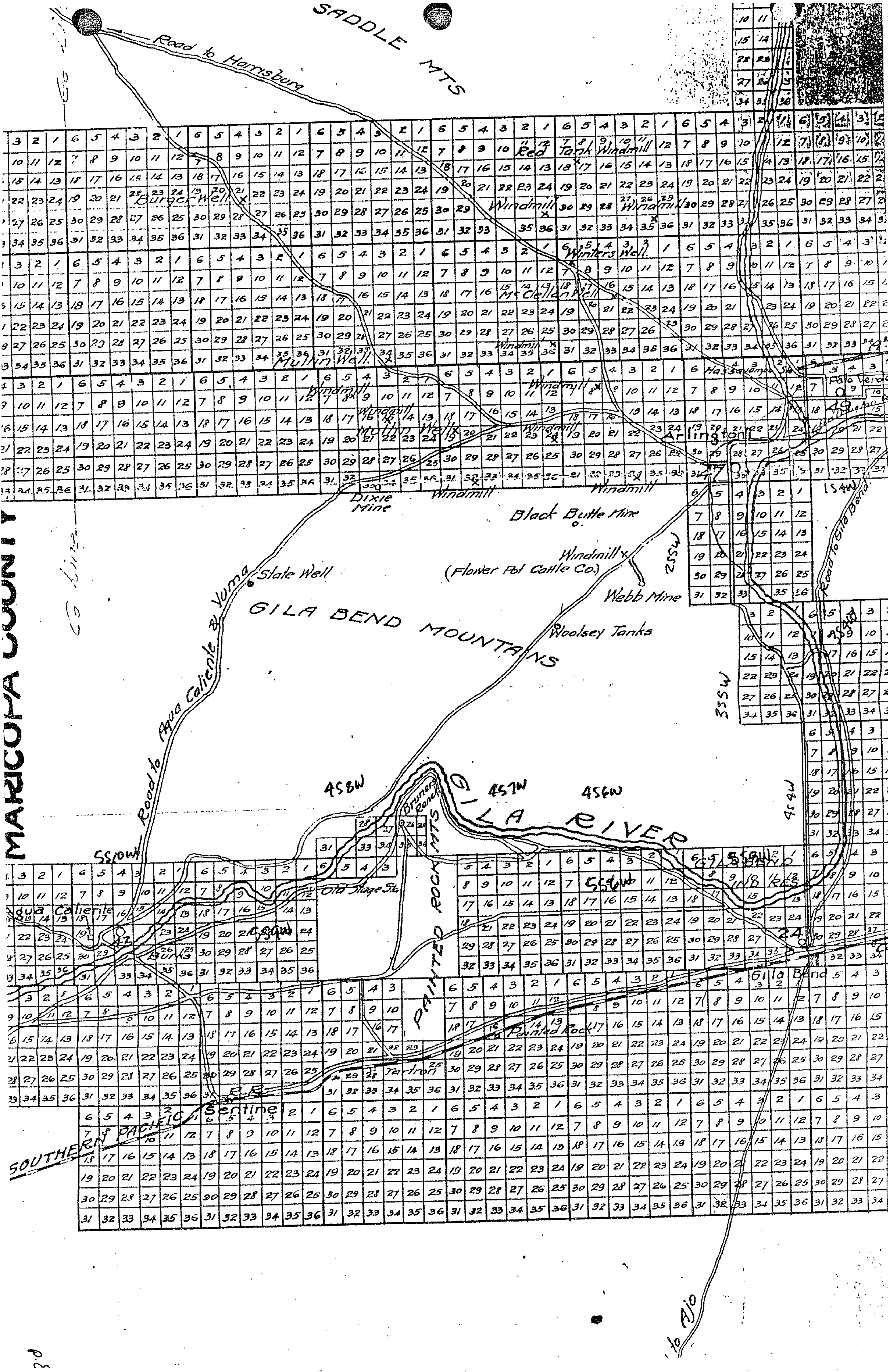
PHOENIX, ARIZONA.

Scale 1/4" = 1 mile.

May 1917.

H. M. Baugman

County Engineer.



SADDLE MTS
Road to Harrisburg
Red Tank Windmill
Burger Well
Windmill
Winters Well
McClellan Well
Mullin Well
Hassayampa
Palo Verde
Arlington
Dixie Mine
Black Butte Mine
Windmill
(Flower Pot Cattle Co.)
Webb Mine
Slate Well
GILA BEND MOUNTAINS
Woolsey Tanks
Road to Agua Caliente & Yuma
GILA RIVER
Bruners Ranch
PAINTED ROCK MTS
Old Stage Sta.
Agua Caliente
Burks
Gila Bend
Painted Rock
Tartron
Sentinel
SOUTHERN PACIFIC R.R.
MARICOPA COUNTY
to Ajo
Road to Gila Bend
1S4W
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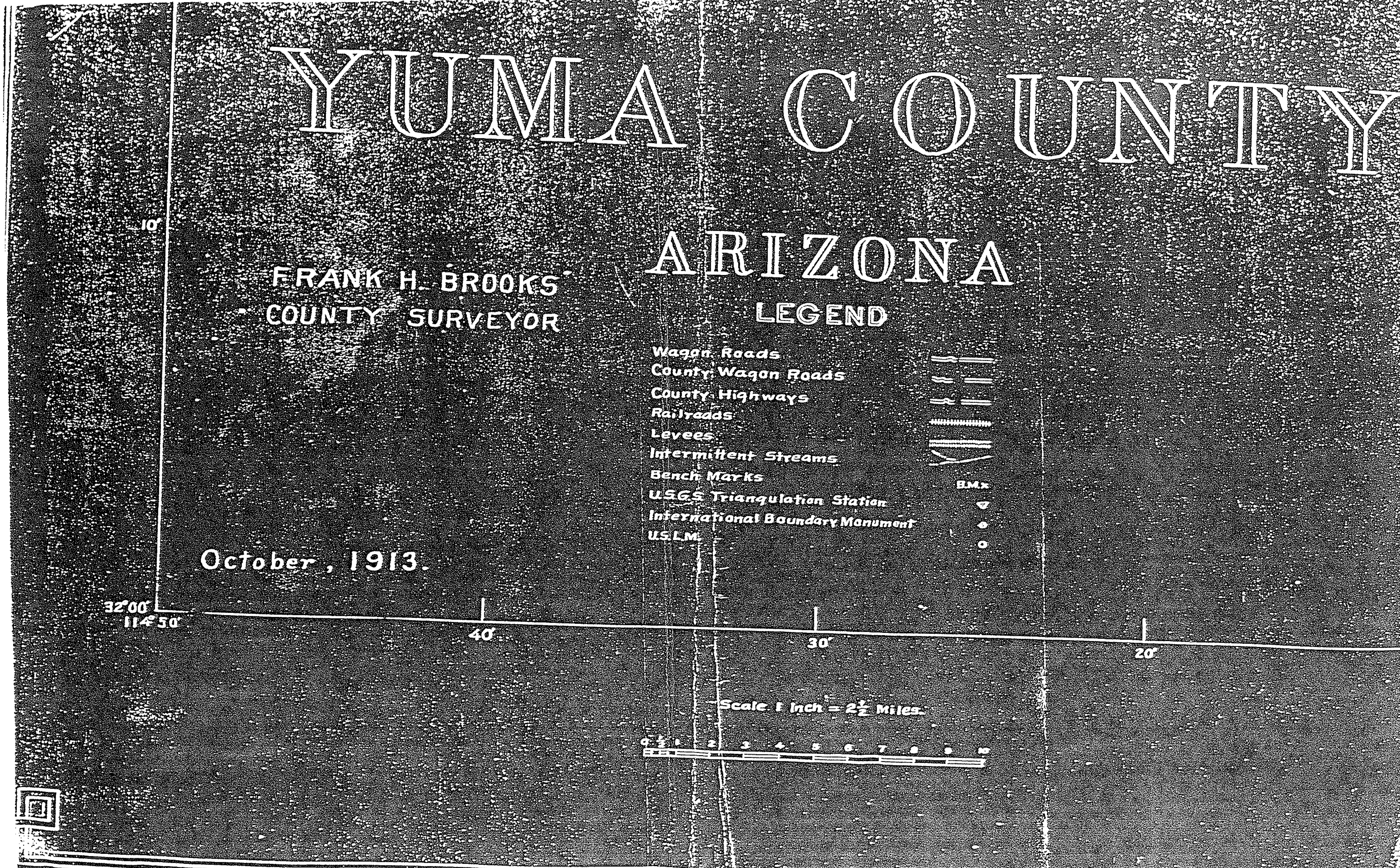
YUMA COUNTY
ARIZONA
FRANK H. BROOKS
COUNTY SURVEYOR
LEGEND
Wagon Roads
County Wagon Roads
County Highways
Railroads
Levees
Intermittent Streams
Bench Marks
B.M.x
U.S.G.S. Triangulation Station
International Boundary Monument
U.S.L.M.
October, 1913.
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40'
30'
20'
Scale 1 Inch = 2½ Miles.
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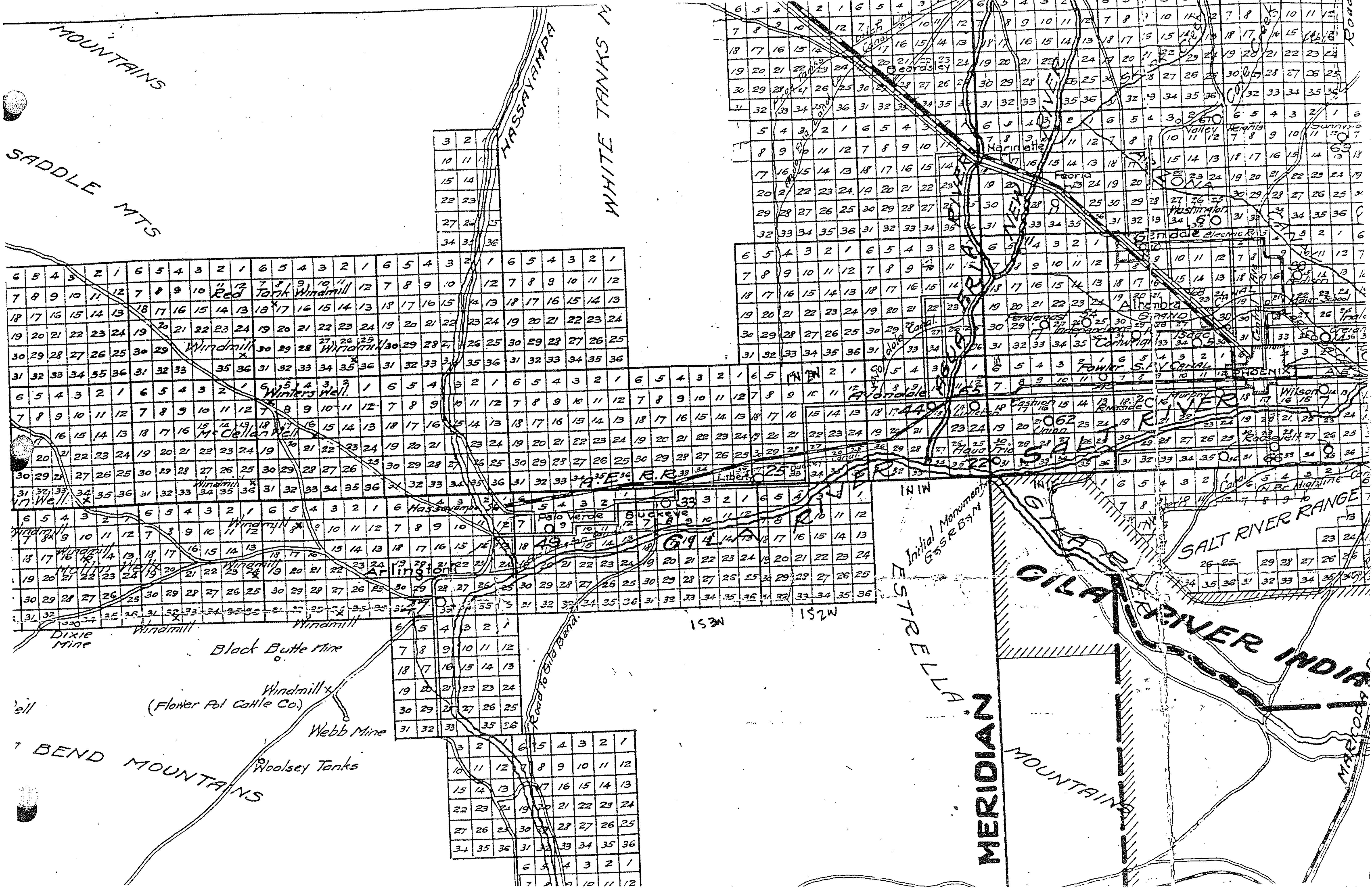

MOUNTAINS
SADDLE MTS
WHITE TANKS
HASSAYAMPA
Red Tank Windmill
Windmill
Winters Well
McClellan Well
Mollin Wells
Hassayampa
Palo Verde
Buckeye
Arlington
GILA RIVER
A.E. R.R.
Liberty
Dixie Mine
Black Butte Mine
(Flower Pot Cattle Co.)
Webb Mine
Woolsey Tanks
BEND MOUNTAINS
Road to Gila Bend
ESTRELLA MOUNTAINS
MERIDIAN
Initial Monument G&SRB&M
SALT RIVER RANGE
GILA RIVER INDIA
AGUA FRIA RIVER
NEW RIVER
Beardsley
Marinette
Peoria
Glendale
Washington
Valley Heights
Alhambra
GRAND CANAL
Pendergast
Independence
Cartwright
Isaac
Fowler
PHOENIX
Avondale
Cashion
Litchfield
Union
Agua Fria
Riverside
Murphy
Wilson
Roosevelt
SALT RIVER
Madison
Creighton
Avondale Canal
Buckeye Canal
Highline Canal
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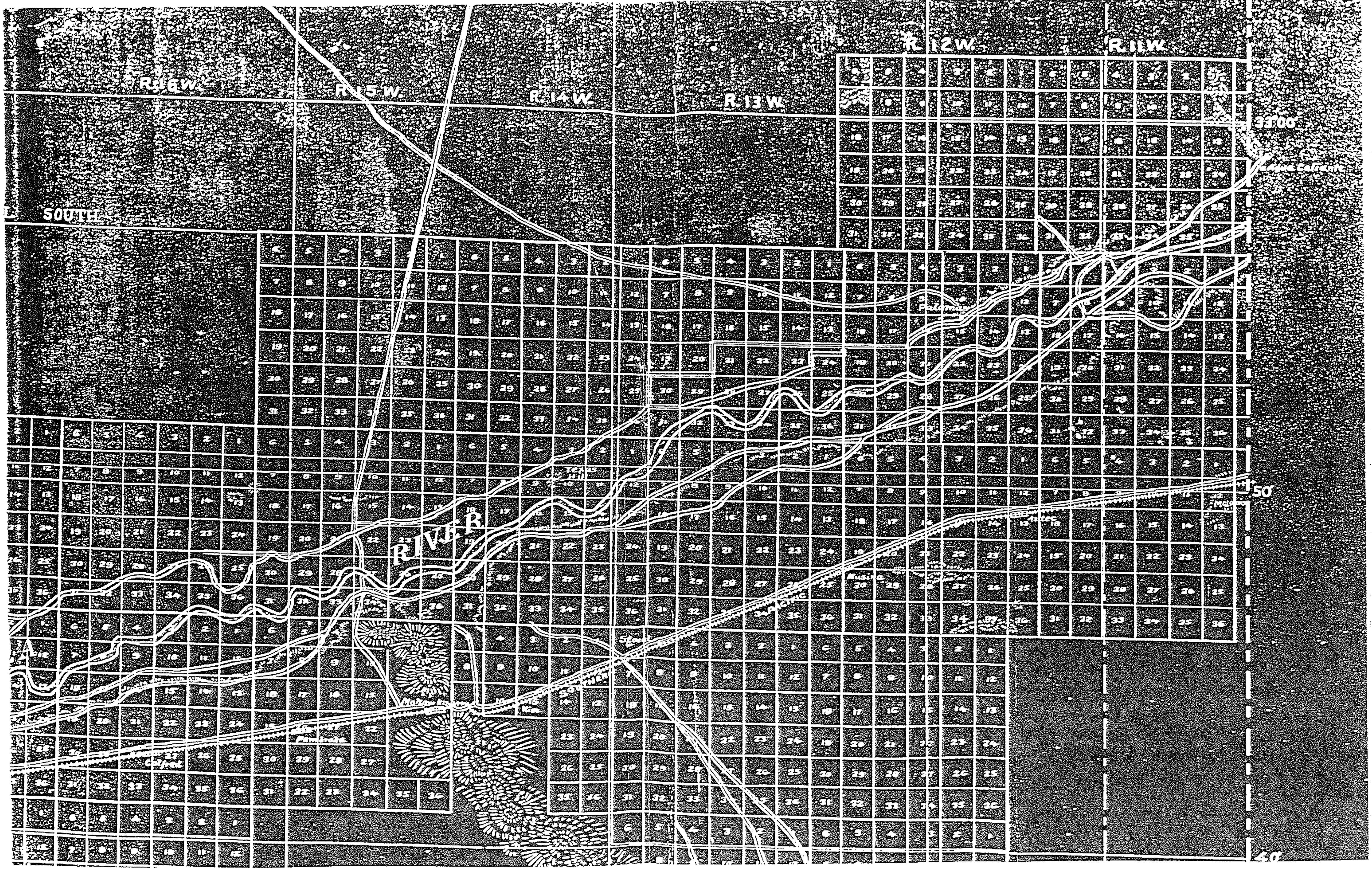
T1S R3W
T1S R2W


R.16 W.
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R.14 W.
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R.11 W.
SOUTH
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33°00'
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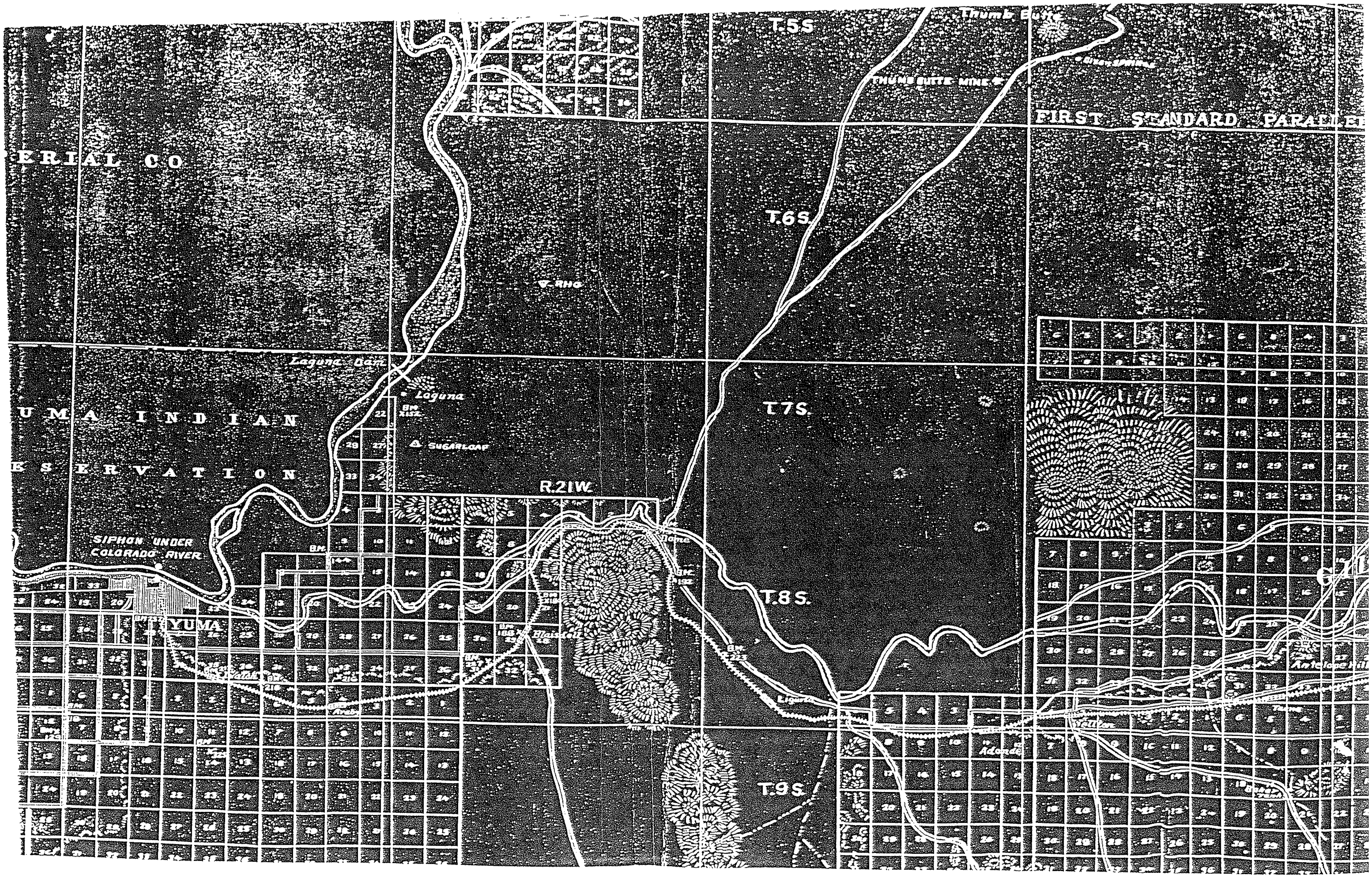
Aztec
Pacific

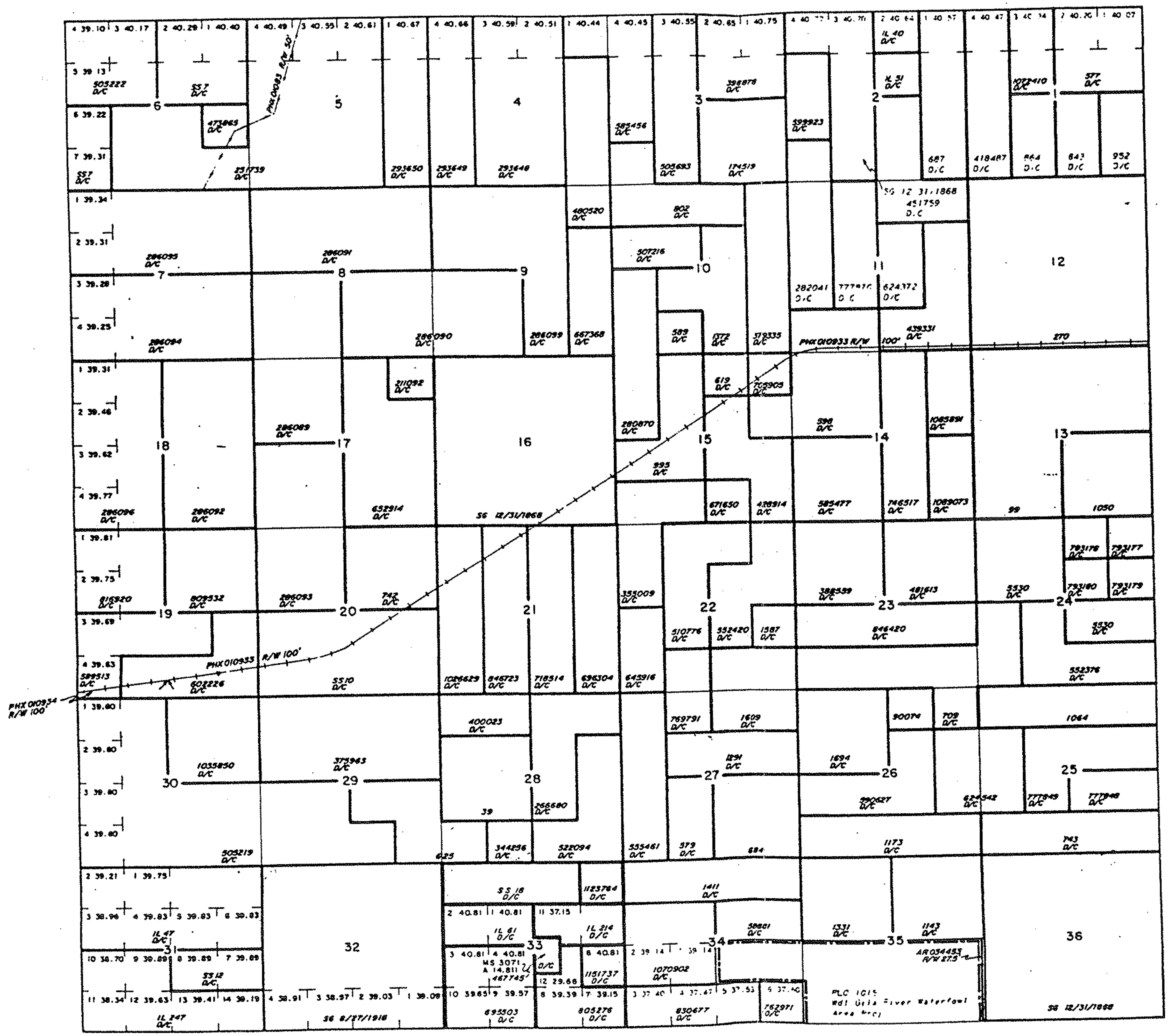

T.5S
Thumb Butte
THUMB BUTTE MINE
FIRST STANDARD PARALLEL
ERIAL CO
T.6S
RHO
Laguna Dam
Laguna
UMA INDIAN
ESERVATION
SUGARLOAF
T.7S
R.21W
SIPHON UNDER
COLORADO RIVER
T.8S
YUMA
Blaisdell
Antelope Hill
Wellton
Adonde
T.9S

p. 86

TOWNSHIP 1 NORTH RANGE 1 WEST OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA

STATUS OF PUBLIC DOMAIN LAND AND MINERAL TITLES

MARICOPA COUNTY



Lat 33°22'33" N
Long 112°18'24" W

INDEX TO SEGREGATED TRACTS

RESURVEY	ORIGINAL SURVEY			
TRACT NO	T	R	SEC	SUBDIVISION

FOR ORDERS EFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION, MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES, REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

DIST NO. 2

A 922 CL MULTIPLE USE
Sec 34 N 1/2 SE 1/4
Sec 35 S 1/2

MDS 202 SW

CURRENT TO	BY

SCALE

30 chains to the inch

WARNING STATEMENT

This plat is the Bureau's Record of Title, and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by lateral movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

T 1N
R 1W

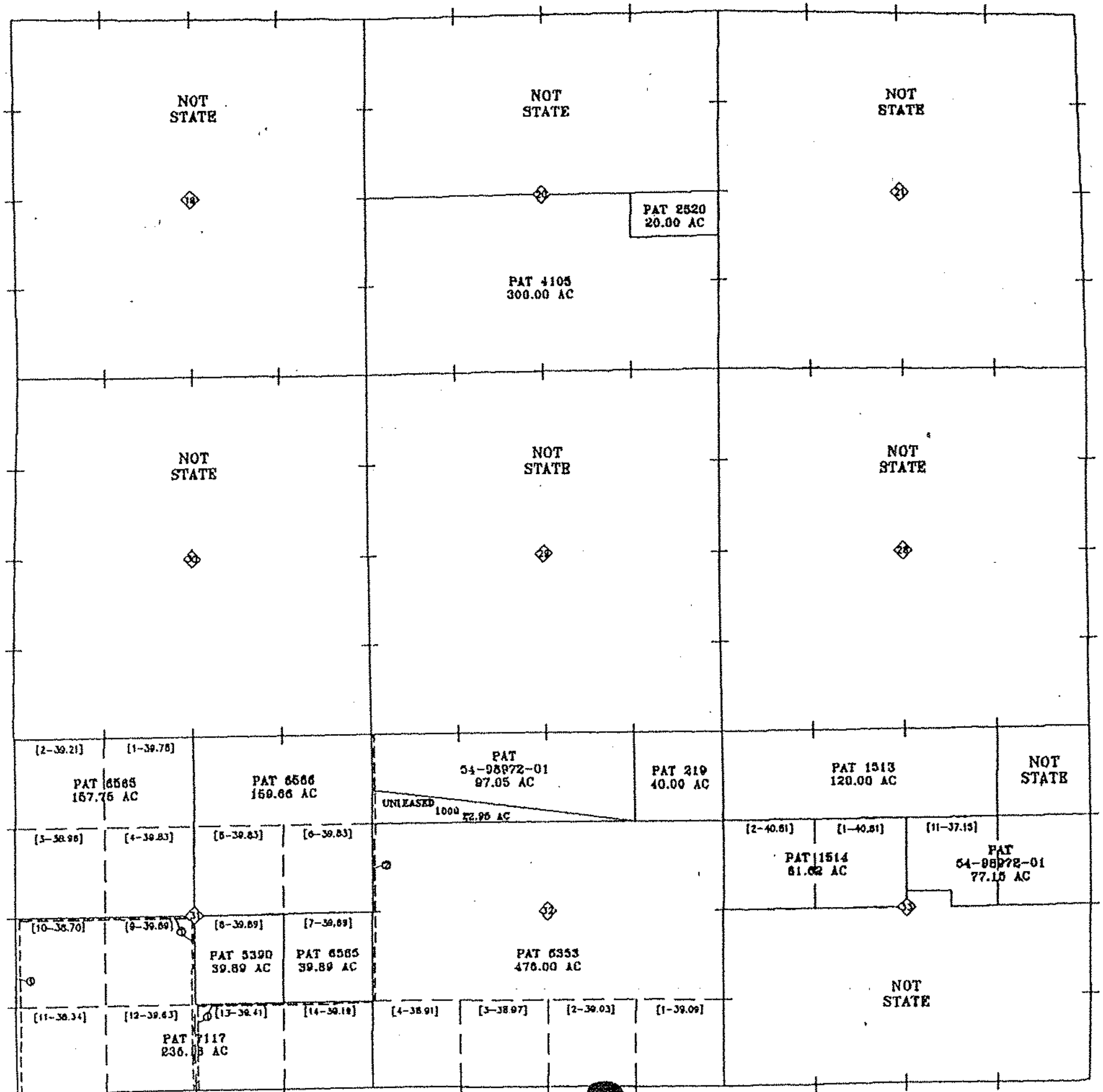
TOWNSHIP 1 NORTH RANGE 1 WEST OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA

SECTION OR TRACT	SUBDIVISION NE ¼				NW ¼				SW ¼				SE ¼				LOTS	OTHER DESCRIPTION	ACRES	KIND OF ENTRY -OR- PURPOSE OF ORDER	SERIAL FILE -OR- ORDER NUMBER	DATE OF ACTION	DATE POSTED	- REMARKS - E.G. DATE CLOSED, TERMINATED, REJECTED OR RESCINDED
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE								
																	FOR ORDERS EFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION, MINERALS, WATER, AND/OR OTHER PUBLIC PURPOSES, REFER TO INDEX OF MISCELLANEOUS DOCUMENTS							
2																	Part 2		18.24	IL Base	142	7/8/1935		
2																	Part 1		0.06	IL Base	148	11/22/1935		
14	x			x															80.00	RHE Pat.	1085891	9/25/1936		
14													x			x			80.00	RHE Pat.	1089073	3/15/1937		
33				x													11	8N 6W	77.15	IL	214	3/3/1941		
33	x																		40.00	CE Pat.	1123764	8/17/1948		
12	x	x																1N 4E		QCD from U.S.	Act of Congress	8/30/1954		
34													x	x										
35									x	x	x	x	x	x	x	x		See Remarks		PLO Wdl. Gila River Waterfowl				
																				Area Proj.	1015	10/1/1954		Other Tps.: 1N 2W, 1S 2W, 1S 3W, 1S 4W, 1S 5W, 2S 5W ; Mod. PLO 3734 7/6/1965 (AR 06341)
33																	6		40.81	PS Pat.	1151737	4/21/1955		
31																	9 thru 14	See Remarks	235.16	IL	247	6/30/1958		Other Tps.: 1N 2W, 1N 3W, 6N 4W, 4S 13W, 14S 11E, 8S 22W, 8S 21W, 13S 17W, 9N 4W,
																								40N 25E
																		Deficiency; 6N 4W	1.32	IL Base	262	10/6/1959		
2																	Part 2	1N 9W Nav. Mer.	22.40	IL Base	269	7/13/1960	7/19/1960	
2																	Part 1	5N 14E	.51	IL Base	279	1/11/1961	2/16/1961	
1			x	x				x					x	x	x	x	1,2,3		400.61					
12	x	x	x	x	x			x	x	x	x	x	x	x	x	x			560.00					
13																		All	640.00					
14	x			x									x			x			160.00					
24	x	x	x	x	x	x	x	x					x	x				See Remarks	400.00	PLO Rev. Recl. Wdl. SO 7/2/1902	2897	1/29/1963	2/4/1963	Other Tps: 2N 1W, 1N 7E, 1N 8E, 2N 8E, 2S 11E, 2S 12E, 1S 10E, 1S 11E; Open to entry 7/30/1963 10AM
35																		See Remarks		PLO Mod. Wdl. Gila River				W 55', E 55', and S 55' of the S½
																				Waterfowl Area Proj. PLO 1015,				
																				10/1/1954	3734	7/6/1965	7/20/1965	
35									x	x	x	x	x	x	x	x				R/W Hwy.	AR 034453	8/10/1965		R.S. 2477; Part.relinquishment,7/22/1982
34													x	x										
35									x	x	x	x	x	x	x	x		See Remarks		O. Proposed Cl. Multiple Use	A 922	6/5/1967		Public lands; segregates from appropriation under agricultural laws, PS, PX, SX, SS,
																								R.S. 2477 and mining laws;Other Tps.: 1N 2W, 1S 2W, 1S 3W, 1S 4W, 1S 5W, 2S 5W,
																								3S 4W, 4S 4W, 4S 5W, 4S 6W, 4S 7W, 4S 8W, 5S 4W, 5S 6W, 5S 7W, 5S 8W, 5S 9W, 5S 10W,
																								5S 11W, 6S 11W, 6S 12W, 6S 13W, 7S 13W, 7S 14W; Pub. F.R. 6/14/1967; O.Cl. 8/31/1967;
																								Pub. F.R.9/14/1967;

FEB 3 10 13 AM '97

T 1N ,R 1W
SEC. 19-21, 28-
SW 1/4

SCALE: 1" = 100



RIGHTS OF WAY
(1) 09-02488 SHOWN
(2) 09-03590 SHOWN
71-03106 THRU SENE; S2 SW (3)
71-03676 THRU S2N2 (4)

The Arizona State Land Department makes no WARRANTIES, implied or expressed, with respect to information shown on these maps.

ARIZONA STAT
LAND DEPARTM

T 1N ,R 1W
Sec. 19-21, 28-
SURFACE
MARICOPA
Sheet 1 of
Da 11/26/96
D y: JAB

D. 8

CHAPTER 3: U.S. GOVERNMENT HISTORICAL RECORDS -- REPORTS AND OTHER DOCUMENTS

Although U.S. government survey records and documents relating to federal and state patents are crucial to understanding perceptions of the Gila River prior to and in 1912, other U.S. government records -- both published and unpublished -- provide a wealth of supplemental information concerning that stream. Aside from the U.S. General Land Office, two of the most important federal agencies concerned with the region were the U.S. Geological Survey and the U.S. Reclamation Service (today, the Bureau of Reclamation). Both of these Department of the Interior agencies were heavily involved in the development of water resources in the American West in the late nineteenth and early twentieth centuries, and their records paint vivid pictures of the Gila River before and at the time of Arizona statehood.

Because of the importance of the records of the Geological Survey and the Reclamation Service, the documents those agencies created will be discussed in detail in this report. There were, however, other federal agencies whose responsibilities brought them into contact with the Gila River. Because those agencies' characterizations of the Gila River essentially duplicated those of the Geological Survey and the Reclamation Service, only those two agencies' papers will be reviewed here in depth to avoid needless repetition. That discussion will cover representative examples from thousands of pages of documents that were examined, all of which substantiated that the Gila River was never viewed as a reliable means of commercial navigation prior to or at the time of Arizona statehood in 1912.

One additional U.S. government report not contained in the records of the Geological Survey or the Reclamation Service will also be discussed here. That report was done in conjunction with the University of Arizona's Agricultural Experiment Station, and it contains a wealth of information about the Gila River.

RECORDS OF THE U.S. GEOLOGICAL SURVEY: The U.S. Geological Survey and its predecessor agencies had started recording commentary concerning the West's resources as early as the 1870s.

The Wheeler Survey: For example, in 1872 George M. Wheeler was sent to obtain topographical information on Arizona and Nevada and to assess the region's resources, climate, and other qualities that might affect homesteaders. (Although this study of the West was conducted under the direction of the U.S. Army prior to the creation of the U.S. Geological Survey in 1879, Wheeler's records are considered part of the those of the Geological Survey's predecessor agencies.)

Following his exploration of the region, Wheeler submitted a report to Congress which contained a daily record of the journey as well as descriptions of various subjects. In the report, Wheeler mentioned several streams in Arizona, including the Gila, the Salt, and the Verde. None of these, however, were described as being navigable, although navigability was certainly a characteristic Wheeler would have commented on given his discussion of the Colorado River. Under a section entitled "Means of Communication," Wheeler noted that boats had gone upriver on the Colorado as high as Camp Mohave. Yet Wheeler was pessimistic about reliable river transport anywhere in the West, even on the Colorado:

> One of the urgent wants felt in the promotion of our mining industry is that of increased and cheapened inland transportation. River transportation upon our western coast is, to a great extent, a failure, as beyond the Columbia and Colorado Rivers, that furnish somewhat irregular avenues of connection with the interior, no streams of considerable magnitude exist; river transportation, even in this very American age, loses its great power when pitted against railroads.[77]

U.S. Geological Survey Annual Reports: Following the Wheeler Survey, the Geological Survey became more directly involved in examining water resources in the West. In 1888 the agency's director, John Wesley Powell, began what became known as the "Powell Irrigation Survey." Essentially a study of which arid lands in the West might be reclaimed by storing and diverting water from the region's streams, Powell's work led to increasingly frequent commentary in the Geological Survey's records regarding water resources throughout the western part of the United States. Many of the descriptions of the streams of the West were included in the Geological Survey's annual reports.

Part II of the Eleventh Annual Report of the U.S. Geological Survey, for example, contained a section devoted solely to the Gila Basin. In describing the basin in general, this 1891 report stated:

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[77] George M. Wheeler, Report on Exploration of the Public Domain in Nevada and Arizona, H. Ex. Doc. 65, 42nd Cong., 2 sess. (Washington, D.C.: U.S. Government Printing Office, 1872), pp. 17-19, 53 [LRA Box/File: 8/18].

> In this basin are found rivers most difficult and dangerous to examine and control, differing in character and habit from those of the North as widely as in geographic position. In place of the regularly recurring annual floods of spring and early summer, so strongly marked on the discharge diagrams of other basins, these rivers show conditions almost the reverse, being at that season at their very lowest stages -- even dry -- and rising in sudden floods at the beginning of and during the winter. These floods are of the most destructive and violent character; the rate at which the water rises and increases in amount is astonishingly rapid, although the volume is not always very great. . . . From this it will be recognized that the onset of such a flood is terrific. Coming without warning, it catches up logs and bowlders [sic] in the bed, undermines the banks, and, tearing out trees and cutting sand-bars, is loaded with this mass of sand, gravel, and driftwood -- most formidable weapons for destruction.[78]

The Twelfth Annual Report of the U.S. Geological Survey contained more description of the Gila. Noting that for farming purposes "water is derived from the Gila River and its tributaries by means of canals and ditches, which distribute it to the fields of each farmer," the report added that "[t]hese streams fluctuate greatly, being at times subject to sudden floods, especially during summer rains, when they often sweep out bridges, dams, and canal head works, while at other times they may diminish until the water almost disappears."[79] The Twelfth Annual Report of the U.S. Geological Survey also described massive torrents and dramatic changes in flow on the Gila:

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[78] Eleventh Annual Report of the United States Geological Survey to the Secretary of the Interior, 1889-1890, Part II-Irrigation (Washington D.C.: U.S. Government Printing Office, 1891), p. 58 [LRA Box/File: 9/9].

[79] Twelfth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1890-91, Part II-Irrigation (Washington D.C.: U.S. Government Printing Office, 1891), p. 292 [LRA Box/File: 9/9].

The floods of the Gila are usually short and violent, the highest water occurring during the months of January and February. During a freshet the river rises in some places from 8 to 12 feet, and increases in width from 300 feet to a mile and a half. It is sometimes impassable for weeks, and has the appearance in places of a sea of muddy water. The season of low water occurs during the months of June and July, the river bed being then dry in places.[80]

U.S. Geological Survey Water Supply Papers: Aside from its annual reports, the U.S. Geological Survey also published a series of research treatises known as "Water Supply Papers." While these studies dealt with specific topics and geographic areas, some examined subjects which shed light on the nature of the Gila River prior to or at the time of Arizona's statehood. The Water Supply Papers further confirm the undependable and unpredictable nature of the stream.

For example, Report of Progress of Stream Measurements for the Calendar Year 1905, Part XI. Colorado River Drainage Above Yuma (U.S. Geological Survey Water Supply Paper No. 175) noted that:

> [t]he river now (1905) flows in a channel fully 1 mile north of the original channel. . . . At every flood the channel shifts. The valley at its narrowest is half a mile wide and the waters may occupy any part or all of it. . . . [The river contains] an enormous amount of mud and sand. At times the waves of sand traveling along the bed of the stream are so large, the current is so swift, and the stream so shallow, that the water is broken into a uniform succession of waves 2 feet high and over.

A table accompanied this description recording discharge at Gila City (Dome), Arizona, and it further indicated the erratic nature

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[80] Twelfth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1890-91, Part II-Irrigation (Washington D.C.: U.S. Government Printing Office, 1891), p. 295 [LRA Box/File: 9/9].

of this river. For instance, on February 8, 1905, the discharge was 82,000 cubic feet per second, but just eight days later, on February 16, no discharge was recorded at all.[81]

U.S. Geological Survey Water Supply Paper No. 162, published in 1906, added additional detail about the Gila's characteristics. Entitled Destructive Floods in the United States in 1905, with a Discussion of Flood Discharge and Frequency and an Index to Flood Literature, this Water Supply Paper described the devastating floods which occurred in the United States in 1905, including five on the Gila. Observing that the first 1905 Gila inundation was "more characteristic of floods on this stream than any of the others," the Water Supply Paper stated that such torrents were "generally of short duration, the rise and fall being very rapid."[82] More telling, however, was the Water Supply Paper's attempt to put the spring floods into proper perspective:

> The total run-off for the five months is 2,957,400 acre-feet. To appreciate the magnitude of the run-off on this stream during this period it is necessary to remember that this stream is usually dry at this place about ten months of the year. . . . [The Gila's bed] not only scours out during a flood and fills in after it, but [the] channel changes from one side of the bottom to the other. . . . This continual changing of the river bed has made it exceedingly difficult to secure reliable

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[81] M.C. Hinderlider and G.L. Swendsen, Report of Progress of Stream Measurements for the Calendar Year 1905, Part XI. Colorado River Drainage Above Yuma, U.S. Geological Survey Water Supply Paper No. 175 (Washington D.C.: U.S. Government Printing Office, 1906), p. 164 [LRA Box/File: 10/27].

[82] Edward Charles Murphy, et al., Destructive Floods in the United States in 1905, with a Discussion of Flood Discharge and Frequency and an Index to Flood Literature, U.S. Geological Survey Water Supply Paper No. 162 (Washington, D.C.: U.S. Government Printing Office, 1906), p. 47 [LRA Box/File: 10/27].

estimates of the rate of flow, and some of the estimates may be largely in error.[83]

U.S. Geological Water Supply Paper No. 289, written about the surface water supply of the United States in 1910, provided additional useful information on the character of the Gila. Calling the river "torrential," the report described the Gila as "sometimes impassable for weeks and [it] has the appearance of a sea of muddy water." The Water Supply Paper added that the "season of low water occurs in June and July, the river bed then being dry in places."[84]

The Gila River's dramatic fluctuation in flow can probably best be seen in U.S. Geological Survey Water Supply Paper No. 1049, which provided a summary of records of the surface waters of the lower Colorado River Basin between 1888-1938. These included records for the gaging station located near Dome, Arizona (also known as Gila City), close to the mouth of the Gila River. Records at this station were available from 1902 to 1938, and they consistently illustrated that the Gila ranged in discharge from nothing to well over 100,000 cubic feet per second in many cases.

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[83] Edward Charles Murphy, et al., Destructive Floods in the United States in 1905, with a Discussion of Flood Discharge and Frequency and an Index to Flood Literature, U.S. Geological Survey Water Supply Paper No. 162 (Washington, D.C.: U.S. Government Printing Office, 1906), p. 48 [LRA Box/File: 10/27].

[84] W.B. Freeman, et al., Surface Water Supply of the U.S.-Colorado River Basin, U.S. Geological Survey Water Supply Paper No. 289 (Washington D.C.: U.S. Government Printing Office, 1912), p. 200 [LRA Box/File: 26/26].

Moreover, at the mouth of the Gila, there was no flow at all in February 1912, and none appeared until the following May.[85]

Unpublished Records of the U.S. Geological Survey: Aside from the published reports and Water Supply Papers created by the Geological Survey, the agency also generated other documents shedding light on the nature of the Gila River prior to and about the time of Arizona's statehood.

The unpublished records of George M. Wheeler that led to his published report to Congress in 1872 (see page 91 above) provide yet more information about the nature of the Gila River. Wheeler's draft "Progress Report Upon Geographical and Geological Explorations and Surveys West of the 100th Meridian in 1872" observed that:

> [t]here are three streams whose navigability gives them more or less importance as commercial lines, namely: the Columbia, the Sacramento, and the Colorado rivers. [Wheeler had reduced the number of navigable streams to two in his final report to Congress -- see above at page 92.] The limit of navigation of these streams for freight carrying vessels, has already been determined and from it, is deduced the conclusive fact that except for their advantages as an assistance to local interior traffic, and as the possible adjunct to trans-continental routes, that the standard for their usefulness has been fixed: which usefulness is governed by the rates of increase of commerce from the ports at their mouths to and from the head of navigation in each case.[86]

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[85] <u>Summary of Records of Surface Waters at Stations on Tributaries in Lower Colorado River Basin, 1888-1938</u>, U.S. Geological Survey Water Supply Paper No. 1049 (Washington D.C.: U.S. Government Printing Office, 1947), pp. 230-237 [LRA Box/File: 18/9].

[86] George M. Wheeler, "Progress Report upon Geographical and Geological Explorations and Surveys West of the 100th Meridian in 1872," p. 256, Box 1, Entry 20, Record Group 57, Records of the (continued...)

Later unpublished records of the U.S. Geological Survey confirmed the inability of the Gila to support commercial navigation. For example, one such document summarized the numerous conflicts in the Gila Valley regarding right-of-ways for canal companies. Writing on February 14, 1911, the Director of the Geological Survey reported upon the application of the Southwestern Arizona Fruit and Irrigation Company to take a canal out of the Gila. Referring to an unspecified survey made the previous year and subsequent report in relation to another canal company, the director observed that:

> [t]he same conditions exist regarding the Southwestern Arizona Irrigation Company's project, and in brief are that no power possibilities exist, but the sufficiency of the water supply is extremely questionable. On account of the appropriations above, the only water available at this site is that of occasional extreme floods, and the underflow and seepage water from upstream, the amount of which is very uncertain. The proposed reservoir is of such small capacity as to have little value for storing flood waters.[87]

One particularly revealing unpublished report prepared for the Geological Survey that sheds light on the nature of the Gila dealt with potential hydroelectric power sites within Arizona. Although written shortly after Arizona became a state, the report was based on data accumulated for many years prior to statehood, and it had

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[86] (...continued) U.S. Geological Survey, U.S. National Archives II, College Park, Maryland [LRA Box/File: 18/15].

[87] Department of the Interior, General Land Office, Affirming R & R Decision, Feb. 24, 1912, "37-A-5 Straights, Preliminary Investigations-Sentinel Project 37-A-5," General Correspondence File (Straights) #37-A, Record Group 115, U.S. Bureau of Reclamation, National Archives-Rocky Mountain Region, Denver, Colorado [LRA Box/File: 12/1].

been done to conform with provisions of the 1910 Enabling Act allowing Arizona to take steps to join the Union. That law, however, also prevented the future state from selecting parcels valuable as hydroelectric power sites as part of acreage granted to Arizona by Congress. The resulting report by E.C. Murphy was the result of an investigation to locate those hydroelectric power sites so the United States could retain them.[88]

Part 2 of Murphy's report dealt with the Gila River. The introduction to this section described the Gila's general characteristics, noting that it was a tributary of the Colorado. Adding that the Gila drained about 70,000 square miles in Arizona, New Mexico, and Mexico, Murphy nevertheless observed that the Gila had "a very small run-off at the mouth except during very wet periods."[89] Murphy then described the Gila:

> On account of the erratic character of the precipitation, the use of the water for irrigation, and the depth and porosity of the valley fill the minimum flow in the valleys along the Gila is very small and uncertain. In all these valleys there is no surface flow at certain places during the low water period of dry years. Though the surface flow may be 0 at one place there may be several second reet at some distance below due to seepage

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[88] Each main part to Murphy's report was re-paginated beginning with page one. Therefore, all citations to his report will include the section as well as page number. See E.C. Murphy, "Water Power Utilization in Arizona," April 1915, Introduction, pp. 4-5, Salt River Project Archives, Phoenix, Arizona [LRA Box/File: 6/4].

[89] E.C. Murphy, "Water Power Utilization in Arizona," April 1915, Part II, p. 1, Salt River Project Archives, Phoenix, Arizona [LRA Box/File: 6/4].

> from irrigated lands, or a reduction in cross section of the ground water channel.[90]

Regarding the Gila's water supply, Murphy explained that the river was:

> partly an under ground stream rising and sinking according to local formations. There is abundant evidence of this fact from Clifton, New Mexico, to Gila Bend, Arizona. In each of the valleys between those places the Gila is dry for a few days nearly every year and at a point a few miles below there is flowing water in the stream. . . . In 1903 there was a flood on the San Francisco that reached a stage of 30 feet above low water at Clifton. By the time this flood reached the mouth of Salt River, 175 miles distant, it had almost entirely disappeared. With the exception of a small part that passed into irrigation ditches and some that passed off in evaporation, this flood went into the ground storage.[91]

Indicating that the Gila was not relied upon for commercial transportation, Murphy stated that one of the major hindrances to reservoirs on the Gila was "a railway running along the river through some of the sites that must be moved to higher location."[92]

In his discussion of hydroelectric power possibilities along the Gila, Murphy said that for the segment of the river from its mouth to Buttes, the

> stream flows through a broad, flat valley in a broad, sandy, changing channel. It is dry for a month or longer each year at Florence, and below Gila Bend it is dry all

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[90] E.C. Murphy, "Water Power Utilization in Arizona," April 1915, Part II, p. 3, Salt River Project Archives, Phoenix, Arizona [LRA Box/File: 6/4].

[91] E.C. Murphy, "Water Power Utilization in Arizona," April 1915, Part II, p. 8, Salt River Project Archives, Phoenix, Arizona [LRA Box/File: 6/4].

[92] E.C. Murphy, "Water Power Utilization in Arizona," April 1915, Part II, p. 8, Salt River Project Archives, Phoenix, Arizona [LRA Box/File: 6/4].

> the time except during large and long continued floods. There are many ditches diverting water from the Gila in this part, and the area that can be irrigated from them is very large, but the area actually irrigated is comparatively small on account of small and uncertain supply. As previously stated there may be several years in succession of very small run-off. During these years only ground water is available for some of this land. The irrigation ditches and especially the head works are allowed to get out of repair and when a flood comes it damages or destroys the head works and little if any of the flood water is utilized. . . . At some places on the Gila Indian Reservation the underflow comes to the surface and is diverted for irrigation, also below the mouth of Salt River where the Buckeye and Arlington canals are located. The canals and ditches that tap the underflow have a permanent supply but those that depend on the surface flow for water are not a success.[93]

RECORDS OF THE U.S. RECLAMATION SERVICE: Following Congress's enactment of the 1902 Reclamation Act, many of the water resource duties formerly carried out by the hydrographic branch of the U.S. Geological Survey were transferred to the young U.S. Reclamation Service. Under the terms of the Reclamation Act, the new agency also was charged with the responsibility of selecting reservoir locations throughout the American West and constructing dams and irrigation canals at those sites. It was under this latter mandate that the agency investigated the Gila River for possible reservoir sites.

U.S. Reclamation Service Annual Reports: Like the Geological Survey, the Reclamation Service issued annual reports delineating its activities, and these contain valuable descriptions of the Gila River. Much of the Reclamation Service's focus was on the San

[93] E.C. Murphy, "Water Power Utilization in Arizona," April 1915, Part II, pp. 9-10, Salt River Project Archives, Phoenix, Arizona [LRA Box/File: 6/4].

Carlos Reservoir site above the Gila's confluence with the Salt River, but nevertheless, the agency also dealt with the Gila below the Salt.

The First Annual Report of the Reclamation Service commented that irrigation in the drainage basin of the Gila and Salt rivers had already been developed to a point that there was insufficient water for the lands. Nonetheless, the report stated that "[t]he situation in this respect, while not peculiar, is most extreme as regards the entire West, the fluctuations of flow of the rivers being most marked and the effect upon the population most disastrous."[94] In addition, the report added:

> The sources from which water may be obtained for reclamation of the arid lands in Arizona are, taken as a whole, the most erratic or irregular in the entire country. There are comparatively few rivers which flow throughout the year. Most of the tributaries of Gila River, beginning in the mountains as perennial streams, lose their waters in the broad, open valleys.[95]

The Ninth Annual Report of the Reclamation Service carried information about progress being made on a canal to serve the Gila River Indian Reservation. Yet the report also indicated that the erratic nature of the Gila made that work difficult:

> [T]he construction of the flood-water canal on the Gila River Indian Reservation was begun, 6 miles of canal being excavated, and most of the concrete structures were

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[94] First Annual Report of the Reclamation Service, from June 17 to December 1, 1902 (Washington D.C.: U.S. Government Printing Office, 1903), p. 75 [LRA Box/File: 9/1].

[95] First Annual Report of the Reclamation Service, from June 17 to December 1, 1902 (Washington D.C.: U.S. Government Printing Office, 1903), p. 76 [LRA Box/File: 9/1].

built. Work was suspended in April, 1910, and will be resumed after the flood season in the Gila River.[96]

Unpublished Records of the U.S. Reclamation Service: Like the annual reports of the U.S. Reclamation Service, the agency's unpublished documents further depicted the Gila River as highly unpredictable and not useful for commercial navigation. While these files contain many documents describing the Gila River and proposals for dams on that stream -- none of which indicate that the river was a reliable means of navigation -- representative examples are provided here.

One such document is a 1911 letter from L.W. Powell to Secretary of the Interior Walter L. Fisher regarding the possible construction of a dam by the Gila Water Company. In this letter, Powell wrote that "[t]he flow of the Gila varying as it does from almost nothing at times to a tremendous volume during floods, makes necessary very accurate data to enable us to decide upon the type and construction of the dam contemplated." Powell asked that the Secretary of the Interior direct the Reclamation Service to undertake a hydrographic study of the Gila to assist the dam construction plan.[97]

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[96] Ninth Annual Report of the Reclamation Service, 1909-1910 (Washington D.C.: U.S. Government Printing Office, 1911), p. 68 [LRA Box/File: 9/1].

[97] L.W. Powell to Walter L. Fisher, July 19, 1911, 37-A-5 Straights, Preliminary Investigations-Sentinel Project, 37-A-5, General Correspondence File (Straights) #37-A, Record Group 115, U.S. Bureau of Reclamation, National Archives-Rocky Mountain Region, Denver, Colorado [LRA Box/File: 12/1].

Correspondence regarding a proposal for a dam at Gila Bend also provided information on the characteristics of the Gila River. Although the following two letters were written in 1913, they both indicate that the descriptions of the Gila were historical in character. The first letter from Louis Hill to Howard S. Reed (both employees of the Reclamation Service) expressed Hill's disbelief about what he thought had been Reed's comment to another party that the Gila had a minimum flow of 125 cubic feet per second all year. Hill stated:

> I feel quite sure that he must be entirely mistaken in this, because we both know that there are certain seasons of the year that you certainly cannot get 125 second feet; in fact, the only time that I went down there, which was with you I believe, there wasn't over about 125 inches and all of that was going into a little ditch on the north side of the river.[98]

Reed responded to Hill's letter on June 10, 1913. In reference to the amount of water which could be expected to flow in the Gila, Reed wrote:

> I am inclined to think the expression that I used was that, "During my various visits to the Gila Dam site, never have I seen less than 100 second feet surface flow, with the river dry between that site and the Buckeye Dam and that canal full to its capacity." . . . [O]n the 10th of August, 1911, I made a current meter measurement, the original notes which are herewith enclosed, when I found a discharge of 103 cubic feet per second and this with no flow at all below the Buckeye Dam. In fact, one

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[98] Louis Hill to H.S. Reed, June 3, 1913, 37-A-5 Straights, Preliminary Investigations-Sentinel Project 37-A-5, General Correspondence File (Straights) #37-A, Record Group 115, U.S. Bureau of Reclamation, National Archives-Rocky Mountain Region, Denver, Colorado [LRA Box/File: 12/1].

could walk across the river and hardly dampen the shoes.[99]

UNIVERSITY OF ARIZONA AGRICULTURAL EXPERIMENT STATION'S 1911 REPORT: Although the largest amount of information about the Gila River in federal files is in the records of the Geological Survey and the Reclamation Service, one especially useful report on the nature of that stream is contained in Department of Agriculture records. That report is Irrigation and Agricultural Practice In Arizona by R.H. Forbes. Published by the U.S. Government Printing Office in 1911, the report had been the fruit of research undertaken at the University of Arizona's Agricultural Experiment Station, which was overseen by the U.S. Department of Agriculture. The report was a detailed discussion of Arizona's principal industries, transportation, climate, water supply, and farmlands.

In his report, Forbes first discussed the territory's principal industries and then turned his attention to transportation. Because of the significance of what Forbes wrote in relation to the Gila River, it is worth quoting this part of his report at length:

> By reason of its isolation, Arizona is dependent upon its transportation facilities to an unusual degree. These consist chiefly of three great railroad systems, which, in order of their construction, are the Southern Pacific, the Santa Fe, and the El Paso & Southwestern. The Santa Fe crosses the northern tier of counties from east to west, and with its branches opens up the mining and lumbering districts of the more elevated half of the

[99] Howard S. Reed to Louis C. Hill, June 10, 1913, 37-A-5 Straights, Preliminary Investigations-Sentinel Project 37-A-5, General Correspondence File (Straights) #37-A, Record Group 115, U.S. Bureau of Reclamation, National Archives-Rocky Mountain Region, Denver, Colorado [LRA Box/File: 12/1].

> Territory. The Southern Pacific runs a roughly parallel course south of the Gila River, and its feeders tap the rich mining districts and the warmer irrigated valleys at lower altitudes. The El Paso & Southwestern road affords an outlet for the copper mines of southeastern Arizona and northern Mexico. A few steamboats of shallow draft ply the Colorado River, and in remote localities freighting with teams is still practiced.[100]

It is significant that Forbes only listed the Colorado River as having regular navigation. Moreover, his statement that the Southern Pacific Railroad ran south of the Gila River additionally indicates that Forbes did not think the Gila was navigable.

In relation to surface streams and water supply, Forbes initially discussed the Colorado, and then turned his attention to the Gila. Forbes wrote that the Gila was:

> a comparatively small and irregular stream, due to its arid watershed and uncertain rainfall, although occasionally it carries enormous floods. Since the appropriation of its upstream waters for irrigation **its lower courses are often dry for months in succession. . . .** The run-off of the Gila is difficult to estimate, differing in this respect from the Salt and Colorado Rivers, which, confined in rocky beds in their upper courses, can be quite definitely and completely measured at established gauging stations. The Gila, flowing in a pervious bed of low gradient, is in varying proportions an underground river, and rising and sinking as it does, according to local formations, can not be measured definitely by ordinary methods. The amount of surface flow, as estimated from the not very continuous or prolonged measurements available, indicates a limited but comparatively constant stream in the upper Gila near the New Mexico line, but an increasingly variable and inconstant irrigating supply between San Carlos and Yuma. The San Pedro and the Santa Cruz Rivers resemble the Gila and give tribute to it mainly in flood waters. The seepage from the Salt River irrigation appears near its confluence with the Gila and affords a very constant and

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[100] R.H. Forbes, <u>Irrigation and Agricultural Practice In Arizona</u>, University of Arizona Agricultural Experiment Station (Washington D.C.: U.S. Government Printing Office, 1911), p. 14 [LRA Box/File: 9/7].

reliable supply for the irrigation of the lands near Buckeye and Arlington. Below the latter point the Gila supply is so uncertain as to preclude satisfactory farming operations. . . . The Gila River is not infrequently dry at Florence, sometimes for several months at a time, as for instance, from March to July, 1899. Without storage, therefore, agriculture at this point is less assured of its necessary irrigating supply than near the New Mexico boundary, where even in driest years, the river has never failed entirely.

At Yuma the Gila is even more variable than at Florence, and the discharge has ranged, it is said, from nothing for a period of a year to as high as 3,665,148 acre-feet in 1905. . . . **It may be stated summarily that the fluctuations in water supply become more and more extreme from the source to the mouth of the Gila.** [Emphases added.][101]

SUMMARY AND CONCLUSIONS REGARDING U.S. GOVERNMENT REPORTS AND OTHER DOCUMENTS: U.S. Government records -- both published and unpublished -- clearly indicate that the Gila River between its confluence with the Salt River and its mouth at the Colorado River was not navigable or susceptible of navigation at or before Arizona's statehood on February 14, 1912. The records of the federal agencies whose responsibilities were most closely associated with water resource development in the West (the Reclamation Service and the Geological Survey) consistently portrayed the Gila River as highly erratic with unpredictable flows and a shifting channel. This assessment was further confirmed by the 1911 report done for the University of Arizona Agricultural Experiment Station by R.H. Forbes. Such a stream could hardly provide a reliable means of water-borne commerce.

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[101] R.H. Forbes, Irrigation and Agricultural Practice In Arizona, University of Arizona Agricultural Experiment Station (Washington D.C.: U.S. Government Printing Office, 1911), pp. 32, 46-48 [LRA Box/File: 9/7].

CHAPTER 4: MISCELLANEOUS DOCUMENTS

The following miscellaneous documents and press accounts, gathered from many sources, reinforce the evidence found in federal surveys, federal and state patents, and other government documents indicating the lack of navigability of the Gila River.

MISCELLANEOUS HISTORICAL DOCUMENTS: Included in this discussion are textual records such as the records of explorers, legislative pronouncements, the observations of irrigation enthusiasts, statements by local residents, and press accounts. This material, which ranges chronologically from 1775 to 1911, supports the findings in other parts of this report that the Gila River was erratic, unreliable, and blocked by obstructions such as sand bars, gravel beds, boulders, and diversion dams. These documents are representative of many more illustrating the same conclusions regarding the Gila.

Spanish Missionaries: There are numerous accounts of the Gila River as it existed prior to Arizona statehood in 1912. Among them are reports of Spanish missionaries, military explorers, and various other visitors to the region. One of the earliest non-Indian to visit the Gila River area was Francisco Garces, a Spanish missionary priest, who travelled through what is now the American Southwest in 1775 and 1776. While in what is today Arizona, Garces described the frequent shifting of the Gila's channel on November 29, 1775, as part of his commentary on that stream and on the Colorado River:

> As the rio Colorado has such a current, and runs so scattered through the bottomlands, we found no Isla de

> Trinidad, neither was there now the ford by which passed the expedition on the former occasion, the Indians saying that the river was now very deep at that ford: for these two rivers Colorado and Gila rise every year to such excess, and run through these flat and friable grounds with such lack of restraint, that they appear to shift their channels, forming wash-outs, and dividing into branches, according as the force of the current bears more or less to this side or to that. The result is, that at its greatest flood the Gila itself extends more than a league, and presumably the Colorado much more.[102]

American Military Expeditions and the U.S.-Mexican Boundary Survey: Many early explorers of the Gila River region were members of the American military. This is partly due to the fact that the Gila and the Colorado River provided an access route across the Southwest that was useful during the war between Mexico and the United States (1846-1848). Other military explorers came after the war, both to document the assets of the region after the United States had acquired it as well as to survey the new border between the United States and Mexico (a part of which was the Gila River until the Gadsden Purchase of 1853). The importance of the Gila as a way across the Southwest has been noted in Odie B. Faulk's Destiny Road; The Gila Trail and the Opening of the Southwest (1973), although in Faulk's opinion, the river itself was not useful for transportation:

> That the Gila Trail should be of such importance was incomprehensible to men in the eastern United States during the 1850s, for there rivers had provided the natural highways for pioneering; these in turn had carried canoes, flatboats, keelboats, and steamboats, and along their banks men had planted their farms and built their cities. **In the arid reaches of the American**

[102] Francisco Garces, On the Trail of a Spanish Pioneer: The Diary and Itinerary of Francisco Garces, Elliot Coues, trans. (New York: Francis P. Harper, 1900), p. 145.

Southwest, however, no such water route was available, and a road, such as the Gila Trail, became the route of exploration, conquest, transportation, and communication. [Emphasis added.][103]

Despite Faulk's assessment that transportation went by land and not by water, there were at least a few attempts to use boats on the Gila, particularly during the war between Mexico and the United States. Among the earliest military groups to attempt using the river for conveyance were members of the so-called Mormon Battalion -- volunteers recruited from Mormon emigrants, who were then headed for Utah. In October 1846, Colonel Phillip St. George Cooke led the Mormon Battalion westward from Santa Fe, New Mexico, following the Gila Trail across Arizona. After passing Gila Bend, Cooke wrote in his journal about a failed attempt to travel down the Gila by boat:

> Sixty or seventy miles above the mouth of the Gila, having more wagons than necessary, and scarcely able to get them on, I tried the experiment, with very flattering assurances of success, of boating with two pontoon wagon beds, and a raft for the running gear. I embarked a portion of the rations, some road tools, and corn. The experiment signally failed, owing to the shallowness of the water on the bars; the river was very low. In consequence of the difficulty of approaching the river, orders mistaken &c., the flour only was saved from the loading, and the pontoons were floated empty to the crossing of the Rio Colorado, where they were used as a ferry boat.[104]

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[103] Odie B. Faulk, Destiny Road; the Gila Trail and the Opening of the Southwest (New York: Oxford University Press, 1973), p. viii.

[104] Philip St. George Cooke, Report of Lieutenant Colonel Phillip St. George Cooke of His March from Santa Fe, New Mexico, to San Diego, Upper California, H. Ex. Doc. 41, 30 Cong., 1 sess. (Washington D.C.: U.S. Government Printing Office, 1848), p. 558.

Other members of the Mormon Battalion also recorded their perceptions of the Gila River, including Nathaniel V. Jones, who told of another attempt to use boats on the Gila -- this time to transport cattle downstream. In early 1847 after camping near the Gila River, Jones noted that the Battalion "[s]tayed in camp all day; here we left one wagon, and made boats of two wagon beds and put about twelve oxen in each boat and started down the river."[105] There is no indication precisely where these boats were first used on the Gila or how far the group was able to travel with them.

Another observer during the war with Mexico also thought boats might be used on the lower Gila -- or at least speculated on the possibility. Henry Smith Turner kept a journal of his travels in the Southwest during his service in the military, and on November 19, 1846, at a place approximately eighty miles west of Gila Bend, Turner wrote:

> The Gila is assuming a much more river-like appearance -- it has attained the width from 100 to 150 yards -- and is in average depth about 4 feet -- quite deep enough to float a steamboat -- its valleys are wide, and but for the want of moisture would doubtless be covered with grass.[106]

While this description indicates that Turner believed the Gila was capable of floating boats far west of Gila Bend, nevertheless his chosen words also suggest that east of this point on the river, the

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[105] Nathaniel V. Jones, "The Journal of Nathaniel V. Jones, with the Mormon Battalion," Utah Historical Quarterly 4:1 (1931), p. 10 [LRA Box/File: 8/12].

[106] Henry Smith Turner, The Original Journal of Henry Smith Turner with Stephen Watts Kearny to New Mexico and California, 1846-47, H.S. Turner and D.L. Clarke, eds., (Norman: Oklahoma University Press, 1966), p. 115.

stream did **not** have "river like" characteristics and presumably was not capable of carrying boats.

Another military observer also thought -- at least initially (although he later changed his mind) -- that the lower Gila might be useful for transportation by water. This was true even though his descriptions of the stream suggest that its channel changed frequently and was filled with sandbars. William H. Emory took many notes of his service in the Southwest in 1846-1847, and upon his return to the East, he submitted an extensive report of his journey to Congress. As his party moved west from what is today the Gila River Indian Reservation, they "found the river spread over a greater surface, about 100 yards wide, and flowing gently along over a sandy bottom, the banks fringed with cane, willow, and myrtle."[107] On November 19, 1846, just west of the confluence of the Gila and the Salt rivers, Emory made note of the Gila's shifting channel when he wrote that his party:

> encamped on an island where the valley is contracted by sand buttes in what had been very recently the bed of the river. It was overgrown with willow, cane, Gila grass, flag grass, &c. The pools in the old bed of the river were full of ducks, and all night the swan, brant and geese, were passing. . . .[108]

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[107] William H. Emory, Notes of a Military Reconnaissance from Fort Leavenworth in Missouri to San Diego in California, S. Ex. Doc. 7, 30 Cong., 1 sess. (Washington D.C.: U.S. Government Printing Office, 1848), p. 92 [LRA Box/File: 18/7].

[108] William H. Emory, Notes of a Military Reconnaissance from Fort Leavenworth in Missouri to San Diego in California, S. Ex. Doc. 7, 30 Cong., 1 sess. (Washington D.C.: U.S. Government Printing Office, 1848), p. 92 [LRA Box/File: 18/7].

commented on the nature of the Gila (which, at the time, was still the border between the United States and Mexico), and strongly suggested that navigating the river would be difficult due to its shifting bed:

> The Gila does not always run in the same bed; whenever it changes the boundary must change, and no survey nor anything else can keep it from changing. The survey of that river, therefore, as it fixes nothing, determines nothing, is of minor importance.[111]

While Emory is credited as the author of the boundary survey report, chapter seven had actually been authored by Lieutenant Nathaniel Michler. Michler's summary supported Emory's conclusion that the Gila was not navigable by indicating that only the Colorado River was useful for boats:

> The Colorado is said to have but few tributaries; the Gila has several, emptying in above and below the Pimas villages. The annual rise in both rivers usually takes place in the months of May and June, sometimes as late as July, and is caused by the melting of the snows in the mountains near their head-waters; the freshets are not of long duration. Frequently the one stream will be up and the other down. **The Gila becomes so low that a sand-bar forms at its mouth during the summer, and at no time does it supply much water. The Colorado on the contrary, is navigable for small steamers, drawing two and two and a half feet water, as high up as Fort Yuma. . . .** This [navigation] is a great saving, as the cost of transportation of stores by trains across the desert is enormous. The navigation is pretty good, but, like all streams of the same nature, the channel frequently changes, owing to the shifting sands and the instability of its banks. [Emphasis added.][112]

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[111] William H. Emory, Report on the United States and Mexican Boundary Survey (reprint ed., Austin: Texas State Historical Association, 1987), p. 21 [LRA Box/File: 18/18].

[112] William H. Emory, Report on the United States and Mexican Boundary Survey (reprint ed., Austin: Texas State Historical Association, 1987), pp. 102-103 [LRA Box/File: 18/18].

Barely two years after Congress had printed Report on the United States and Mexican Boundary Survey Made Under the Direction of the Secretary of the Interior, by William H. Emory another military observer confirmed the assessment that the Gila River was not navigable. In March 1859, Lieutenant Sylvester Mowry gave a speech before the American Geographical and Statistical Society regarding proposals to create the Territory of Arizona out of what was then New Mexico Territory. In commenting on the resources of the region, Mowry stated the existing territory "embraces within its borders three of the largest rivers on the continent west of the Mississippi, viz: the Rio Grande, the Gila, and the Colorado of the West. **The Colorado is the only navigable stream. . . .**"[113]

TERRITORIAL LEGISLATION: Military officials in Arizona were not the only people to believe that the Gila was not navigable. Barely four years after Mowry had spoken to the American Geographical and Statistical Society, President Abraham Lincoln signed a bill creating Arizona Territory out of the western part of New Mexico Territory. Among the earliest actions taken by the new territory's legislature involved the issue of navigable streams in Arizona. Meeting in 1865 in its second session, the Arizona Territorial Legislature passed a "Memorial Asking Congress for an Appropriation to Improve the Navigation of the Colorado River." The memorial sought $150,000 to remove obstacles such as sand bars, snags, boulders, and other obstructions in the Colorado's bed, and

[113] Sylvester Mowry, "The Geography and Resources of Arizona and Sonora," Journal of the American Geographical and Statistical Society 1 (March 1, 1859): 66 [LRA Box/File: 25/47].

it declared that "**the Colorado River is the only navigable water in this Territory[.]**" (Emphasis added.)[114]

NEWSPAPER AND OTHER PRESS ACCOUNTS OF THE GILA RIVER: Although the impressions of early explorers and the declaration of the Arizona Territorial Legislature all attest to the lack of navigability of the Gila River, so too do historical newspapers and other press reports. To understand the significance of press accounts of the Gila, some background information on nineteenth and early twentieth century papers in the American West is necessary. Local newspapers in the American West were among their respective communities' biggest boosters, not only because of civic pride, but also due to a desire to attract settlers. Articles in out-of-town papers which provided positive accounts of visits to a particular community were often reprinted verbatim by the latter town's press, and residents who commented on their hamlet's virtues while away received considerable attention by the home-town press if those remarks became known. As enthusiastic promoters of their communities, local papers frequently ran long articles extolling their respective areas' many advantages not only for their own readership, but also for readers in other more distant places -- to which copies of the paper would be sent to attract newcomers.

Arizona's newspapers and journals were no exception in the desire to report all positive aspects of their communities. Such

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[114] "Memorial Asking Congress for an Appropriation to Improve the Navigation of the Colorado River," <u>Acts, Resolutions, and Memorials of the Territorial Legislature of Arizona, 1865</u> (N.p., n.d), copy at Arizona Historical Foundation, Arizona State University, Tempe, Arizona [LRA Box/File: 8/23].

benefits as the fertility of the soil, the long growing season, and assets such as schools, churches, and businesses, were all hailed in the papers of Arizona. Importantly, the ability to market crops to distant areas was also a significant item to be reported upon, and in that regard, railroads and wagon roads were championed. Significantly, press reports did **not** brag about the navigability of the Gila -- something they surely would have noted as a benefit to local residents.

Nevertheless, as had been the case with military expeditions, there were a few non-military attempts to use the Gila for transportation, and these events were duly noted by the press. Yet in those instances where boating was attempted, it was reported in the press more for its novelty than for being practicable on a regular and reliable basis.

On February 17, 1881, for example, the Arizona Gazette reported that two individuals planned to float an eighteen-foot flat-bottomed skiff from Phoenix to Yuma via the Salt and Gila rivers. The paper stated that the boat appeared "very strong and durable, and able to stand pretty severe buffeting."[115]

Either that boat trip did not take place, or it was delayed. Whatever the outcome, in late November of the same year, the Gazette carried the following story about a water-borne exploration of the Salt and Gila rivers: The "'Yuma or Bust' party which left Phoenix recently for the purpose of exploring the Salt and Gila

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[115] [No title], Arizona Gazette, Feb. 17, 1881 [LRA Box/File: 5/10].

rivers were seen yesterday, only twelve miles from here, all waiding [sic] in mud and water up to their knees, pulling the boat, and apparently as happy (?) as mudturtles." (The question mark is in the original.)[116]

Four days later, the Gazette detailed the final outcome of the boating expedition down the Salt and Gila rivers:

> The officers of the "Yuma or Bust" returned on to-day's stage. They report having arrived safely at Yuma six days out from this port. We have advice, however, that the boat reached Gila Bend and "busted." . . . [The crew] endured great hardships, being compelled to wade in the water the greater portion of the time and push the craft ahead of them.[117]

Ten years after the "Yuma or Bust" busted, Stanton P. Allen wrote an article for Capitol Magazine describing his trip from Fort Yuma to Camp McDowell near Phoenix. He noted that transportation within Arizona had long gone overland, and not by boat on the Gila:

> In the ante-railroad days of the territory all freight for the interior was transported in bull trains. From Yuma to Tucson, 260 miles, the merchandise for the stores, and goods of all kinds were shipped in wagons.[118]

Allen's own trip, too, was undertaken on wagons, rather than by boat on the Gila River.

Only two years later, however, D.K. Allen reported in Arizona Magazine that a steam wheeler had attempted to use the Gila River

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[116] [No title], Arizona Gazette, Nov. 30, 1881 [LRA Box/File: 5/10].

[117] [No title], Arizona Gazette, Dec. 3, 1881 [LRA Box/File: 5/10].

[118] Stanton P. Allen, "After the Indians," Capitol Magazine I (Aug. 1, 1891) [LRA Box/File: 25/48].

occasionally. Ultimately, he observed, the boat was unable to navigate the Gila on a regular basis:

> The stern wheel iron steamer Explorer of Lieut. [J.C.] Ives, was the third steamer on the Colorado. [For more about Lieutenant Ives, see page 123; for more about the Explorer, see page 124 below.] She [the Explorer] was sent here in 1857 by the U.S. Government, and run on the Colorado and Gila rivers until 1864, when she became unmanageable, as she came out of the Gila river, up which she had been after a load of wood. The current of the river carried her down to Pilot Knob where she was made fast to a tree on the bank. The bank caved in, when tree, steamer and all, floated into a slough eight miles below. The channel of the river changed, and her iron frame now lies miles from the river, overshadowed by the cottonwood trees two feet or more in diameter.[119]

Another author, Isaac N. Taylor, also writing in the late nineteenth century, provided a detailed description of the Gila River. Appearing in the Southwest Illustrated Magazine in 1896, Taylor's article commented that although the Gila stretched over four hundred miles through Arizona:

> it is what would be called a small stream . . . so far as surface water is concerned, because not only itself but all its tributaries pass through valleys of sand, gravel and boulders of great depth, and therefore have a broad and deep underflow. But because of rare great floods, carrying the loose alluvial soil away, the banks are usually far apart, varying from say twenty to a hundred and sixty rods, while the current itself on the surface, especially where drained away by irrigating canals, is all the way from nothing to eight to ten rods.[120]

Perhaps having heard of the "Yuma or Bust" attempt to float down the Salt and Gila rivers from Phoenix to Yuma, in 1905 another party decided to attempt the feat again. On March 24, 1905, the

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[119] D.K. Allen, "The Colorado River," Arizona Magazine II (Aug. 1, 1893) [LRA Box/File: 25/47].

[120] Isaac N. Taylor, "The Gila Valley, Arizona," The Southwest Illustrated Magazine II (May 1, 1896) [LRA Box/File: 25/47].

Arizona Republican carried the story, "The Phoenix Shipyard," an article about a local resident who planned to take advantage of that season's floods and ride a self-built boat downstream from Phoenix to Yuma. The story indicated that the construction and use of such a boat was extremely unusual.[121]

SUMMARY AND CONCLUSIONS REGARDING MISCELLANEOUS DOCUMENTS AND PRESS ACCOUNTS: The wide variety of the miscellaneous documents and press accounts discussed above all point to the same conclusion that the Gila River was not navigable prior to or at the time of Arizona statehood in 1912. The documents and press stories clearly demonstrated that the Gila was unreliable for the purposes of consistent commercial navigation. Fluctuating flows, channel changes, and dams all combined to cause major impediments to any sort of regular commerce on the Gila River. Such boating that did take place was noteworthy only for its novelty.

[121] "The Phoenix Shipyard," Arizona Republican, March 24, 1905 [LRA Box/File: 5/10].

CHAPTER 5: WESTERN WATERCRAFT AT THE TURN OF THE CENTURY

At the turn of the twentieth century, the only waterway in the American Southwest considered navigable to most contemporaneous observers was the Colorado River. Laced with sandbars, fluctuating wildly in flow, and generally unpredictable, the Colorado nevertheless carried enough water on a regular basis to make it a testing ground for boats with shallow drafts and lightweight construction. Beginning in the late nineteenth century, many attempts were made to navigate this tempestuous stream from its mouth in the Gulf of California as far upstream as possible, and stories of such expeditions appeared in a multitude of newspapers, promotional publications, as well as in published government documents. The significance of such efforts to navigate the Colorado was not lost on prospective businessmen, possible settlers, and military officials, all of whom hoped for easier access to the interior parts of the southwestern United States. The Colorado, of course, was not the only river navigated in the West (others included the Columbia, the Sacramento, and the San Joaquin, to name a few), but the Colorado was the only river that offered possible water-borne access to the American Southwest.

This is not to say that navigation was not **attempted** on southwestern streams other than the Colorado -- indeed, efforts to travel on other waterways in the Southwest certainly were made because such a mode of travel was by far the most economical method of internal communication at the time. Nevertheless, river navigation in the region proved to be exceedingly unreliable and risky, and the Colorado River was the only southwestern stream where sustained attempts at regular navigation occurred. A brief examination of the history of navigation on the Colorado, therefore can provide useful insights into the nature and technology of watercraft used for transportation on southwestern rivers in the years leading up to Arizona's statehood in 1912.

NAVIGATION ON THE COLORADO RIVER: Following the acquisition of much of the western part of the United States in the late 1840s and early 1850s, federal authorities sent explorers West to determine just what the new territory held. Frequently, these parties consisted of military officers who kept journals of their travels, making note of the natural environment, Indians, and possibilities for settlement. Some of these expeditions included references to travel on western rivers, notably the Colorado.

Probably the most famous of these was the expedition of John Wesley Powell through the Colorado River's Grand Canyon in 1869. In later reports, Powell, who used wooden dories to make the descent through the previously unexplored massive gorge, made it clear that while he had survived the experience, the multitude of rapids and other obstacles in the Grand Canyon made this part of the Colorado River not practicable as a possible water-based access route to the interior part of North America. Indeed, the experiences of Powell and his companions through the many rapids at the bottom of the Grand Canyon proved to be so frightening that several of the group opted to abandon the river and climb out (where they were subsequently killed by Indians).[122]

Whereas Powell had chosen to go downstream on the Colorado, other adventurers tested the river's navigability by moving upstream from its mouth at the Gulf of California. Lieutenant J.C. Ives, for example, was one such explorer. Ives was sent to assess the utility of the Colorado River as a navigable waterway from where it discharged into the gulf upriver to the Virgin River (today, near the central part of Lake Mead). Following his expedition, he completed a report on March 23, 1858, where he discussed the problems associated with navigating the Colorado. He also offered recommendations for the type of watercraft to use on the Colorado if it was to be employed for transportation on a regular basis.

Although his experience was nowhere near as terrifying as the ordeal endured by Powell and his colleagues, Ives recounted that the Colorado River was extremely difficult to navigate because the channel was "exceedingly circuitous and constantly shifting." Furthermore, Ives noted repeatedly the presence of sand bars and shoals, observing:

> boats rarely make a trip between tide water and Fort Yuma without grounding many times a day. By working them about in the shifting sand . . . and as a last resort, by lightening the boat of the cargo, these shoals may always be passed with more or less labor.

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[122] See generally Wallace Stegner, <u>Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West</u> (Boston: Houghton-Mifflin, 1954).

Due to these hazardous and difficult conditions, Ives recommended an "iron stern wheel boat, with the hull 100 feet long and the greatest breadth of beam 22 feet-built sufficiently [illegible] to ensure a drought when light, not exceeding 12 inches." Although Ives believed that five trips a year could be made on the Colorado by such a watercraft, he repeatedly asserted that it was an extremely troublesome stream due to the rip and spring tides near its mouth, the constantly shifting channel, the numerous obstacles, and the rapids near the mouth of the Virgin River.[123]

Later reports of attempts to navigate the Colorado seemed to suggest that the river had greater transportation possibilities than Lieutenant Ives had given it. Written in the late nineteenth century, the History of Arizona Territory Showing its Resources and Advantages with Illustrations: Descriptive of its Scenery, Residences, Farms, Mines, Mills, Hotels, Business, Houses, Schools, Churches, Etc., for instance, provided excellent characterizations of the rivers of Arizona before statehood as well as descriptions of contemporaneous watercraft. Noting that a ship named the Explorer soon was expected to ascend the Colorado River, the History of Arizona recounted that this vessel was fifty-four feet long from the bow to the stern wheel -- about half the length of Ives's recommended boat. The shorter craft presumably would be

[123] J.C. Ives, "Report Upon Navigable Portion of Colorado River, March 23, 1858," pp. 1, 2, 7, Box 2, Entry 726, Records of the Office of Explorations and Surveys, Miscellaneous Records, Records of the Office of the Secretary of the Interior, Record Group 48, U.S. National Archives II, College Park, Maryland [LRA Box/File: 18/14].

more maneuverable in the Colorado's shifting channel. Nonetheless, the Explorer's draft was reported to be two and a half feet, considerably more than Ives believed to be feasible on the Colorado River, at least if the boat was to ascend as far as the Virgin River.[124]

While this account of a watercraft capable of navigating the Colorado appears more promising than that offered by Lieutenant Ives, its tone of confidence, however, should be tempered with the knowledge that the book -- as its title suggested and like many similar regional chronologies of the day -- had been paid for by western promoters eager to attract businesses and settlers to the sparsely populated part of the United States. Ives's report, therefore, is probably more objective regarding the Colorado's possibilities as a transportation artery, at least below the Grand Canyon.

Other accounts, such as those in U.S. Government printed documents, further acknowledged the possibilities of using the Colorado below the Grand Canyon as an artery of commerce and transportation. A January 30, 1907, letter from J.A. Mellon, master of the Colorado River steamer Cochran, to the Bureau of Corporations (and printed in the Report of the Commissioner of Corporations on Transportation by Water in the United States), noted that his ship weighed 237 tons and drew twenty inches of

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[124] History of Arizona Territory Showing its Resources and Advantages with Illustrations: Descriptive of its Scenery, Residences, Farms, Mines, Mills, Hotels, Business, Houses, Schools, Churches, Etc. (San Francisco: Wallace W. Elliot & Co., 1884) [LRA Box/File: 26/26].

water when light and an additional inch of water for every 10 tons of freight. At the end of his letter, Mellon wrote that "I have come to the conclusion that any river that has over 4 feet fall to the mile can not compete with a railroad for freight or passengers." According to other records of the Bureau of Corporations, another Colorado steamer, the Silas J. Lewis, weighed 100 tons and drew seven inches of water with no load and one inch more for every 11 tons.[125]

WESTERN WATERCRAFT IN GENERAL: Regarding western rivers more generally, the 1909 report of the Commissioner of Corporations provides additional insight on the state of navigation and types of vessels in use in the Southwest around the time of Arizona statehood in 1912. The report noted that "[o]n the western rivers there soon appeared the well-known flat-bottom, stern-wheel steamboat, adapted to the shallow waters of those streams, the design of which has not greatly changed for half a century." Those vessels, the report added, "used in the river trade are still mainly built of wood."[126] When specifically discussing river steamers, the report stated that:

> [r]equirements on the western rivers are the least possible load draft, economical speed, readiness of handling the vessel, and freight and passenger capacity.

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[125] Report of the Commissioner of Corporations on Transportation by Water in the United States, Water-Borne Traffic (Washington D.C.: U.S. Government Printing Office, 1909), pp. 370-371 [LRA Box/File: 18/10].

[126] Report of the Commissioner of Corporations on Transportation by Water in the United States, General Conditions of Transportation by Water (Washington D.C.: U.S. Government Printing Office, 1909), pp. 128-129 [LRA Box/File: 18/10].

> In the case of towboats large reserve power is an important item.[127]

Although the report conceded that little change had been made in the stern-wheel, light-draft steamers in two decades, it declared that recently "a new type of light-draft steamer has been developed, with screwpropeller built in a tunnel in the after part of the vessel." A vessel similar to this operating on the Ohio River had a draft of 3 feet, with length of 150 and beam of 26.[128]

Water Trails West, a more recent (and more objective) compilation of essays by western writers regarding various western streams, includes one article containing additional information about navigation on the Colorado River as well as other western waterways. This essay, by Donald H. Bufkin and C.L. Sonnichsen, indicates that boats larger than that proposed by Ives were used successfully on the Colorado. According to Bufkin and Sonnichsen, the largest ship placed into use on the Colorado was the Mohave II. With a length of 175 feet (over three times that of the Explorer described in the History of Arizona Territory and one and three quarters as long as Ives' boat), the Mohave II had a 32-foot beam. This was 10 feet wider than Ives' recommendation. The Mohave II was approximately 190 tons and drew less than two feet of water.

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127 Report of the Commissioner of Corporations on Transportation by Water in the United States, General Conditions of Transportation by Water (Washington D.C.: U.S. Government Printing Office, 1909), p. 138 [LRA Box/File: 18/10].

128 Report of the Commissioner of Corporations on Transportation by Water in the United States, General Conditions of Transportation by Water (Washington D.C.: U.S. Government Printing Office, 1909), p. 139 [LRA Box/File: 18/10].

(Ives suggested only one foot, while the History of Arizona claimed two and a half). Other boats similar to the Mohave II in use in the West, according to Bufkin and Sonnichsen, were all over 100 feet in length and over 25 feet in width. Further, these vessels were generally stern-wheeled, making them easier to navigate streams filled with sandbars and shallow water.[129]

SUMMARY AND CONCLUSIONS REGARDING WESTERN WATERCRAFT: The state of commercial boating technology around the turn of the century make it clear that the Gila River was not susceptible to navigation at the time of Arizona statehood. The flow in the Gila, while perennial, was not consistent enough to support boats used for regular transport. A draft of two feet could not be had in a river that was sometimes only a few inches deep or completely dry. Furthermore, the channel's shifting nature made its course unreliable as well as dangerous.

[129] Donald H. Bufkin and C.L. Sonnichsen, "Steamboat Through Hell: River Traffic on the Colorado of the West," in Water Trails West, (Garden City: Doubleday & Company, 1978), pp. 218-230 [LRA Box/File: 18/11].

SUMMARY AND CONCLUSIONS

Since modern settlement began in Arizona in the mid-nineteenth century, there have been a multitude of documents created describing the Gila River. These cover a wide spectrum of published and unpublished sources, including federal and state (and territorial) materials, diaries, journals, reminiscences, and other archival records.

Some of the most important sources for ascertaining the nature of the Gila River prior to and at the time of Arizona's statehood in 1912 are survey field notes and plats created by U.S. government surveyors as they carried out their responsibilities mapping Arizona. Directed by manuals conveying precise instructions, surveyors were to make careful note of the region in which they were working, and they were provided with specific instructions about how to record the presence of navigable bodies of water. A substantial part of the area through which the Gila River flowed was surveyed prior to 1912, and in some cases resurveys were done for some sections of the river. Significantly, although these surveys were undertaken by many different parties at different times and under various seasonal conditions, none of the federal surveyors indicated in his field notes or on the related plats that the Gila River was navigable. While some sections of the stream were, in fact, meandered, the surveyors' field notes clearly show that those meanders had been done to conform with surveying instructions **not** related to navigability. In addition, the field notes and plats illustrated a stream that varied enormously in flow and that had a changing channel in many places. Moreover, the notes and plats contain references to roads and railroads parallelling the Gila, suggesting that transportation was carried out on land and not on the river.

Supporting the U.S. government surveys' determination that the Gila River was not navigable are federal government homestead patents, U.S. grants to Arizona, and Arizona's disposition of those lands. Many patents were issued by the U.S. Government Land Office to parcels of land through which the Gila River ran. In every single case when these patents were formalized, the United States made no effort to deny title to the applicants based on a possible claim of ownership due to Arizona's sovereignty. Furthermore, when lands were granted to Arizona through which the Gila River flowed, the state made no effort to obtain in-lieu selections for the acreage covered by the stream's bed -- as it would have been entitled to do had the Gila River been navigable at the time of statehood. And, when Arizona subsequently disposed of lands it had acquired from the federal government through which the Gila River ran, the state made no indication that it was withholding the bed of the river due to navigability and the public's interest.

The federal and state grant and patenting process is significant in relation to determining the Gila River's navigability because with so many different parcels and transfers of land involved, a large number of parties ultimately reached the same conclusion -- that the Gila River was not navigable. Each applicant who requested land through which the river flowed implicitly asserted the river's non-navigability; each federal official approving a homestead application or grant to Arizona reached the same implicit conclusion, as did each state authority who sold Arizona's federally-granted lands. Not only did many individuals all indicate the same finding with regard to the Gila River's non-navigability, but they did so over a lengthy span of time, and their actions covered a large and diverse geographic area.

Further strengthening the finding that the Gila River was not navigable in 1912 are other published and unpublished records of the U.S. government. Records of the U.S. Geological Survey and the Reclamation Service described a stream that was extremely erratic in flows, unreliable in relation to channels, subject to severe floods, and potentially dangerous.

Much like the federal agencies' records, explorers' journals, personal reminiscences, other historical documents, and more recent historical studies all reached the same conclusion regarding the lack of navigability of the Gila River. Indeed, the Arizona Territorial Legislature in 1865 declared that the only stream in Arizona that was navigable was the Colorado, and Odie Faulk, in his study of the Gila Trail, noted the lack of navigable waterways in the region.

From this wealth of information, covering a huge array of documentary sources, only one conclusion can be reached: The Gila River was not navigable or susceptible of navigation on or before February 14, 1912.

ARIZONA NAVIGABLE STREAM ADJUDICATION COMMISSION

FILE TITLE: Letter from James Johnson to Messrs. Brashear, Eisenhower, Evans, Miller and Ms. Getzwiller, Dec. 10, 1996

FILE TITLE: Gila River Navigability Study

FILE TITLE: Land Ownership Maps for the Gila River Navigability Study

FILE TITLE: ANSAC, In the Matter of the Navigability of the Gila River, Submittal of Ownership Evidence Re: Public Trust

FILE TITLE: John S. Schaper to Christina Waddell, Aug. 30, 1996, on Behalf of Buckeye Irrigation Company re: Navigability of the Gila River

ARIZONA STATE UNIVERSITY

Arizona Historical Foundation

FILE TITLE: 4331 P3 P25 1880 AZ

COLLECTION: Hancock Family Collection
FILE TITLE: Maricopa County Superior Court -- Nels Benson vs. J Allison & . . . Others
LOCATION: box 2, file 16

COLLECTION: Newspaper Index
FILE TITLE: "Arizona Newspaper Project"

Luhrs Reading Room

COLLECTION: Joseph and Grace Alexander Papers
FILE TITLE: MSS # 11 Alexander Papers, Box 15, Folder 43
LOCATION: Box 15, Folder 43

COLLECTION: Philip A. Bailey Papers, MSS 91
FILE TITLE: "Gila River Route"
LOCATION: Box 14, Folder 7

COLLECTION: Roland Gail Baker Collection
FILE TITLE: Roland Gail Baker, Box 10, Folder 3
LOCATION: Box 10, file 3

COLLECTION: Carl Hayden Papers, MSS 01
FILE TITLE: "Folder 25"
LOCATION: Box 607, folder 25

LOCATION: Box 83

COLLECTION: Maricopa County Superior Court, Water Commissioner
FILE TITLE: Filmfile 137.1.1, Civil Cases 4526-4824, Jan 1905 to May 1905, p. 124
LOCATION: Filmfile 137.1.1 - 137.1.7

COLLECTION: Maricopa County Superior Court, Water Commissioner
FILE TITLE: Filmfile 137.1.2, Civil Cases 4526-4824, Jan. 1905 to May 1905, pg. 125
LOCATION: Filmfile 137.1.1 - 137.1.7

COLLECTION: Maricopa County Superior Court, Water Commissioner
FILE TITLE: Filmfile 137.1.3, Civil Cases Series One Litigation 17-32
LOCATION: Filmfile 137.1.1 - 137.1.7

COLLECTION: Maricopa County Superior Court, Water Commissioner
FILE TITLE: Filmfile 137.1.4, Civil Cases Series One Litigation 32-45
LOCATION: Filmfile 137.1.1 - 137.1.7

COLLECTION: Maricopa County Superior Court, Water Commissioner
FILE TITLE: Filmfile 137.1.5, Civil Cases Series One Litigation 46, Series Two Decree Implementation 68
LOCATION: Filmfile 137.1.1 - 137.1.7

COLLECTION: Maricopa County Superior Court, Water Commissioner
FILE TITLE: Filmfile 137.1.6, Series Two Decree Implementation 69-72
LOCATION: Filmfile 137.1.1 - 137.1.7

COLLECTION: Maricopa County Superior Court, Water Commissioner
FILE TITLE: Filmfile 137.1.7, Series Two Decree Implementation 73-79
LOCATION: Filmfile 137.1.1 - 137.1.7

COLLECTION: RG 141, Interstate Stream Commission
FILE TITLE: Lyman Decree on Gila
LOCATION: Box 25

COLLECTION: RG 59, Arizona State Land Commission
FILE TITLE: Arizona State Land Department Historical Records Index f. 322 - f. 328
LOCATION: Filmfile # 51.28.8

COLLECTION: RG 59, Arizona State Land Commission
FILE TITLE: Arizona State Land Department Historical Records Index f. 366-f. 393
LOCATION: Filmfile # 51.28.10

COLLECTION: RG 59, Arizona State Land Commission

FILE TITLE: f. 21
LOCATION: Filmfile 51.28.1

COLLECTION: RG 59, Arizona State Land Commission
FILE TITLE: f. 22
LOCATION: Filmfile 51.28.1

COLLECTION: RG 59, Arizona State Land Commission
FILE TITLE: f. 371
LOCATION: SS 299, 133925 [Gunther and Shirley v. State of Arizona]

COLLECTION: RG 59, Arizona State Land Commission
FILE TITLE: f. 372
LOCATION: SS 299, 133925 [Gunther and Shirley v. State of Arizona]

COLLECTION: RG 59, Arizona State Land Commission
FILE TITLE: f. 373
LOCATION: SS 299, 133925 [Gunther and Shirley v. State of Arizona]

COLLECTION: RG 59, State Land Commission
FILE TITLE: Land Granted State in 1894 Revealed
LOCATION: SS (?)f.469

COLLECTION: RG 59, State Land Commission
FILE TITLE: f. 443
LOCATION: SS 342, f. 443

COLLECTION: Records of the Secretary of the Territory of Arizona
FILE TITLE: Report on Resources of the Salt River Valley [ca. 1872]
LOCATION: Box 49, file 710

SALT RIVER PROJECT ARCHIVES

FILE TITLE: "Drainage Map of Arizona Showing Perennial Streams and Some Important Wetlands"

FILE TITLE: (April-May, 1915) Water Power Utilization in Arizona, "Part I, Introduction" and "Salt River & Smaller Tributaries"

COLLECTION: Gila River (N.D. thru 1939)
FILE TITLE: "Gila Bend Project, Arizona"

COLLECTION: Gila River (N.D. thru 1939)
FILE TITLE: "Report on Lands Withdrawn for Water Power Purposes Along the Gila River in Arizona and New Mexico"

APPENDIX B -- UNPUBLISHED DOCUMENTS -- FEDERAL ARCHIVES, AGENCIES, AND MISCELLANEOUS ARCHIVES

BANCROFT LIBRARY, BERKELEY

FILE TITLE: Dictation by Abraham Frank
LOCATION: Banc MSS P-D 12:5

FILE TITLE: Dictation of Charles Baker
LOCATION: Banc MSS P-D 12:2

FILE TITLE: Dictation of George M. Thurlow
LOCATION: Banc MSS P-D 12:10

FILE TITLE: Dictation of John W. Dorrington
LOCATION: Banc MSS P-D 12:4

FILE TITLE: Duncan, Fountain of the Gila River, 1883-1983
LOCATION: pf F818 D8D8 1983

FILE TITLE: Gila Expedition Papers
LOCATION: Banc MSS P-E 202:1-18

FILE TITLE: Irrigated Lands, the Best in the World for Fruit and Vine Culture are Found Under the Gila Bend Canal on the Lower Gila River
LOCATION: F 808 .A5 v. 2x

FILE TITLE: Letter to Father Antonio de Balthazer, Treasurer of the Jesuit Province of Mexico
LOCATION: Banc MSS P-D 102

FILE TITLE: Mortgage on Ambrosio Arvizo's property on the Gila River, to Mrs. Anna Woffenden
LOCATION: Banc MSS P-D 100:3

U.S. NATIONAL ARCHIVES, ROCKY MOUNTAIN REGION, DENVER

COLLECTION: RG 115, U.S. Bureau of Reclamation

FILE TITLE: "37-A Preliminary Investigations, Arizona-General Thru Nov. 1929"
LOCATION: General Correspondence File (Straights) #37-A

FILE TITLE: "37-A-5 Straights, Investigations----Sentinel Project, January 1936 thru____ 37-A-5"
LOCATION: General Correspondence File (Straights) #37-A, Box 532

FILE TITLE: "37-A-5 Straights, Preliminary Investigations-SENTINEL PROJECT 37-A-5"

LOCATION: General Correspondence File (Straights) #37-A

FILE TITLE: "429 SAN CARLOS Preliminary Reports of Engineers Submitting Plans Estimates etc. To Dec 31, 1911, 429"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919, San Carlos Project

FILE TITLE: "429 SAN CARLOS. Preliminary Reports of Engineers, Submitting Plans, Estimates, Jan 1, 1912 to...429"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919, San Carlos Project

FILE TITLE: "429-A SAN CARLOS. Miscellaneous 429-A"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919, San Carlos Project

FILE TITLE: "757-D1 Cooperation with Office of Indian Affairs. Gila River & Pima Ind. Res. Thru 1905."
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "757-D1 Cooperation With Office of Indian Affairs. Gila River & Pima Ind. Resv. 1910 thru June 1911. 757-D1"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "757-D1 Cooperation with Office of Indian Affairs - Gila River and Pima Indian Reservation, 1913-"
LOCATION: General Administrative and Project Records, 1902-1919

FILE TITLE: "757-D1 Cooperation with Office of Indian Affairs. Gila River & Pima Ind. Resv. 1912. 757-D1"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "757-D1 Cooperation with office of Indian Affairs. Gila River & Pima Ind. Resv. 1906 thru 1909 757-D1"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "Annual Project History, Gila Project, Yuma, Arizona, 1939, Volume IV"
LOCATION: Engineering & Research Center PROJECT HISTORIES

FILE TITLE: "General Correspondence Re: Right of Way Applications"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "Prior Reports, Gila River Basin, Arizona-New Mexico."
LOCATION: Studies, Reports, & Projects, 1899-1978, Box 147, File 1, 8NS-115-93-001

FILE TITLE: "Report on San Carlos Project, Arizona, 1920"
LOCATION: Engineering & Research Center PROJECT REPORTS

FILE TITLE: "SALT RIVER PROJECT, Consulting Engineers Reports, January 1, 1914 -- December 31, 1914."
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "SALT RIVER PROJECT. Board of Survey Reports. 544-D"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "SALT RIVER PROJECT. Classification of Lands, Soil Surveys 559"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "SALT RIVER PROJECT. Corres. Re Board of Survey 544-D"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "SALT RIVER PROJECT. Water Appropriations"
LOCATION: Entry 3, General Administrative and Project Records, 1902-1919

FILE TITLE: "San Carlos Project Report on Water Supply"
LOCATION: Studies, Reports, & Projects, 1899-1978, Box 146, File 9, 8NS-115-93-001

FILE TITLE: "Sedimentation in San Carlos Reservoir Gila River, Arizona"
LOCATION: Engineering & Research Center PROJECT REPORTS

FILE TITLE: "Soil Reconnaissance of the Sentinel Project --- Arizona"
LOCATION: Studies, Reports, & Projects, 1899-1978, Box 146, File 10, 8NS-115-93-001

U.S. NATIONAL ARCHIVES, MAIN BRANCH, WASHINGTON, D.C.

COLLECTION: Microfilm

COLLECTION: M95, roll 3

FILE TITLE:	"History of the Papago Indians and History of Irrigation, Papago Indian Reservations, Arizona. Dec., 1917"
LOCATION:	Entry 657, Papago Reservation, 1913-17, Box 30
FILE TITLE:	"Memo and Recommendations of Mr. Truesdell Concerning the Water Rights of the Pima & Papago Indians, May, 1913"
LOCATION:	Entry 657, Papago Reservation, 1913-17, Box 30
FILE TITLE:	"Pima, Maricopa, A Report, By J.R. Meskimons, Aug. 1904"
LOCATION:	Entry 657, Gila River Project, 1906-1940, Box 15
FILE TITLE:	"Report on Contention of J.S. Anderson that his Canal Will be Too Low to Help Indians, Gila Bend Res. Aug. 1909"
LOCATION:	Entry 657, Gila Bend Reservation, 1909-1916, Box 9
FILE TITLE:	"Report on Preliminary Plans and Estimates, Bridge and Diversion Dam, Gila Bend Ariz. by C.R. Olberg, Oct., 1916"
LOCATION:	Entry 657, Gila Bend Reservation, 1909-1916, Box 9
FILE TITLE:	"Report on Underground Water Investigations Near Maricopa, Arizona, October, 1914."
LOCATION:	Classified Files, 1907-1939, Pima, 2868-16-341 Pts. 6 to 8
FILE TITLE:	"Report on Water Available for Irrigation from Florence and Sacaton Dams. By C.R. Olberg, Apr. 4, 1917"
LOCATION:	Entry 657, Ashurst Hayden Dam and Florence Dam, 1916-22, Box 24
FILE TITLE:	"Report on the Irrigation Investigation for the Benefit of the Pima and Other Indians on the Gila River Indians Res. Ariz., 1896"
LOCATION:	Entry 657, Gila River Project, 1906-1940, Box 16
FILE TITLE:	"Resume of Irrigation Conditions End of Fiscal Year 1914, June 30, 1914"
LOCATION:	Entry 655, Box 29
FILE TITLE:	"616 16657-1913 San Carlos 377"
LOCATION:	Entry 121, San Carlos, Box 35469-10-375 to 14724-15-410
FILE TITLE:	"616 36109-1909 (Pt. 4) 371"
LOCATION:	Entry 121, San Carlos, Box 94509-07-352 to 36109-09-371 Pt. 4
FILE TITLE:	"Gila River 1905"

LOCATION: Entry 653, District 4, Box 82

FILE TITLE: "Gila River 1906"
LOCATION: Entry 653, District 4, Box 82

FILE TITLE: "Gila River 1908"
LOCATION: Entry 653, District 4, Box 82

FILE TITLE: "History of Irrigation, Gila River Indian Reservation, Arizona, 1916"
LOCATION: Entry 657, Papago Reservation, 1913-17, Box 30

FILE TITLE: "Irrigation Conditions San Carlos Indian Reservation, June 30, 1909, Two Maps accompany"
LOCATION: Entry 121, San Carlos, Box 56874-35-339 - 20521-14-341

FILE TITLE: "Proposed Diversion Weir and Bridge Across the Gila River, Gila River Indian Reservation, Ariz., November, 1914, Volume I"
LOCATION: Entry 657, Gila River Project, 1906-1940, Box 15

FILE TITLE: "Report on Irrigation, Pima Indian Lands, Containing Preliminary Plans and Est. of Costs, by W.H. Code and J.J. Granville, April, 1906"
LOCATION: Entry 657, Gila River Project, 1906-1940, Box 14

FILE TITLE: "Report on Surface Flow of Gila at Damsite of S. Gila Canal Co., 1904"
LOCATION: Entry 657, Salt River-Verde, Box 48

FILE TITLE: "Soil Survey of the Middle Gila Valley Area, Arizona, by E.C. Eckmann, Mark Baldwin, and E.J. Carpenter, 1920"
LOCATION: Entry 657, Gila River Project, 1906-1940, Box 14

<u>COLLECTION:</u> <u>RG 49, U.S. General Land Office</u>
<u>Serial Land Patent Files</u>

FILE TITLE: Cash Entry Patent File 1134, Benjamin L. Rodgers
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 1396, Arthur Wood
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 1464, Frank B. Griffith
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 595, Charles Baker
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 608, Frederick B. Southworth

LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 656, Charles C. Maag
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 710, Jacob E. Nelson
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 722, William P. Teel
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 746, Leonidas Beatty
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 753, Charles C. Stowe
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 764, Andrew Magnus Runsick
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 769, Thomas A. Jordan
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 784, Fort Snider
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 793, Theodore D. Teal
LOCATION: Serial Land Patents
FILE TITLE: Cash Entry Patent File 869, Norton Marshall
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 876, Isaac Rudisill
LOCATION: Serial Land Patents

FILE TITLE: Cash Entry Patent File 970, Thomas A. Fulton
LOCATION: Serial Land Patents

FILE TITLE: Desert Land Entry Patent 1136359, Kenneth K. Surber
LOCATION: Serial Land Patents

FILE TITLE: Desert Land Entry Patent 395, Elizabeth W. Barney
LOCATION: Serial Land Patents

FILE TITLE: Desert Land Entry Patent 426, Joseph H. Godfrey
LOCATION: Serial Land Patents

FILE TITLE: Desert Land Entry Patent 774552, Eliza Turner Bell
LOCATION: Serial Land Patents

FILE TITLE: Desert Land Entry Patent File 1033448, James Thorpe
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 324, Charles W. Hackett
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 346351, Thomas B. Thedford
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 373, William J. Johns
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 400, Wilbur H. Phillips
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 436, Jennie Cameron
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 486, Francisco Toledo
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 552403, James D. Collins
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 556, Edward A. Stout
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 567610, Lewis S. Streit
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 585, Henry H. McPhaul
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 660, Herbert Morgan
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 661, William Morgan
LOCATION: Serial Land Patents
FILE TITLE: Homestead Entry Patent File 702, John B. Martin
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 824, Elias F. Snider
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 89, Conception Armenta
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 941526, Robert W. Peirce
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 942, Willard A. Bondurant

LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 954, Thomas W. Underhill
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 956, Daniel B. Morris
LOCATION: Serial Land Patents

FILE TITLE: Homestead Entry Patent File 999752, Edward F. Holland
LOCATION: Serial Land Patents
FILE TITLE: Public Sale Patent File 1140493, Ben Harrelson
LOCATION: Serial Land Patents

FILE TITLE: Taylor Grazing Act Patent File 1113357, Palmer Dysart
LOCATION: Serial Land Patents

FILE TITLE: Taylor Grazing Act Patent File 1118955, C.W. Davis
LOCATION: Serial Land Patents

FILE TITLE: Taylor Grazing Act Patent File 1123260
LOCATION: Serial Land Patents

FILE TITLE: Taylor Grazing Act Patent File 1128592
LOCATION: Serial Land Patents

<u>Other General Land Office Records:</u>

FILE TITLE: Anderson Canal, Land, and Stock Co.
LOCATION: Entry 572, Division "F" New Canal and Reservoir Files, Box 3

FILE TITLE: Antelope Valley Co.
LOCATION: Entry 572, Division "F" New Canal and Reservoir Files, Box 3

FILE TITLE: Arizona Enterprise Land and Water Company
LOCATION: Entry 572, Division "F" New Canal and Reservoir Files, Box 58

FILE TITLE: Arizona, Gila Land & Water Co.
LOCATION: Division "F" New Canal and Reservoir Files, 1908-1922, Box 68

FILE TITLE: Arizona, Gila Land and Cattle Co.
LOCATION: Division "F" New Canal and Reservoir Files, 1908-1922, Box 68

FILE TITLE: Buckeye Irrigation Company

LOCATION: Entry 572, Division "F" New Canal and Reservoir Files, Box 23

FILE TITLE: James Bent Irrigation Company
LOCATION: Entry 572, Division "F" New Canal and Reservoir Files, Box 95

FILE TITLE: "Gila Bend Reservoir and Irrigation Company"
LOCATION: Entry 569, Old Canal & Reservoir Files, Box 5

FILE TITLE: Fort Yuma
LOCATION: Entry 690, Division K, Abandoned Military Reservations File, Box 19

FILE TITLE: Gila Water Co.
LOCATION: Entry 569, Old Canal and Reservoir Files, Box 58

FILE TITLE: Mohawk Canal and Improvement Co.
LOCATION: Entry 569, Old Canal & Reservoir Files, Box 17

FILE TITLE: Mohawk Municipal Water Conservation District
LOCATION: Entry 572, New Canal & Reservoir Files, 1908-1922, Box 121

FILE TITLE: New Dendora Canal Co.
LOCATION: Entry 572, New Canal & Reservoir Files, 1908-1922, Box 132

FILE TITLE: Southside Irrigation District
LOCATION: Entry 572, New Canal & Reservoir Files, 1908-1922, Box 178

U.S. NATIONAL ARCHIVES II, COLLEGE PARK, MARYLAND

COLLESTION: RG 22, U.S. Fish and Wildlife Service

COLLECTION: Records of the Division of River Basin Studies
FILE TITLE: "Gila, 7148-6160"
LOCATION: Entry 261, Box 201

COLLECTION: RG 48, U.S. Secretary of the Interior

COLLECTION: Records of the Division of Water and Power
FILE TITLE: Gila River
LOCATION: Entry 867, Reports Concerning River Basin & Reclamation Projects, 1941-50, Box No. 16

COLLECTION: Records of the Division of Water and Power
FILE TITLE: Gila River
LOCATION: Entry 867, Reports Concerning River Basin & Reclamation Projects, 1941-50

COLLECTION: Records of the Office of Explorations and Surveys
FILE TITLE: "Lieut. J.C. Ives to Capt. Humphreys - Report Upon Navigable Portion of Colorado River, March 23, 1858"
LOCATION: Entry 726, Miscellaneous Records, 1859-end, Box 2

FILE TITLE: #115, Concerning Allotments made on the Gila Bend Reservation, and the Problem of White Settlers on the Reservation, 1896
LOCATION: Entry 662, Miscellaneous Records, 1838-1905, Box 2

COLLECTION: RG 57, Records of the U.S. Geological Survey

FILE TITLE: File 2184
LOCATION: Entry 369, Conservation Division, Water and Power Branch, Records Concerning Land and Stream Classification, 1900-61

COLLECTION: Wheeler Survey
FILE TITLE: Progress Report upon Geographical and Geological Explorations and Surveys West of the 100th Meridian in 1872...
LOCATION: Entry 20, Report on Wheeler Survey in 1872, Box 1

COLLECTION: RG 76, Records of Boundary and Claims Commissions and Arbitrations

FILE TITLE: Entry 399, Letters Sent by the U.S. Commissioner, 1848-58, Emory
LOCATION: U.S.-Mexican Border, Box 2

FILE TITLE: Entry 424, file 2 of 6
LOCATION: U.S.-Mexican Border, Box 6

FILE TITLE: Entry 424, file 5 of 6
LOCATION: U.S.-Mexican Border, Box 6

FILE TITLE: Entry 424, file 6 of 6
LOCATION: U.S.-Mexican Border, Box 6

U.S. NATIONAL ARCHIVES, SOUTHWEST REGION, LAGUNA NIGUEL

COLLECTION: RG 75, U.S. Bureau of Indian Affairs

FILE TITLE: F 44 Claims & Complaints 1-33
LOCATION: Pima Indian Agency, Subject Files of the Superintendent, Frank Thackery, 1911-1913 F40-F47, Box 24

FILE TITLE: "15307, 1916 Pima 341"

FILE TITLE: Master Title Plat and Historical Index for Township 4 South, Range 5 West

FILE TITLE: Master Title Plat and Historical Index for Township 4 South, Range 6 West

FILE TITLE: Master Title Plat and Historical Index for Township 4 South, Range 7 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 4 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 5 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 6 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 7 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 8 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 9 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 10 West

FILE TITLE: Master Title Plat and Historical Index for Township 5 South, Range 11 West

FILE TITLE: Master Title Plat and Historical Index for Township 6 South, Range 11 West

FILE TITLE: Master Title Plat and Historical Index for Township 6 South, Range 12 West

FILE TITLE: Master Title Plat and Historical Index for Township 6 South, Range 13 West

FILE TITLE: Master Title Plat and Historical Index for Township 7 South, Range 13 West

FILE TITLE: Master Title Plat and Historical Index for Township 7 South, Range 14 West

FILE TITLE: Master Title Plat and Historical Index for Township 7 South, Range 15 West

TITLE: Master Title Plat and Historical Index for Township 7 South, Range 16 West

ILE TITLE: Master Title Plat and Historical Index for Township 8 South, 22 West

ILE TITLE: Master Title Plat and Historical Index for Township 8 South, Range 16 West

ILE TITLE: Master Title Plat and Historical Index for Township 8 South, Range 17 West

ILE TITLE: Master Title Plat and Historical Index for Township 8 South, Range 18 West

ILE TITLE: Master Title Plat and Historical Index for Township 8 South, Range 19 West

ILE TITLE: Master Title Plat and Historical Index for Township 8 South, Range 20 West

ILE TITLE: Master Title Plat and Historical Index for Township 8 South, Range 21 West

ILE TITLE: Master Title Plat and Historical Index for Township 9 South, Range 19 West

TION: U.S. General Land Office

ILE TITLE: Exterior Survey Plats for the Gila River

OLLECTION: U.S. General Land Office
ILE TITLE: Survey Plats for Township 1 North, Range 1 West

OLLECTION: U.S. General Land Office, Field Notes and Survey Plats
ILE TITLE: Township 1 South, Range 1 East

OLLECTION: U.S. General Land Office, Field Notes and Survey Plats
ILE TITLE: Township 1 South, Range 2 West

OLLECTION: U.S. General Land Office, Field Notes and Survey Plats
ILE TITLE: Township 1 South, Range 3 West

OLLECTION: U.S. General Land Office, Field Notes and Survey Plats
ILE TITLE: Township 1 South, Range 4 West

OLLECTION: U.S. General Land Office, Field Notes and Survey Plats

FILE TITLE: Township 7 South, Range 16 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 8 South, Range 16 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 8 South, Range 17 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 8 South, Range 18 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 8 South, Range 19 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 8 South, Range 20 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 8 South, Range 21 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 8 South, Range 22 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 9 South, Range 19 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 9 south, Range 20 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 4 South, Range 8 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 5 South, Range 10 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 5 South, Range 8 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats

FILE TITLE: Township 5 South, Range 9 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 6 South, 11 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 6 South, Range 12 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 6 South, Range 13 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 7 South, Range 13 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 7 South, Range 14 West

COLLECTION: U.S. General Land Office, Field Notes and Survey Plats
FILE TITLE: Township 7 South, Range 15 West

FILE TITLE: Tract Book for Township 1 South, Range 1 East

FILE TITLE: Tract Book for Township 1 South, Range 2 West

FILE TITLE: Tract Book for Township 1 South, Range 3 West

FILE TITLE: Tract Book for Township 1 South, Range 4 West

FILE TITLE: Tract Book for Township 1 South, Range 5 West

FILE TITLE: Tract Book for Township 2 South, Range 5 West

FILE TITLE: Tract Book for Township 3 North, Range 7 East

FILE TITLE: Tract Book for Township 3 South, Range 4 West

FILE TITLE: Tract Book for Township 3 South, Range 5 West

FILE TITLE: Tract Book for Township 4 South, Range 4 West

FILE TITLE: Tract Book for Township 4 South, Range 5 West

FILE TITLE: Tract Book for Township 4 South, Range 6 West

FILE TITLE: Tract Book for Township 4 South, Range 7 West

FILE TITLE: Tract Book for Township 4 South, Range 8 West

FILE TITLE: Tract Book for Township 5 North, Range 7 East

FILE TITLE: Tract Book for Township 5 South, Range 10 West

FILE TITLE: Tract Book for Township 5 South, Range 11 West

FILE TITLE: Tract Book for Township 5 South, Range 4 West

FILE TITLE: Tract Book for Township 5 South, Range 5 West

FILE TITLE: Tract Book for Township 5 South, Range 6 West

FILE TITLE: Tract Book for Township 5 South, Range 7 West

FILE TITLE: Tract Book for Township 5 South, Range 8 West

FILE TITLE: Tract Book for Township 5 South, Range 9 West

FILE TITLE: Tract Book for Township 6 South, Range 11 West

FILE TITLE: Tract Book for Township 6 South, Range 12 West

FILE TITLE: Tract Book for Township 6 South, Range 13 West

FILE TITLE: Tract Book for Township 7 South, Range 13 West

FILE TITLE: Tract Book for Township 7 South, Range 14 West

FILE TITLE: Tract Book for Township 7 South, Range 15 West

FILE TITLE: Tract Book for Township 7 South, Range 16 West

FILE TITLE: Tract Book for Township 8 South, Range 16 West

FILE TITLE: Tract Book for Township 8 South, Range 17 West

FILE TITLE: Tract Book for Township 8 South, Range 18 West

FILE TITLE: Tract Book for Township 8 South, Range 19 West

FILE TITLE: Tract Book for Township 8 South, Range 20 West

FILE TITLE: Tract Book for Township 8 South, Range 21 West

FILE TITLE: Tract Book for Township 8 South, Range 22 West

FILE TITLE: Tract Book for Township 9 South, Range 19 West

FILE TITLE: Tract Book for Township 9 South, Range 20 West

TITLE: Tract Books on Microfilm for Gila and Verde River Townships

WATER RESOURCES CENTER ARCHIVES, BERKELEY

OLLECTION: James Dix Schuyler

ILE TITLE: Report of James D. Schuyler, Consulting Engineer, on the General Conditions and Cost of Water Storage for Irrigation on the Gila River, Arizona, for the Benefit of the Indians Occupying the Gila River Reservation
OCATION: Item 130

ILE TITLE: Report on the Water Supply of the Agua Fria River and the Storage Reservoir Project of the Agua Fria Water and Land Company for Irrigation in the Gila River Valley, Arizona
OCATION: Item 139

OLLECTION: Joseph Barlow Lippincott

ILE TITLE: Report on the Buckeye Irrigation Co's. Proposed Weir Gila River Maricopa Co. Arizona, Buckeye Valley
TION: Box II, Item 6, volume 4

ILE TITLE: Report on the Buckeye Irrigation Co's. Proposed Weir Gila River Maricopa Co. Arizona, Hydrographic Section
OCATION: Box II, Item 6, volume 2

OLLECTION: Photographs
ILE TITLE: Gila River Photographs, originals

PATENT DATE: 09/20/1955
PATENTEE: Eula P. Greenwood

LOCATION: Township 1 S, Range 2 W, Section 4
PATENT NUMBER: DLE, 1168161
PATENT DATE: 01/08/1957
PATENTEE: Ira G. Greenwood

LOCATION: Township 1 S, Range 2 W, Section 4
PATENT NUMBER: CE Pat., 154 1/4
PATENT DATE: 12/01/1891
PATENTEE: James H. Brown

LOCATION: Township 1 S, Range 2 W, Section 4
PATENT NUMBER: CE, 284
PATENT DATE: 10/08/1891
PATENTEE: Eugene Jackson

LOCATION: Township 1 S, Range 2 W, Section 4
PATENT NUMBER: HE, 545
PATENT DATE: 12/20/1892
PATENTEE: Abraham Charlton

LOCATION: Township 1 S, Range 2 W, Section 4
PATENT NUMBER: CE, 668
PATENT DATE: 03/28/1903
PATENTEE:
LOCATION: Township 1 S, Range 2 W, Section 5
PATENT NUMBER: Curative Pat., 02-76-0013
PATENT DATE: 12/03/1975
PATENTEE: Antonio & Antonia Gonzales

LOCATION: Township 1 S, Range 2 W, Section 5
PATENT NUMBER: Curative Pat., 02-76-0014
PATENT DATE: 12/03/1975
PATENTEE: Manuel & Alberta Espinosa

LOCATION: Township 1 S, Range 2 W, Section 5
PATENT NUMBER: Curative Pat., 02-76-0020
PATENT DATE: 12/03/1975
PATENTEE: Alberto & Emilia Castaneda

LOCATION: Township 1 S, Range 2 W, Section 5
PATENT NUMBER: Curative Pat., 02-76-0021
PATENT DATE: 12/03/1975
PATENTEE: Thomas C. & Lupe R. Perez

LOCATION: Township 1 S, Range 2 W, Section 5
PATENT NUMBER: Curative Pat., 02-76-0022
PATENT DATE: 12/03/1975
PATENTEE: Sa Prvulov

LOCATION:	Township 1 S, Range 2 W, Section 5
PATENT NUMBER:	Curative Pat., 02-76-0035
PATENT DATE:	06/23/1976
PATENTEE:	Hijinio Lopez
LOCATION:	Township 1 S, Range 2 W, Section 5
PATENT NUMBER:	Curative Pat., 02-76-0036
PATENT DATE:	07/21/1976
PATENTEE:	Vicenta L. Alvarez
LOCATION:	Township 1 S, Range 2 W, Section 5
PATENT NUMBER:	Curative Pat., 02-77-0001
PATENT DATE:	12/07/1976
PATENTEE:	Rafael Alvarez
LOCATION:	Township 1 S, Range 2 W, Section 5
PATENT NUMBER:	Cur. TC Pat., 1010387
PATENT DATE:	12/27/1927
PATENTEE:	Investment Company Dwight B. Heard
LOCATION:	Township 1 S, Range 2 W, Section 5
PATENT NUMBER:	Cur. CE, 1033448
PATENT DATE:	01/03/1930
PATENTEE:	James R. Thorpe
LOCATION:	Township 1 S, Range 2 W, Section 5
PATENT NUMBER:	TC Pat., 16
PATENT DATE:	02/16/1895
PATENTEE:	William R. Beloat
LOCATION:	Township 1 S, Range 2 W, Section 5
PATENT NUMBER:	CE, 258
PATENT DATE:	06/30/1892
PATENTEE:	Joshua L. Spain
LOCATION:	Township 1 S, Range 2 W, Section 7
PATENT NUMBER:	HE, 1036618
PATENT DATE:	04/28/1930
LOCATIO	Township 1 S, Range 2 W, Section 7
PATENT NUMBER:	HE Pat., 1042
PATENT DATE:	05/08/1901
PATENTEE:	William McDonald
LOCATION:	Township 1 S, Range 2 W, Section 7
PATENT NUMBER:	HE Pat., 1071855
PATENT DATE:	09/05/1934
PATENTEE:	Walter R. Ford
LOCATION:	Township 1 S, Range 2 W, Section 7
PATENT NUMBER:	HE Pat., 1072938
PATENT DATE:	10/31/1934
PATENTEE:	Walter R. Ford

LOCATION: Township 1 S, Range 2 W, Section 7
PATENT NUMBER: DLE, 1134685
PATENT DATE: 04/29/1952
PATENTEE: David R. Hefley

LOCATION: Township 1 S, Range 2 W, Section 7
PATENT NUMBER: Cur. HE Pat., 911357
PATENT DATE: 07/09/1923
PATENTEE: William R. McDonald

LOCATION: Township 1 S, Range 2 W, Section 7
PATENT NUMBER: Cur. HE, 911357
PATENT DATE: 07/09/1923

LOCATION: Township 1 S, Range 2 W, Section 7
PATENT NUMBER: HE, 942273
PATENT DATE: 08/01/1924

LOCATION: Township 1 S, Range 2 W, Section 8
PATENT NUMBER: Cur. CE Pat., 1071005
PATENT DATE: 07/18/1934
PATENTEE: Mary E. Allison

LOCATION: Township 1 S, Range 2 W, Section 8
PATENT NUMBER: SX, 1128592
PATENT DATE: 03/30/1950
PATENTEE: State of Arizona

LOCATION: Township 1 S, Range 2 W, Section 8
PATENT NUMBER: HE Pat., 1319
PATENT DATE: 07/27/1904
PATENTEE: Edward Brewster

LOCATION: Township 1 S, Range 2 W, Section 8
PATENT NUMBER: CE Pat., 137246
PATENT DATE: 06/16/1910
PATENTEE: Guy F. Morgan

LOCATION: Township 1 S, Range 2 W, Section 8
PATENT NUMBER: SS Deaf, Dumb, 7
PATENT DATE: 02/07/1921
PATENTEE: State of Arizona

LOCATION: Township 1 N, Range 2 W, Section 25
PATENT NUMBER: CE, 233230
PATENT DATE: 11/09/1911

LOCATION: Township 1 N, Range 2 W, Section 25
PATENT NUMBER: CE, 265029
PATENT DATE: 05/09/1912

LOCATION:	Township 1 N, Range 2 W, Section 25
PATENT NUMBER:	CE, 814694
PATENT DATE:	07/18/1921
LOCATION:	Township 1 N, Range 2 W, Section 26
PATENT NUMBER:	CE, 178376
PATENT DATE:	02/16/1911
LOCATION:	Township 1 N, Range 2 W, Section 26
PATENT NUMBER:	CE, 280872
PATENT DATE:	06/27/1912
LOCATION:	Township 1 N, Range 2 W, Section 26
PATENT NUMBER:	CE, 513101
PATENT DATE:	02/12/1916
LOCATION:	Township 1 N, Range 2 W, Section 26
PATENT NUMBER:	HE, 527
PATENT DATE:	10/15/1892
LOCATION:	Township 1 N, Range 2 W, Section 27
PATENT NUMBER:	CE, 289506
PATENT DATE:	08/26/1912
LOCATION:	Township 1 N, Range 2 W, Section 33
PATENT NUMBER:	HE, 657
PATENT DATE:	11/22/1894
LOCATION:	Township 1 N, Range 2 W, Section 34
PATENT NUMBER:	CE, 173 3/4
PATENT DATE:	08/08/1892
LOCATION:	Township 1 N, Range 2 W, Section 34
PATENT NUMBER:	CE, 475
PATENT DATE:	04/25/1894
LOCATION:	Township 1 N, Range 2 W, Section 34
PATENT NUMBER:	HE, 936943
PATENT DATE:	04/24/1924
PATENTEE:	Refugio Saldate
LOCATION:	Township 1 N, Range 2 W, Section 34
PATENT NUMBER:	HE, 942
PATENT DATE:	06/28/1899
PATENTEE:	Willard A. Bondurant
LOCATION:	Township 1 N, Range 2 W, Section 35
PATENT NUMBER:	HE, 1101664
PATENT DATE:	03/14/1939
PATENTEE:	Henry L. Magby
LOCATION:	Township 1 N, Range 2 W, Section 35

PATENT NUMBER: PS, 1153351
PATENT DATE: 08/08/1955
PATENTEE: Clarence L. Reidhead

LOCATION: Township 1 N, Range 2 W, Section 35
PATENT NUMBER: In Lieu, 247
PATENT DATE: 06/30/1958
PATENTEE: State of Arizona

LOCATION: Township 1 N, Range 2 W, Section 35
PATENT NUMBER: CE, 276689
PATENT DATE: 06/18/1912

LOCATION: Township 1 N, Range 2 W, Section 35
PATENT NUMBER: CE, 532042
PATENT DATE: 06/03/1916
PATENTEE: Jeff Viliborghi

LOCATION: Township 1 N, Range 2 W, Section 35
PATENT NUMBER: In Lieu, 80
PATENT DATE: 03/29/1929

LOCATION: Township 1 S, Range 3 W, Section 7
PATENT NUMBER: HE, 1453
PATENT DATE: 02/28/1906
PATENTEE: Nelson Griffith

LOCATION: Township 1 S, Range 3 W, Section 7
PATENT NUMBER: CE, 1464
PATENT DATE: 03/29/1902
PATENTEE: B. Frank Griffith

LOCATION: Township 1 S, Range 3 W, Section 8
PATENT NUMBER: SX, 1123260
PATENT DATE: 02/19/1948
PATENTEE: State of Arizona

LOCATION: Township 1 S, Range 3 W, Section 8
PATENT NUMBER: HE, 402994
PATENT DATE: 05/06/1914
PATENTEE: Edward J. Downing

LOCATION: Township 1 S, Range 3 W, Section 11
PATENT NUMBER: HE Pat., 1014
PATENT DATE: 09/07/1900
PATENTEE: William Burch

LOCATION: Township 1 S, Range 3 W, Section 11
PATENT NUMBER: DLE, 1126843
PATENT DATE: 07/25/1949

LOCATION: Township 1 S, Range 3 W, Section 11

PATENT NUMBER: HE, 524339
PATENT DATE: 04/13/1916
PATENTEE: Thomas Hastie Bell

LOCATION: Township 1 S, Range 3 W, Section 17
PATENT NUMBER: DLE, 774552
PATENT DATE: 09/23/1920
PATENTEE: Charles, heirs of Turner

LOCATION: Township 1 S, Range 3 W, Section 18
PATENT NUMBER: HE, 1107503
PATENT DATE: 03/27/1940
PATENTEE: William M. Calthorp

LOCATION: Township 1 S, Range 3 W, Section 18
PATENT NUMBER: IN LIEU, 55
PATENT DATE: 03/22/1922
PATENTEE: State of Arizona

LOCATION: Township 1 S, Range 4 W, Section 14
PATENT NUMBER: IND RES X PAT, 1060996
PATENT DATE: 01/19/1933

LOCATION: Township 1 S, Range 4 W, Section 14
PATENT NUMBER: SS, 29
PATENT DATE: 09/01/1925

LOCATION: Township 1 S, Range 4 W, Section 14
PATENT NUMBER: CE, 500
PATENT DATE: 12/19/1894

LOCATION: Township 1 S, Range 4 W, Section 19
PATENT NUMBER: CE, 1362
PATENT DATE: 09/30/1899

LOCATION: Township 1 S, Range 4 W, Section 19
PATENT NUMBER: HE, 810319
PATENT DATE: 06/16/1921

LOCATION: Township 1 S, Range 4 W, Section 20
PATENT NUMBER: HE, 1066211
PATENT DATE: 09/22/1933

LOCATION: Township 1 S, Range 4 W, Section 20
PATENT NUMBER: SS, 12
PATENT DATE: 10/22/1917

LOCATION: Township 1 S, Range 4 W, Section 20
PATENT NUMBER: HE, 602230
PATENT DATE: 09/29/1917

LOCATION: Township 1 S, Range 4 W, Section 20

PATENT NUMBER: CE, 882
PATENT DATE: 01/25/1892
PATENTEE:

LOCATION: Township 1 S, Range 4 W, Section 20
PATENT NUMBER: HE, 902
PATENT DATE: 04/01/1899
PATENTEE:

LOCATION: Township 1 S, Range 4 W, Section 21
PATENT NUMBER: CE, 342345
PATENT DATE: 06/19/1913
PATENTEE:

LOCATION: Township 1 S, Range 4 W, Section 22
PATENT NUMBER: HE, 523517
PATENT DATE: 04/08/1916
PATENTEE: Ellice W. Minor

LOCATION: Township 1 S, Range 4 W, Section 22
PATENT NUMBER: CE, 984970
PATENT DATE: 09/09/1926
PATENTEE: David E. Anderson

LOCATION: Township 1 S, Range 4 W, Section 23
PATENT NUMBER: DLE, 680744
PATENT DATE: 06/02/1919
PATENTEE: Thomas J. Kenworthy

LOCATION: Township 1 S, Range 4 W, Section 23
PATENT NUMBER: HE, 745392
PATENT DATE: 04/16/1920
PATENTEE: Thomas Durr

LOCATION: Township 1 S, Range 4 W, Section 24
PATENT NUMBER: CE, 528502
PATENT DATE: 05/11/1916
PATENTEE: Thomas V., heirs of Coony

LOCATION: Township 1 S, Range 4 W, Section 24
PATENT NUMBER: HE, 897526
PATENT DATE: 02/27/1923
PATENTEE: Murrell E. Flood

LOCATION: Township 1 S, Range 4 W, Section 29
PATENT NUMBER: HE, 567410
PATENT DATE: 02/14/1917
PATENTEE: Juan Romo

LOCATION: Township 1 S, Range 4 W, Section 30
PATENT NUMBER: CE, 805970
PATENT DATE: 05/11/1921

PATENTEE: Jesse D. Williams

LOCATION: Township 1 S, Range 5 W, Section 25
PATENT NUMBER: SS, 2
PATENT DATE: 10/13/1930
PATENTEE: State of Arizona

LOCATION: Township 1 S, Range 5 W, Section 25
PATENT NUMBER: HE, 552403
PATENT DATE: 10/30/1916
PATENTEE: James D. Collins

LOCATION: Township 1 S, Range 5 W, Section 25
PATENT NUMBER: HE, 552418
PATENT DATE: 10/30/1916
PATENTEE: William Forbes

LOCATION: Township 1 S, Range 5 W, Section 27
PATENT NUMBER: CE, 1396
PATENT DATE: 04/09/1901
PATENTEE: Arthur C. Wood

LOCATION: Township 1 S, Range 5 W, Section 27
PATENT NUMBER: CE, 227
PATENT DATE: 11/08/1890
PATENTEE: Edward A. Torrea

LOCATION: Township 1 S, Range 5 W, Section 27
PATENT NUMBER: IN LIEU, 40
PATENT DATE: 11/26/1920
PATENTEE:

LOCATION: Township 1 S, Range 5 W, Section 27
PATENT NUMBER: DLE, 726990
PATENT DATE: 01/10/1920
PATENTEE: Marion A. Peterson

LOCATION: Township 1 S, Range 5 W, Section 33
PATENT NUMBER: HE, 1208
PATENT DATE: 03/17/1903
PATENTEE: Walter J. Wood

LOCATION: Township 1 S, Range 5 W, Section 33
PATENT NUMBER: CE, 669
PATENT DATE: 06/03/1903
PATENTEE: John K. Wood

LOCATION: Township 1 S, Range 5 W, Section 34
PATENT NUMBER: DLE, 1050259
PATENT DATE: 10/05/1931
PATENTEE: May T. Fink

LOCATION: Township 1 S, Range 5 W, Section 34
PATENT NUMBER: HE, 521583
PATENT DATE: 03/25/1916
PATENTEE:

LOCATION: Township 1 S, Range 5 W, Section 34
PATENT NUMBER: HE, 761344
PATENT DATE: 07/14/1920
PATENTEE: Lee Fred Bowser

LOCATION: Township 2 S, Range 5 W, Section 3
PATENT NUMBER: HE, 1081492
PATENT DATE: 02/25/1936
PATENTEE:

LOCATION: Township 2 S, Range 5 W, Section 4
PATENT NUMBER: SS, 2
PATENT DATE: 10/13/1930
PATENTEE: State of Arizona

LOCATION: Township 2 S, Range 5 W, Section 10
PATENT NUMBER: DLE, 1123231
PATENT DATE: 02/16/1948
PATENTEE:

LOCATION: Township 2 S, Range 5 W, Section 15
PATENT NUMBER: HE, 1071037
PATENT DATE: 07/25/1934
PATENTEE:

LOCATION: Township 2 S, Range 5 W, Section 21
PATENT NUMBER: CE, 698
PATENT DATE: 11/30/1904
PATENTEE:

LOCATION: Township 2 S, Range 5 W, Section 28
PATENT NUMBER: HE, 302129
PATENT DATE: 11/25/1912
PATENTEE:

LOCATION: Township 2 S, Range 5 W, Section 28
PATENT NUMBER: HE, 479997
PATENT DATE: 06/26/1915
PATENTEE: Frank H. Hereford

LOCATION: Township 2 S, Range 5 S, Section 28
PATENT NUMBER: CE, 579
PATENT DATE: 06/03/1891
PATENTEE:

LOCATION: Township 2 S, Range 5 W, Section 28
PATENT NUMBER: HE, 999752

LOCATION:	Township 4 S, Range 4 W, Section 5
PATENT NUMBER:	IND RES X PAT, 175044
PATENT DATE:	02/03/1911
PATENTEE:	
LOCATION:	Township 4 S, Range 4 W, Section 8
PATENT NUMBER:	DLE, 1001597
PATENT DATE:	05/10/1927
PATENTEE:	
LOCATION:	Township 4 S, Range 4 W, Section 8
PATENT NUMBER:	DLE, 1146468
PATENT DATE:	09/03/1954
PATENTEE:	Lola Arlene Pierpont
LOCATION:	Township 4 S, Range 4 W, Section 17
PATENT NUMBER:	DLE, 1147922
PATENT DATE:	11/15/1954
PATENTEE:	
LOCATION:	Township 4 S, Range 4 W, Section 20
PATENT NUMBER:	CE, 1066811
PATENT DATE:	11/03/1933
PATENTEE:	Miller Woods
LOCATION:	Township 4 S, Range 4 W, Section 20
PATENT NUMBER:	CE, 1066811
PATENT DATE:	11/03/1933
PATENTEE:	
LOCATION:	Township 4 S, Range 4 W, Section 20
PATENT NUMBER:	PS, 1088399
PATENT DATE:	02/12/1937
PATENTEE:	Emil F. Jones
LOCATION:	Township 4 S, Range 4 W, Section 28
PATENT NUMBER:	HE, 660
PATENT DATE:	11/21/1894
PATENTEE:	Herbert Morgan
LOCATION:	Township 4 S, Range 4 W, Section 28
PATENT NUMBER:	HE, 661
PATENT DATE:	11/22/1894
PATENTEE:	William Morgan
LOCATION:	Township 4 S, Range 4 W, Section 29
PATENT NUMBER:	PS, 1140493
PATENT DATE:	08/25/1953
PATENTEE:	Ben Harrelson
LOCATION:	Township 4 S, Range 4 W, Section 33

PATENT NUMBER:	HE, 373
PATENT DATE:	11/09/1891
PATENTEE:	William J. Johns
LOCATION:	Township 4 S, Range 6 W, Section 27
PATENT NUMBER:	CE, 541
PATENT DATE:	10/23/1894
PATENTEE:	Joseph Edwin Davis
LOCATION:	Township 4 S, Range 6 W, Section 30
PATENT NUMBER:	CE, 494
PATENT DATE:	02/08/1894
PATENTEE:	Bruce Barney
LOCATION:	Township 4 S, Range 6 W, Section 31
PATENT NUMBER:	HE, 60411
PATENT DATE:	05/11/1909
PATENTEE:	Josiah J. Anderson
LOCATION:	Township 4 S, Range 6 W, Section 33
PATENT NUMBER:	HE, 556
PATENT DATE:	12/20/1892
PATENTEE:	Edward A. Stout
LOCATION:	Township 4 S, Range 6 W, Section 33
PATENT NUMBER:	HE, 562
PATENT DATE:	03/27/1893
PATENTEE:	William L. Garrigus
LOCATION:	Township 4 S, Range 6 W, Section 34
PATENT NUMBER:	CE, 435
PATENT DATE:	03/08/1894
PATENTEE:	Winfield S. Millis
LOCATION:	Township 4 S, Range 6 W, Section 35
PATENT NUMBER:	CE, 1134
PATENT DATE:	12/26/1895
PATENTEE:	Benjamin L. Rodgers
LOCATION:	Township 4 S, Range 6 W, Section 35
PATENT NUMBER:	CE, 499
PATENT DATE:	08/22/1894
PATENTEE:	Andrew Fomberg
LOCATION:	Township 4 S, Range 7 W, Section 23
PATENT NUMBER:	CE, 395
PATENT DATE:	03/21/1893
PATENTEE:	Elizabeth W. Ramey
LOCATION:	Township 4 S, Range 7 W, Section 34
PATENT NUMBER:	HE, 670
PATENT DATE:	11/22/1894

PATENTEE:	William A. Westbrook
LOCATION:	Township 4 S, Range 8 W, Section 14
PATENT NUMBER:	HE, 567610
PATENT DATE:	02/16/1917
PATENTEE:	Lewis S. Streit
LOCATION:	Township 4 S, Range 8 W, Section 15
PATENT NUMBER:	HE, 567612
PATENT DATE:	02/16/1917
PATENTEE:	Jesse W. Utz
LOCATION:	Township 4 S, Range 8 W, Section 23
PATENT NUMBER:	HE, 602244
PATENT DATE:	09/29/1917
PATENTEE:	Weigand Trusheim
LOCATION:	Township 4 S, Range 8 W, Section 23
PATENT NUMBER:	HE, 680853
PATENT DATE:	06/02/1919
PATENTEE:	Alfred Bartine
LOCATION:	Township 4 S, Range 8 W, Section 26
PATENT NUMBER:	HE, 434354
PATENT DATE:	10/08/1914
PATENTEE:	William W. Bruner
LOCATION:	Township 5 S, Range 4 W, Section 5
PATENT NUMBER:	CE, 656
PATENT DATE:	01/22/1891
PATENTEE:	Charles C. Maag
LOCATION:	Township 5 S, Range 4 W, Section 5
PATENT NUMBER:	HE, 947
PATENT DATE:	11/20/1899
PATENTEE:	Charles W. Padelford
LOCATION:	Township 5 S, Range 4 W, Section 7
PATENT NUMBER:	CE, 656
PATENT DATE:	01/22/1891
PATENTEE:	
LOCATION:	Township 5 S, Range 4 W, Section 8
PATENT NUMBER:	HE, 1087
PATENT DATE:	08/29/1901
PATENTEE:	Jane H. Narramore
LOCATION:	Township 5 S, Range 4 W, Section 8
PATENT NUMBER:	CE, 746
PATENT DATE:	11/16/1891
PATENTEE:	Leonidas Beatty

LOCATION:	Township 5 S, Range 4 W, Section 18
PATENT NUMBER:	CE, 645
PATENT DATE:	01/22/1891
PATENTEE:	Ira P. Gould
LOCATION:	Township 5 S, Range 6 W, Section 1
PATENT NUMBER:	HE, 400
PATENT DATE:	01/11/1892
PATENTEE:	Wilbur H. Phillips
LOCATION:	Township 5 S, Range 6 W, Section 1
PATENT NUMBER:	HE, 400
PATENT DATE:	01/11/1892
PATENTEE:	Wilbur H. Phillips
LOCATION:	Township 5 S, Range 6 W, Section 1
PATENT NUMBER:	HE, 585
PATENT DATE:	07/06/1893
PATENTEE:	Henry H. McPhaul
LOCATION:	Township 5 S, Range 6 W, Section 2
PATENT NUMBER:	HE, 249
PATENT DATE:	01/13/1891
PATENTEE:	Patrick Kelley
LOCATION:	Township 5 S, Range 6 W, Section 2
PATENT NUMBER:	HE, 316
PATENT DATE:	04/27/1891
PATENTEE:	WIlliam J. Welcome
LOCATION:	Township 5 S, Range 8 W, Section 6
PATENT NUMBER:	HE, 785777
PATENT DATE:	12/10/1920
PATENTEE:	Frederick J. Kreager
LOCATION:	Township 5 S, Range 9 W, Section 12
PATENT NUMBER:	CE, 769
PATENT DATE:	11/09/1891
PATENTEE:	Thomas A. Jordan
LOCATION:	Township 5 S, Range 10 W, Section 13
PATENT NUMBER:	HE, 927808
PATENT DATE:	12/28/1923
PATENTEE:	Herschel B. Wright
LOCATION:	Township 5 S, Range 10 W, Section 14
PATENT NUMBER:	SS, 18
PATENT DATE:	02/28/1919
PATENTEE:	
LOCATION:	Township 5 S, Range 10 W, Section 27
PATENT NUMBER:	HE, 436

PATENT DATE: 01/20/1892
PATENTEE: Jennie Cameron

LOCATION: Township 5 S, Range 10 W, Section 28
PATENT NUMBER: HE, 559
PATENT DATE: 04/08/1893
PATENTEE: Jahail Hoople

LOCATION: Township 5 S, Range 10 W, Section 29
PATENT NUMBER: HE, 518080
PATENT DATE: 03/09/1916
PATENTEE: Roman Amabisca

LOCATION: Township 5 S, Range 10 W, Section 30
PATENT NUMBER: FLS, 7376
PATENT DATE: 06/03/1904
PATENTEE: Edward B. Perrin

LOCATION: Township 5 S, Range 11 W, Section 35
PATENT NUMBER: CE, 1443
PATENT DATE: 12/12/1901
PATENTEE: William E. Brown

LOCATION: Township 5 S, Range 11 W, Section 35
PATENT NUMBER: IN LIEU, 5
PATENT DATE: 05/01/1918
PATENTEE: State of Arizona

LOCATION: Township 6 S, Range 11 W, Section 7
PATENT NUMBER: IND RES X PAT, 505222
PATENT DATE: 12/30/1915
PATENTEE: Santa Fe Pacific Railroad

LOCATION: Township 6 S, Range 11 W, Section 7
PATENT NUMBER: CE, 710
PATENT DATE: 10/16/1891
PATENTEE: Jacob E. Nelson

LOCATION: Township 6 S, Range 11 W, Section 8
PATENT NUMBER: HE, 324
PATENT DATE: 01/11/1892
PATENTEE: Charles W. Hackett

LOCATION: Township 6 S, Range 11 W, Section 9
PATENT NUMBER: HE, 966772
PATENT DATE: 09/24/1925
PATENTEE: Martin L. Howard

LOCATION: Township 6 S, Range 12 W, Section 10
PATENT NUMBER: TC, 1001698
PATENT DATE: 05/14/1927
PATENTEE: Hans Peter Johansen

LOCATION:	Township 6 S, Range 12 W, Section 11
PATENT NUMBER:	CE, 546
PATENT DATE:	05/10/1895
PATENTEE:	Mary H. Wham
LOCATION:	Township 6 S, Range 12 W, Section 12
PATENT NUMBER:	HE, 702
PATENT DATE:	06/19/1895
PATENTEE:	John B. Martin
LOCATION:	Township 6 S, Range 12 W, Section 15
PATENT NUMBER:	HE, 1059385
PATENT DATE:	11/02/1932
PATENTEE:	Harold D. McDaniel
LOCATION:	Township 6 S, Range 12 W, Section 15
PATENT NUMBER:	HE, 3129
PATENT DATE:	04/01/1907
PATENTEE:	John F. Nottbusch
LOCATION:	Township 6 S, Range 12 W, Section 15
PATENT NUMBER:	HE, 956
PATENT DATE:	07/26/1899
PATENTEE:	Daniel B. Morris
LOCATION:	Township 6 S, Range 12 W, Section 19
PATENT NUMBER:	HE, 486
PATENT DATE:	05/16/1892
PATENTEE:	Francisco Toledo
LOCATION:	Township 6 S, Range 12 W, Section 20
PATENT NUMBER:	HE, 1133
PATENT DATE:	02/12/1902
PATENTEE:	Noah C. Nelson
LOCATION:	Township 6 S, Range 12 W, Section 20
PATENT NUMBER:	HE, 824
PATENT DATE:	11/05/1897
PATENTEE:	Elias F. Snider
LOCATION:	Township 6 S, Range 12 W, Section 20
PATENT NUMBER:	HE, 954
PATENT DATE:	07/26/1899
PATENTEE:	Thomas W. Underhill
LOCATION:	Township 6 S, Range 12 W, Section 21
PATENT NUMBER:	CE, 722
PATENT DATE:	10/16/1891
PATENTEE:	William P. Teel
LOCATION:	Township 6 S, Range 12 W, Section 30

PATENTEE: Company Santa Fe Pacific Railroad

LOCATION: Township 7 S, Range 14 W, Section 11
PATENT NUMBER: DLE, 873940
PATENT DATE: 07/31/1922
PATENTEE: Andrew J. Case

LOCATION: Township 7 S, Range 14 W, Section 14
PATENT NUMBER: PX PAT, 02-70-0065
PATENT DATE: 03/13/1970
PATENTEE: Florence Vandenberg

LOCATION: Township 7 S, Range 14 W, Section 19
PATENT NUMBER: IND RES X PAT, 505224
PATENT DATE: 12/30/1915
PATENTEE: Santa Fe Pacific Railroad

LOCATION: Township 7 S, Range 15 W, Section 22
PATENT NUMBER: CE, 207
PATENT DATE: 12/20/1890
PATENTEE: Frederick Griffith

LOCATION: Township 7 S, Range 15 W, Section 22
PATENT NUMBER: HE, 390340
PATENT DATE: 03/07/1914
PATENTEE: Frank Corona

LOCATION: Township 7 S, Range 15 W, Section 23
PATENT NUMBER: CE, 784
PATENT DATE: 01/11/1892
PATENTEE: Fort E. Snider

LOCATION: Township 7 S, Range 15 W, Section 28
PATENT NUMBER: IN LIEU, 82
PATENT DATE: 02/28/1925
PATENTEE: State of Arizona

LOCATION: Township 7 S, Range 15 W, Section 29
PATENT NUMBER: CE, 427
PATENT DATE: 06/24/1893
PATENTEE: John H. Shanssey

LOCATION: Township 7 S, Range 15 W, Section 30
PATENT NUMBER: CE, 359
PATENT DATE: 08/01/1892
PATENTEE: William R. Cluness

LOCATION: Township 7 S, Range 15 W, Section 30
PATENT NUMBER: CE, 426
PATENT DATE: 06/24/1893
PATENTEE: Joseph H. Godfrey

LOCATION:	Township 7 S, Range 15 W, Section 33
PATENT NUMBER:	HE, 1066294
PATENT DATE:	09/27/1933
PATENTEE:	George Lewis Brooks
LOCATION:	Township 7 S, Range 16 W, Section 25
PATENT NUMBER:	CE, 360
PATENT DATE:	08/01/1892
PATENTEE:	Lafayette B. Clark
LOCATION:	Township 8 S, Range 16 W, Section 4
PATENT NUMBER:	SS, 3
PATENT DATE:	12/13/1915
PATENTEE:	State of Arizona
LOCATION:	Township 8 S, Range 16 W, Section 5
PATENT NUMBER:	CE, 640 1/2
PATENT DATE:	10/20/1891
PATENTEE:	Conrad Ochsner
LOCATION:	Township 8 S, Range 16 W, Section 7
PATENT NUMBER:	HE, 1037198
PATENT DATE:	05/15/1930
PATENTEE:	Malcolm L. Sheldon
LOCATION:	Township 8 S, Range 16 W, Section 8
PATENT NUMBER:	DLE, 987760
PATENT DATE:	10/21/1926
PATENTEE:	James D. Forest
LOCATION:	Township 8 S, Range 16 W, Section 9
PATENT NUMBER:	HE, 1073385
PATENT DATE:	11/30/1934
PATENTEE:	Chesterton Dennis Norton
LOCATION:	Township 8 S, Range 16 W, Section 17
PATENT NUMBER:	SS, 3
PATENT DATE:	09/16/1915
PATENTEE:	State of Arizona
LOCATION:	Township 8 S, Range 16 W, Section 18
PATENT NUMBER:	SS, 1
PATENT DATE:	06/30/1914
PATENTEE:	State of Arizona
LOCATION:	Township 8 S, Range 16 W, Section 18
PATENT NUMBER:	CE, 1009152
PATENT DATE:	11/04/1927
PATENTEE:	Thomas T. Davidson
LOCATION:	Township 8 S, Range 16 W, Section 18
PATENT NUMBER:	DLE, 1041071

PATENT DATE: 10/07/1930
PATENTEE: William R. Yancy

LOCATION: Township 8 S, Range 16 W, Section 18
PATENT NUMBER: CE, 1053257
PATENT DATE: 02/09/1932
PATENTEE: Jesse F. Jeffreys

LOCATION: Township 8 S, Range 16 W, Section 24
PATENT NUMBER: CE, 774
PATENT DATE: 11/16/1891
PATENTEE: Hiram W. Blaisdell

LOCATION: Township 8 S, Range 17 W, Section 11
PATENT NUMBER: CE, 347
PATENT DATE: 12/01/1891
PATENTEE: Norton Marshall

LOCATION: Township 8 S, Range 17 W, Section 11
PATENT NUMBER: CE, 836
PATENT DATE: 03/17/1892
PATENTEE: William H. Treichler

LOCATION: Township 8 S, Range 17 W, Section 12
PATENT NUMBER: CE, 432
PATENT DATE: 06/24/1893
PATENTEE: Christopher Horner

LOCATION: Township 8 S, Range 17 W, Section 12
PATENT NUMBER: CE, 869
PATENT DATE: 11/16/1891
PATENTEE: Norton Marshall

LOCATION: Township 8 S, Range 17 W, Section 12
PATENT NUMBER: CE, 970
PATENT DATE: 02/14/1893
PATENTEE: Thomas A. Fulton

LOCATION: Township 8 S, Range 17 W, Section 13
PATENT NUMBER: HE, 1018586
PATENT DATE: 08/24/1928
PATENTEE: Wilber A. Hughes

LOCATION: Township 8 S, Range 17 W, Section 13
PATENT NUMBER: DLE, 1074012
PATENT DATE: 01/16/1935
PATENTEE: Hiram Todd

LOCATION: Township 8 S, Range 17 W, Section 13
PATENT NUMBER: SS, 3
PATENT DATE: 12/13/1915
PATENTEE: State of Arizona

LOCATION:	Township 8 S, Range 17 W, Section 14
PATENT NUMBER:	DLE, 1009161
PATENT DATE:	11/08/1927
PATENTEE:	Allen B. Ming
LOCATION:	Township 8 S, Range 17 W, Section 14
PATENT NUMBER:	DLE, 1028040
PATENT DATE:	05/31/1929
PATENTEE:	William C. Lacy
LOCATION:	Township 8 S, Range 17 W, Section 18
PATENT NUMBER:	IND RES X PAT, 505229
PATENT DATE:	12/30/1915
PATENTEE:	Santa Fe Pacific Railroad
LOCATION:	Township 8 S, Range 17 W, Section 19
PATENT NUMBER:	HE, 1017463
PATENT DATE:	07/12/1928
PATENTEE:	Thomas H. Maroney
LOCATION:	Township 8 S, Range 17 W, Section 19
PATENT NUMBER:	HE, 1028522
PATENT DATE:	06/14/1929
PATENTEE:	Randolph H. McElhaney
LOCATION:	Township 8 S, Range 17 W, Section 19
PATENT NUMBER:	HE, 1045475
PATENT DATE:	04/09/1931
PATENTEE:	James P. Davis
LOCATION:	Township 8 S, Range 17 W, Section 20
PATENT NUMBER:	HE, 1018585
PATENT DATE:	08/24/1928
PATENTEE:	James Hoyt Cowan
LOCATION:	Township 8 S, Range 17 W, Section 20
PATENT NUMBER:	CE, 876
PATENT DATE:	02/18/1892
PATENTEE:	Isaac Rudisill (sp?)
LOCATION:	Township 8 S, Range 17 W, Section 20
PATENT NUMBER:	HE, 949047
PATENT DATE:	12/03/1924
PATENTEE:	Sadie Carswell
LOCATION:	Township 8 S, Range 17 W, Section 21
PATENT NUMBER:	HE, 1026741
PATENT DATE:	04/26/1929
PATENTEE:	Sadie Simonsen
LOCATION:	Township 8 S, Range 17 W, Section 21

PATENT NUMBER: HE, 1027712
PATENT DATE: 05/24/1929
PATENTEE: Nathan M. Huckaby

LOCATION: Township 8 S, Range 17 W, Section 21
PATENT NUMBER: SS, 5
PATENT DATE: 01/02/1918
PATENTEE: State of Arizona

LOCATION: Township 8 S, Range 17 W, Section 21
PATENT NUMBER: CE, 595
PATENT DATE: 10/16/1891
PATENTEE: Charles Baker

LOCATION: Township 8 S, Range 17 W, Section 22
PATENT NUMBER: HE, 670611
PATENT DATE: 03/19/1919
PATENTEE: Charles S. Wheaton

LOCATION: Township 8 S, Range 17 W, Section 23
PATENT NUMBER: SS, 3
PATENT DATE: 12/13/1915
PATENTEE:

LOCATION: Township 8 S, Range 17 W, Section 24
PATENT NUMBER: DLE, 1032755
PATENT DATE: 12/12/1929
PATENTEE: Mattie M. Yancy

LOCATION: Township 8 S, Range 18 W, Section 11
PATENT NUMBER: HE, 1008083
PATENT DATE: 10/03/1927
PATENTEE: Andrew Arsensault

LOCATION: Township 8 S, Range 18 W, Section 12
PATENT NUMBER: HE, 615533
PATENT DATE: 01/31/1918
PATENTEE: William Forrest

LOCATION: Township 8 S, Range 18 W, Section 13
PATENT NUMBER: IND RES X PAT, 507210
PATENT DATE: 01/11/1916
PATENTEE: Santa Fe Pacific Railroad

LOCATION: Township 8 S, Range 18 W, Section 22
PATENT NUMBER: DLE, 591585
PATENT DATE: 07/11/1917
PATENTEE: Joseph E. Curry

LOCATION: Township 8 S, Range 18 W, Section 27
PATENT NUMBER: DLE, 591586
PATENT DATE: 07/11/1917

PATENTEE: Avery G. Curry

LOCATION: Township 8 S, Range 18 W, Section 28
PATENT NUMBER: CE, 528494
PATENT DATE: 05/11/1916
PATENTEE: Konrad Schmid

LOCATION: Township 8 S, Range 18 W, Section 29
PATENT NUMBER: IND RES X PAT, 505226
PATENT DATE: 12/30/1915
PATENTEE: Santa Fe Pacific Railroad

LOCATION: Township 8 S, Range 18 W, Section 30
PATENT NUMBER: CE, 537728
PATENT DATE: 07/13/1916
PATENTEE: Sarah Gertrude Stone

LOCATION: Township 8 S, Range 19 W, Section 25
PATENT NUMBER: RHE, 1187589
PATENT DATE: 10/20/1958
PATENTEE: Joseph R. Cullison

LOCATION: Township 8 S, Range 19 W, Section 33
PATENT NUMBER: HE, 1087246
PATENT DATE: 11/30/1936
PATENTEE: Dillard Johnson

LOCATION: Township 8 S, Range 19 W, Section 34
PATENT NUMBER: HE, 1061413
PATENT DATE: 02/09/1933
PATENTEE: Rubert Rufus Buereklin

LOCATION: Township 8 S, Range 20 W, Section 5
PATENT NUMBER: HE, 908845
PATENT DATE: 06/13/1923
PATENTEE: Sylvestre Villa

LOCATION: Township 8 S, Range 20 W, Section 6
PATENT NUMBER: HE, 1029407
PATENT DATE: 07/18/1929
PATENTEE: Henry C. Dollarhide

LOCATION: Township 8 S, Range 20 W, Section 17
PATENT NUMBER: DLE, 1017673
PATENT DATE: 07/18/1928
PATENTEE: William Edwin Oliver

LOCATION: Township 8 S, Range 20 W, Section 21
PATENT NUMBER: , 9182164
PATENT DATE: / /
PATENTEE: Lewis K. (heirs of) Hadnot

LOCATION: Township 8 S, Range 20 W, Section 27
PATENT NUMBER: DLE, 1186288
PATENT DATE: 09/16/1958
PATENTEE: M. Luther Bewley (sp?)

LOCATION: Township 8 S, Range 20 W, Section 28
PATENT NUMBER: CE, 1010546
PATENT DATE: 01/09/1928
PATENTEE: Francis Knowles
LOCATION: Township 8 S, Range 20 W, Section 34
PATENT NUMBER: HE, 1066400
PATENT DATE: 10/07/1933
PATENTEE: William Bradley Powers

LOCATION: Township 8 S, Range 21 W, Section 2
PATENT NUMBER: Ag. Lease, 01-514
PATENT DATE: 09/01/1992
PATENTEE: James H. and Mary L. Dunn

LOCATION: Township 8 S, Range 21 W, Section 3
PATENT NUMBER: IN LIEU, 370
PATENT DATE: 06/23/1967
PATENTEE: State of Arizona

LOCATION: Township 8 S, Range 21 W, Section 8
PATENT NUMBER: IN LIEU, 40
PATENT DATE: 11/26/1920
PATENTEE: State of Arizona

LOCATION: Township 8 S, Range 21 W, Section 17
PATENT NUMBER: DLE, 950221
PATENT DATE: 12/18/1924
PATENTEE: Henry Hansberger

LOCATION: Township 8 S, Range 21 W, Section 20
PATENT NUMBER: HE, 259679
PATENT DATE: 04/18/1912
PATENTEE: James Meana

LOCATION: Township 8 S, Range 21 W, Section 20
PATENT NUMBER: HE, 709732
PATENT DATE: 09/29/1919
PATENTEE: Alice Connor

LOCATION: Township 8 S, Range 22 W, Section 20
PATENT NUMBER: HE, 1022535
PATENT DATE: 01/21/1929
PATENTEE: Rufus Dees

LOCATION: Township 8 S, Range 22 W, Section 20
PATENT NUMBER: CE, 739285
PATENT DATE: 03/10/1920

PATENTEE:	Charles A. Cassel
LOCATION:	Township 8 S, Range 22 W, Section 21
PATENT NUMBER:	HE, 261568
PATENT DATE:	04/25/1912
PATENTEE:	Thomas W. Knox
LOCATION:	Township 8 S, Range 22 W, Section 22
PATENT NUMBER:	HE, 327362
PATENT DATE:	04/21/1913
PATENTEE:	John M. Harris
LOCATION:	Township 8 S, Range 22 W, Section 22
PATENT NUMBER:	HE, 941526
PATENT DATE:	07/17/1924
PATENTEE:	Robert W. Reinse (illegible)
LOCATION:	Township 8 S, Range 22 W, Section 24
PATENT NUMBER:	CE, 753
PATENT DATE:	11/09/1891
PATENTEE:	Charles C. Stowe
LOCATION:	Township 8 S, Range 22 W, Section 24
PATENT NUMBER:	CE, 764
PATENT DATE:	11/09/1891
PATENTEE:	Andrew Magnus Runsick
LOCATION:	Township 8 S, Range 22 W, Section 27
PATENT NUMBER:	CE, 608
PATENT DATE:	09/06/1890
PATENTEE:	Frederick B. Southworth
LOCATION:	Township 8 S, Range 22 W, Section 29
PATENT NUMBER:	HE, 89
PATENT DATE:	04/01/1907
PATENTEE:	Concepcion Armenta
LOCATION:	Township 8 S, Range 22 W, Section 30
PATENT NUMBER:	HE, 1034203
PATENT DATE:	01/24/1930
PATENTEE:	Kate Maddox
LOCATION:	Township 8 S, Range 22 W, Section 30
PATENT NUMBER:	HE, 1034203
PATENT DATE:	01/24/1930
PATENTEE:	
LOCATION:	Township 8 S, Range 22 W, Section 30
PATENT NUMBER:	DLE, 1136359
PATENT DATE:	09/04/1952
PATENTEE:	Kenneth K. Surber

LOCATION: Township 9 S, Range 19 W, Section 3
PATENT NUMBER: IN LIEU, 8
PATENT DATE: 06/18/1918
PATENTEE: State of Arizona

LOCATION: Township 9 S, Range 19 W, Section 3
PATENT NUMBER: HE, 969797
PATENT DATE: 11/20/1925
PATENTEE: John Maurice Goold

LOCATION: Township 9 S, Range 19 W, Section 6
PATENT NUMBER: HE, 1026016
PATENT DATE: 04/12/1929
PATENTEE:

LOCATION: Township 9 S, Range 19 W, Section 6
PATENT NUMBER: HE, 1045220
PATENT DATE: 06/27/1929
PATENTEE:

LOCATION: Township 9 S, Range 19 W, Section 6
PATENT NUMBER: CE, 1054073
PATENT DATE: 03/25/1932
PATENTEE:

STATE PATENTS

LOCATION: Township 1 N, Range 1 W, Section 31
PATENT NUMBER: State Patent, 6566
PATENT DATE: 03/30/1978
PATENTEE: James L. King

LOCATION: Township 1 N, Range 1 W, Section 32
PATENT NUMBER: State Patent, 219
PATENT DATE: 09/24/1918
PATENTEE: Buckeye Irrigation Co.

LOCATION: Township 1 N, Range 1 E, Section 32
PATENT NUMBER: State Patent 54-98972-01
PATENT DATE: 11/05/1991
PATENTEE: Maricopa County Flood Control District of

LOCATION: Township 1 N, Range 1 W, Section 32
PATENT NUMBER: State Patent, 6353
PATENT DATE: 11/12/1975
PATENTEE: Maricopa County Board of Supervisors,

LOCATION: Township 1 N, Range 1 W, Section 33
PATENT NUMBER: State Patent 1513
PATENT DATE: 11/20/1929
PATENTEE: Chula Vista Ranch Co.

LOCATION:	Township 1 N, Range 1 W, Section 33
PATENT NUMBER:	State Patent 1514
PATENT DATE:	11/20/1929
PATENTEE:	Chula Vista Ranch Co.
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State patent, 1124
PATENT DATE:	09/27/1927
PATENTEE:	L.J. Holzwarth
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State Patent, 2946
PATENT DATE:	02/11/1944
PATENTEE:	Elgie L. Burleson
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State Patent, 3166
PATENT DATE:	11/30/1944
PATENTEE:	Lakin-Peter Cattle Co.
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State Patent, 4437
PATENT DATE:	06/19/1950
PATENTEE:	Bert and Alice Amator
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State Patent, 5826
PATENT DATE:	06/05/1970
PATENTEE:	William L. Amator
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State Patent, 6980
PATENT DATE:	01/31/1984
PATENTEE:	William L. Amator
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State Patent, 6981
PATENT DATE:	01/31/1984
PATENTEE:	William L. Amator
LOCATION:	Township 1 N, Range 1 W, Section 36
PATENT NUMBER:	State Patent, 986
PATENT DATE:	08/18/1926
PATENTEE:	Bruno Ramirez
LOCATION:	Township 1 N, Range 2 W, Section 36
PATENT NUMBER:	State Patent, 3676
PATENT DATE:	12/08/1959
PATENTEE:	M.B. and Cecil M. Kubelsky and Colvin
LOCATION:	Township 1 N, Range 2 W, Section 36
PATENT NUMBER:	State patent, 3677

PATENT DATE: 03/15/1946
PATENTEE: M.B., Cecil M. Kubelsky, Colwin

LOCATION: Township 1 S, Range 3 W, Section 16
PATENT NUMBER: State Patent, 2091
PATENT DATE: 05/16/1939
PATENTEE: Arlington Canal Company

LOCATION: Township 5 S, Range 5 W, Section 16
PATENT NUMBER: State Patent, 7505
PATENT DATE: 10/29/1992
PATENTEE: J & R LTD.

LOCATION: Township 5 S, Range 5 W, Section 16
PATENT NUMBER: State Patent, 7506
PATENT DATE: 10/29/1992
PATENTEE: J & R LTD.

LOCATION: Township 6 S, Range 13 W, Section 32
PATENT NUMBER: State Patent, 1542
PATENT DATE: 02/19/1930
PATENTEE: S.R. Jackson

LOCATION: Township 7 S, Range 14 W, Section 16
PATENT NUMBER: State Patent, 5520
PATENT DATE: 02/23/1967
PATENTEE: Augusta M. Phillips

LOCATION: Township 7 S, Range 14 W, Section 16
PATENT NUMBER: State Patent, 5521
PATENT DATE: 02/23/1967
PATENTEE: Brahma Farms, Inc.

LOCATION: Township 7 S, Range 14 W, Section 16
PATENT NUMBER: State Patent, 5957
PATENT DATE: 02/04/1972
PATENTEE: Wellton-Mohawk Irrigation and Drainage District

LOCATION: Township 7 S, Range 14 W, Section 16
PATENT NUMBER: State Patent, 5826
PATENT DATE: 02/04/1972
PATENTEE: Drainage District Wellton-Mohawk Irr. &

LOCATION: Township 7 S, Range 15 W, Section 32
PATENT NUMBER: State Patent, 5958
PATENT DATE: 02/04/1972
PATENTEE: Drainage District Wellton-Mohawk Irr. &

LOCATION: Township 7 S, Range 16 W, Section 36
PATENT NUMBER: State Patent, 5291
PATENT DATE: 03/28/1963
PATENTEE: Kenilworth Farms

LOCATION: Township 7 S, Range 16 W, Section 36
PATENT NUMBER: State Patent, 5292
PATENT DATE: 03/28/1963
PATENTEE: Lehi Farms Company

LOCATION: Township 7 S, Range 16 W, Section 36
PATENT NUMBER: State Patent, 5295
PATENT DATE: 03/29/1963
PATENTEE: Ipswich Farms

LOCATION: Township 7 S, Range 16 W, Section 36
PATENT NUMBER: State Patent, 5959
PATENT DATE: 02/04/1972
PATENTEE: Drainage District Wellton-Mohawk Irr. &

LOCATION: Township 8 S, Range 18 W, Section 16
PATENT NUMBER: State Patent, 3780
PATENT DATE: 07/23/1946
PATENTEE: D.M. and Evelyn A. Ritchie

LOCATION: Township 8 S, Range 19 W, Section 32
PATENT NUMBER: State Patent 5867
PATENT DATE: 01/07/1971
PATENTEE: Charles S. Powell

LOCATION: Township 8 S, Range 19 W, Section 32
PATENT NUMBER: State Patent 5968
PATENT DATE: 02/04/1972
PATENTEE: and Drainage Dist. Wellton-Mohawk Irr.

LOCATION: Township 8 S, Range 20 W, Section 16
PATENT NUMBER: State Patent, 5581
PATENT DATE: 11/22/1967
PATENTEE: Oscar & Dorothea Walls

LOCATION: Township 8 S, Range 20 W, Section 16
PATENT NUMBER: State Patent, 5638
PATENT DATE: 06/12/1968
PATENTEE: Ronnie L. Moore

LOCATION: Township 8 S, Range 20 W, Section 16
PATENT NUMBER: State Patent 5874
PATENT DATE: 01/27/1971
PATENTEE: Carolyn Lucille Walls

LOCATION: Township 8 S, Range 20 W, Section 16
PATENT NUMBER: State Patent, 5969
PATENT DATE: 02/04/1972
PATENTEE: Drainage District Wellton-Mohawk Irr. &

LOCATION: Township 8 S, Range 20 W, Section 16

PATENT NUMBER:	State Patent, 6440
PATENT DATE:	02/16/1977
PATENTEE:	Howard and Ellen Moore

LOCATION:	Township 8 S, Range 20 W, Section 16
PATENT NUMBER:	State Patent 7550
PATENT DATE:	10/22/1993
PATENTEE:	Leslie W. and Bobbie Kammann

LOCATION:	Township 8 S, Range 20 W, Section 16
PATENT NUMBER:	State Patent 7549
PATENT DATE:	10/15/1993
PATENTEE:	Leslie W. and Bobbie Kammann

LOCATION:	Township 8 S, Range 20 W, Section 36
PATENT NUMBER:	State Patent, 5970
PATENT DATE:	02/04/1972
PATENTEE:	Drainage District Wellton-Mohawk Irr. &

LOCATION:	Township 8 S, Range 20 W, Section 36
PATENT NUMBER:	State Patent, 7210
PATENT DATE:	03/17/1987
PATENTEE:	Jesse Ray & Sammie Hancock

LOCATION:	Township 8 S, Range 20 W, Section 36
PATENT NUMBER:	State Patent, 7373
PATENT DATE:	03/02/1989
PATENTEE:	Jesse Ray & Sammie Hancock

LOCATION:	Township 8 S, Range 20 W, Section 36
PATENT NUMBER:	State Patent, 7374
PATENT DATE:	03/02/1989
PATENTEE:	Jesse Ray Hancock

LOCATION:	Township 8 S, Range 21 W, Section 2
PATENT NUMBER:	State Patent 5807
PATENT DATE:	03/03/1970
PATENTEE:	Hattie L. Spann

LOCATION:	Township 8 S, Range 21 W, Section 2
PATENT NUMBER:	State Patent 5971
PATENT DATE:	02/04/1972
PATENTEE:	and Drainage Dist. Wellton-Mohawk Irr.

LOCATION:	Township 11 S, Range 24 W, Section 14
PATENT NUMBER:	State Patent, 5824
PATENT DATE:	/ /
PATENTEE:	Robert M. Taubman

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APPENDIX E -- VITA OF DOUGLAS R. LITTLEFIELD

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EDUCATION:

Ph.D. American history. University of California, Los Angeles, 1987. Dissertation: "Interstate Water Conflicts, Compromises, and Compacts: The Rio Grande."

M.A. American history. University of Maryland, College Park, 1979. Master's thesis: "A History of the Potomac Company and Its Colonial Predecessors."

B.A. English literature. Brown University, 1972.

CONSULTING AND EXPERT WITNESS EXPERIENCE:

1995 - Present: Research historian and consultant for the Salt River Project (Arizona). Providing historical documentation and report on the commercial navigability of the Salt, Gila, and Verde rivers in 1912 for use in relation to hearings in front of the Arizona Navigable Stream Adjudication Commission.

1995 - Present: Research historian and consultant for Nebraska Department of Water Resources. Providing historical documentation and report on the history of Nebraska v. Wyoming, 325 U.S. 589 (1945), for use in present litigation between Nebraska and Wyoming over the apportionment of the waters of the North Platte River.

1993 - 1994: Research historian and consultant for Simms and Stein, attorneys specializing in water law in Santa Fe, New Mexico. Providing historical documentation and affidavit testimony for use in In re: the General Adjudication of All Rights to Use Water in the Big Horn River System and All Other Sources, State of Wyoming (presently on appeal to the Wyoming Supreme Court as Nos. 94-58 to 94-63).

1991 - Present: Research historian and consultant for Legal Counsel, Division of Water Resources, Kansas State Board of Agriculture. Providing historical documentation and report on water rights and history of apportionment of Republican River among Kansas, Nebraska, and Colorado.

1991 - 1993: Research historian and consultant for Carlsmith, Ball, Wichman, Murray, Case, Mukai & Ichiki, in Long Beach, California. Provided historical documentation and report for use in Nickel Enterprises v. State of California, Kern County Superior Court, Case No. 199557, regarding past uses of Kern River. Testified as an expert witness historian in this case for eleven days.

1989 - 1990: Research historian for Pacific Enterprises, Los Angeles, California. Directed historical research for and coauthored a corporate history of this southern California holding company entitled The Spirit of Enterprise: A History of Pacific Enterprises, 1867-1989 (1990).

1988 - 1989: Research historian and consultant for Water Defense Association, Roswell, New Mexico. Provided historical documentation on the history of water rights claims along the Bonito, Hondo, and Ruidoso rivers in southeastern New Mexico for use in State v. Lewis, Chaves County Cause Nos. 20294 & 22600, Consolidated.

1986 - 1990: Research historian and consultant for Legal Counsel, Division of Water Resources, Kansas State Board of Agriculture. Provided historical documentation and report on water rights and interstate apportionment of the Arkansas River between Kansas and Colorado for use in U.S. Supreme Court case, Kansas v. Colorado, October Term 1985, Original No. 105. Testified as an expert witness historian for twelve days.

1986 - 1989: Research historian and consultant for Legal Counsel, State Engineer Office, State of New Mexico. Provided historical documentation and report on water rights in the Carlsbad Irrigation District in southeastern New Mexico for use in State v. Lewis, Chaves County Cause Nos. 20294 & 22600, Consolidated.

1986 - 1987: Historical consultant for National Geographic Magazine. Advised editors on June 1987 article, "George Washington's Patowmack Canal."

1984 - 1986: Research historian and consultant for Legal Counsel, State Engineer Office, State of New Mexico. Provided historical documentation and report on the history of Rio Grande water rights and interstate apportionment disputes between New Mexico and Texas for use in El Paso v. Reynolds, U.S.D.C. Civ. No. 80-730-HB.

OTHER PROFESSIONAL EXPERIENCE:

January 1992 - 1994: Member of Board of Editors of Western Historical Quarterly.

1991 - 1995: Part-time lecturer, Department of History, California State University, Hayward. Taught survey courses on American history and California history.

1980 - 1984: Editorial Assistant, Pacific Historical Review. Edited scholarly articles and book reviews.

PUBLICATIONS:

Books:

The Spirit of Enterprise: A History of Pacific Enterprises, 1867-1989 (coauthor, 1990).

Articles:

"The Forensic Historian: Clio in Court," Western Historical Quarterly (1994).

"The Rio Grande Compact of 1929: A Truce in an Interstate River Apportionment War," Pacific Historical Review (1991).

"Eighteenth Century Plans to Clear the Potomac River: Technology, Expertise, and Labor in a Developing Nation," Virginia Magazine of History and Biography (1985).

"The Potomac Company: A Misadventure in Financing an Early American Internal Improvement Project," Business History Review (1984).

"Water Rights During the California Gold Rush: Conflicts over Economic Points of View," Western Historical Quarterly (1983).

"Maryland Sectionalism and the Development of the Potomac Route to the West, 1768-1826," Maryland Historian (1983).

Book Reviews:

David C. Frederick, Rugged Justice: The Ninth Circuit Court of Appeals and the American West, 1891-1941 (Berkeley: University of California Press, 1994), in Pacific Historical Review (forthcoming).

Daniel Tyler, The Last Water Hole in the West: The Colorado - Big Thompson Project and the Northern Colorado Water Conservancy District (Niwot, Colorado: University Press of Colorado, 1992), in Montana: The Magazine of Western History (1994).

Lloyd Burton, American Indian Water Rights and the Limits of Law (Lawrence: University Press of Kansas, 1991), in Journal of the West (1994).

Zachary A. Smith, ed., Water and the Future of the Southwest (Albuquerque: University of New Mexico Press, 1989), in Western Historical Quarterly (1991).

F. Lee Brown and Helen Ingram, Water and Poverty in the Southwest (Tucson: University of Arizona Press, 1987), in The Public Historian (1990).

David J. Eaton and Michael Andersen, The State of the Rio Grande/Rio Bravo: A Study of Water Resource Issues Along the Texas/Mexico Border (Tucson: University of Arizona Press, 1987), in New Mexico Historical Review (1988).

Pat Kelley, River of Lost Dreams: Navigation on the Rio Grande (Lincoln: University of Nebraska Press, 1986), in Pacific Historical Review (1988).

Marc Reisner, Cadillac Desert: The American West and Its Disappearing Water (New York: Viking Penguin, Inc., 1986), in Environmental Review (1987).

Thomas F. Hahn, The Chesapeake and Ohio Canal: Pathway to the Nation's Capitol (Metuchen, N.J.: Scarecrow Press, Inc., 1984), in Business History Review (1987).

PROFESSIONAL AFFILIATIONS:

American Association for State and Local History, American Historical Association, California Committee for the Promotion of History, California Historical Society, California Map Society, National Council on Public History, Ninth Judicial Circuit Court Historical Society, Organization of American Historians, Western History Association, Western Council on Legal History.

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EDUCATION:

M.A. American History. University of California, Santa Barbara, 1995.

B.A. History and Political Science, University of California, Santa Barbara, with Honors, 1993.

AREAS OF CONCENTRATION IN GRADUATE STUDY:

American Environmental Policy, River Management, 20th Century America, Western Settlement, Agricultural Policy, Legal History from 1900-1940.

HISTORICAL CONSULTING EXPERIENCE:

1995-Present: Assistant research historian and consultant for the Salt River Project (Arizona). Determining the commercial navigability of the Salt River, Gila River, and Verde River at the time of statehood (1912) through historical documentation for use in hearings before the Arizona Navigable Stream Adjudication Commission.

1995-Present: Assistant research historian and consultant for Nebraska Department of Water Resources. Providing research on the history of _Nebraska v. Wyoming_, 325 U.S. 589 (1945), for use in present litigation between Nebraska and Wyoming over the apportionment of North Platte River waters.

TEACHING EXPERIENCE:

1994-1995: Teaching Assistant. Department of History, University of California, Santa Barbara. United States History, settlement-present. Incorporation of environmental history into mainstream history taught by professors.

OTHER RELATED WORK EXPERIENCE:

1995: Water Policy Researcher/Analyst. Environmental Policy Center, San Francisco. Responsible for researching local government policies dealing with water efficiency and water quality. Updated information on Center's Web site, followed trends in policy making and assisted local government clients in implementing policies suitable for their particular locality.

1992: Campaign Aide. Santa Barbara District Supervisor Bill Wallace. Responsible for schedulings, mailings, and public relations work with University students in successful 1992 campaign.

1990-1991: Reporter. UC Santa Barbara's Daily Nexus. Reported on the community's environmental issues. Specifically followed stories associated with Chevron's use of the Santa Barbara Channel.

1991: Political Journalist Intern. Cable News Network (CNN), Washington, D.C. Produced a weekly newsletter summarizing national news for producers. Responsible for following specific national campaigns and compiling updates.

CONFERENCES ATTENDED:

American Environmental Historians, "Gambling With Our Environment." March, 1995. Las Vegas.

SCHOLARLY WORKS:

In Name But Not in Practice: The Role of the Agrarian Myth in Western Water Development and State Building. Partial fulfillment for M.A. Degree.

Dam the Progressives: Multi-Purpose River Development, 1900-1914. Partial fulfillment for M.A. Degree.

BOOK REVIEWS:

William D. Rowley, Reclaiming the Arid West, The Career of Francis G. Newlands (Bloomington and Indianapolis: Indiana University Press, 1996), in Journal for the History of Technology (forthcoming).

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Statement
of
Clyde L. Gould
on behalf of
Wellton-Mohawk Irrigation and Drainage District
before
Arizona Stream Adjudication Commission
Lower Gila River
Yuma, Arizona
May 14th, 10:00 a.m.

96 - 003 - 020
Gila River

Members of the Commission, my name is Clyde L. Gould, General Manager of the Wellton-Mohawk Irrigation and Drainage District. I thank you for the opportunity to comment on the question of navigability of the lower Gila River at the time of statehood for Arizona, February 12, 1912. My comments will be brief and will be focused towards a questionable, sustainable, commercial utilization of the lower Gila as a navigable water channel.

Since most of the citizens addressing this question did not live during that era, we must relay heavily on historical records and narratives of our predecessors. I will refer to two documents.

Document I

Author Edwin Corle compiled a history of the Gila River in 1951 which was entitled ***The Gila – River of the Southwest***. This book is a very interesting documentation of the early days on the Gila River from the 1500's to statehood in 1912 and briefly into the 1940's. Of particular interest is the ***Forward*** for the book and a brief narrative of Lt. Colonel P. St. George Cooke's experience as commander of the Mormon Battalion of the United States Army in the year 1846. This group originated at Council Bluffs, Iowa and were to travel by wagon train via Santa Fe to California.

The ***Forward*** defines the needs of a functional river submitted by Captain Richard Bissell, an Ohio River pilot, and then follows a statement of the condition of the Gila River, significantly devoid of those characteristics (copy attached).

The experience of Lt. Colonel Cooke and his men attempting to use the Gila River to transport some of the battalion's supplies down river provides a rather graphic record of the problems of trying to navigate the Gila in the year 1846 (copy attached).

Document II

The second record that should be examined comes from research and documentation done by U.S. Bureau of Reclamation staff during the feasibility study for detailing the construction of the Wellton-Mohawk Irrigation and Drainage District. The report was dated November 1950 and was titled ***Definite Plan Report, Volume I & II.***

The particular point of interest is the record of Gila River flows at the Dome gauging station near the Dome narrows; today the historic McPhaul bridge area. These records cover the period from 1903 through 1949. Of note are the unique characteristics of the Gila River flows. They tend to be very extreme and erratic. During this 46 year period, the record does not show any year with continuous year around flow. There are extensive time periods with no flow. Then there are extremes on the other side wherein flows attained destructive rates such as in 1916 with a peak of 230,000 cfs followed by severe flood damage. In 1912, the year of statehood, the Gila was dry for six months but did have a 2,000 cfs flow in March as spring runoff.

A tabulation of month by month water records is attached for review as well as a series of bar graphs depicting graphically the very unstable nature of the lower Gila. While there are extended periods of river flow, the shallow soft bottom channel would not permit trouble-free utilization of the river for commercial navigation only as a transitory activity.

In conclusion, with only this very brief review of the behavior of the Gila River in the early days, one rapidly forms an opinion that only a creative definition of the concept of navigability would permit such an assignment to the lower Gila River.

THE GILA

River of the Southwest

BY EDWIN CORLE

***Illustrated by* ROSS SANTEE**

$2.25

CORLE THE GILA

Library of Congress catalog card number 51-6152
Manufactured in the United States of America

First Bison Book printing: October 1964

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Foreword

"The important thing about a river," wrote Captain Richard Bissell, an Ohio River pilot, "is that it is made of water, has fish in it, and steamboats, rowboats, or floating logs on its surface."

The Gila has been a changeable river throughout its lifetime of many millions of years, of which only the past twenty-five thousand years can be called history visible to man. It has never known a steamboat, very few rowboats, some floating logs, and only a fair assortment of fish. At one time it resembled the modern Everglades and at another time the Mississippi. In 1950 fully half its length, the lower river, was as dry as dust. Where it "flows" into the Colorado there hasn't been a drop of water come downstream in over four years. From its ice caves and raging mountain torrents, through its tortuous canyons and dam-impounded waters, across its broad desert valley to its parched, sandy and sunbaked confluence with the Colorado, this six-hundred-mile river of unpredictable liquid content has a history as long, as dramatic, and as significant as any in America.

The Colorado, entirely west of the Great Divide, might be called the river of the West; and the Rio Grande, entirely east of the divide, might be designated the international river. But the Gila is literally the river of the American Southwest. There is no other stream that even resembles it.

E. C.

General Kearny. They turned the animals over to Colonel Cooke, and again he recorded his admiration of the Gila Valley inhabitants:

> They live in cordial amity . . . and their religion consists in a simple belief in a great ever-ruling spirit. This seems to have proved a foundation for a most enviable practical morality. . . . Their dwellings are domed shape wicker work, thatched with straw or cornstalks, and from twenty to fifty feet in diameter; in front is usually a large arbor, on which is piled the cotton in the pod for drying; horses, mules, oxen, chickens, and dogs seem to be the only domestic animals; they have axes, hoes, shovels, and harrows. The soil is so easily pulverized as to make the plow unnecessary. . . .
>
> They have the simplicity of nature, and none of the affected reserve and dignity characteristic of other Indians, before whites. At the sound of a trumpet, playing of a violin, the killing of a beef, they rush to see and hear, with delight or astonishment strongly exhibited.

With all this happiness of environment, Colonel Cooke made his first mistake of the trip. He took a look at the Gila River, which was at this point, and would be today if there were any water in it, about four or five feet deep and 150 yards wide.

He decided to construct a boat, to be made of two wagon beds lashed together, and ballasted by two long cottonwood logs.

Lieutenant George Stoneman, whose self-shot thumb had now healed, was put in command of this first ship to attempt to run the Gila. The clumsy craft was overloaded. Colonel Cooke's thought was to lighten the burden of the wagon train, and to utilize water power by letting the Gila pull his boat downstream as if it were a raft. That plan might have worked on eastern rivers, but not on the unpredictable Gila.

Lieutenant Stoneman became the first skipper on the Gila River—and he regretted it. The improvised boat carried mostly meat and flour. At times the craft caught on sand bars and spun crazily. Once it was half submerged and Stoneman and his crew of three had to hustle the cargo ashore. Then the boat was freed of the sand bar and they had to moor it and reload. Irksome was the word for it. For in less than a mile it snagged on another sand bar and the same tedious process had to be repeated. As this kind of thing became the routine of the day, Stoneman decided he'd never get to the mouth of the Gila. So he lightened his ship by making a cache of half the cargo and eventually guided, pushed, and poled her to the lower end of the Gila, and beached her just in time to prevent her from being sucked into the more mighty Colorado. Here he met his commanding officer. Boating on the Gila, he reported to Colonel Cooke, was definitely not to be recommended to Washington. Cooke, being a man of adaptability, dropped the subject. And, without making an issue of it, he sent four men and four mules back upstream to salvage the cached meat and flour.

The battalion didn't find the Yuma Indians quite so co-operative as the Pimas and the Maricopas, but at least there was no hostility. It took three days to get the expedition across the Colorado to the California side. But by swimming the animals and fording the wagons it was finally accomplished at the site of the present city of Yuma, a point virtually the same as when Kearny had crossed. And the cumbersome first ship to navigate the Gila saw useful service at last as a ferryboat.

West of the Gila, across the dreaded Colorado Desert of California, the battalion met its greatest hardships. Mules and horses collapsed and some of the weaker members could not keep up with the advance guard. The party became strung out, and for a while it appeared that lack of water would take a heavy toll. But those in the lead, finding a spring in the mountains, sent back water to the stragglers, and at last the Mormon Battalion reached the security of Warner's Ranch and from there on their troubles were over.

And so was the war in California. Shortly before the battalion arrived in San Diego, Stockton and Frémont, plus what was left of Kearny's Army of the West, managed to crush the last vestige of native strength at Los Angeles. As a military force the battalion was no longer necessary, but it could indeed function as a colonizing force. In July of 1847, one year after its organization in Iowa, the battalion was marched to Los Angeles and its members honorably discharged.

The importance of the Mormon Battalion in southwestern history was institutional rather than active. It brought the Mormon culture through the Gila Valley to California, it proved that wheels could move west; and it instilled the idea in some men's minds that where wagon wheels could go so might, some future day, a railroad. It demonstrated that the Gila River was not practical for navigation, and it added considerably to the knowledge of remote Arizona. Because of the success of the expedition other wagons prepared to move west. Americans were on the march.

14

THE OATMAN CASE

It was Hilaire Belloc who wrote, "R
odrama," and the story of the Oatman case
tragedy with a happy ending for only two
occurred on the banks of the Gila Rive
until 1857 that it received national pu
tional news value, and made its printed
its day. *The Captivity of the Oatman*
Royal B. Stratton sold thirty thousand cop
remarkable sale for nonfiction in 1857. T
road west by the Mormon Battalion, ba
rance of Indians on the part of the fath
Oatman, and the murderous lust and i
Apaches—all were the causes of this stor

With the end of the Mexican Wa
covery of gold in California that same y
immigration of Americans moving west. T
Hidalgo, formally terminating the Mexica
States all of California, New Mexicc
Arizona north of the Gila River. In oth
its mouth to the western boundary of p
formed the international line. For the U
was an unsatisfactory choice; but Washi
stand the topography of Arizona sufficie
need of grabbing more of it. North of

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DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary

BUREAU OF RECLAMATION
Michael W. Straus, Commissioner
E. A. Moritz, Regional Director, Region 3

DEFINITE PLAN REPORT
VOLUME I
WELLTON-MOHAWK DIVISION
GILA PROJECT, ARIZONA

Boulder City, Nevada
November 1950

of the salts involved. In some of the valley areas the ground water is so saline that it is unfit for livestock consumption. The fluorine content of the water from some of the wells is sufficiently high that the water is not potable. On the other hand, water from a number of the wells located on the mesa near the town of Wellton is being used for domestic purposes, although it is not entirely satisfactory.

When canal water is available, and as municipal and industrial requirements for water expand, it is anticipated that railroad companies, municipalities, and other users of large quantities of potable water will arrange for canal water that can be made available under contract from the project system.

Flood Control

According to the "Interim Report on Survey, Flood Control, Gila River and Tributaries Below Gillespie Dam, Arizona" of September 1, 1948, by the Corps of Engineers, Department of the Army, historical accounts indicate that general floods occurred on the Gila River in 1833, 1862, 1869, 1880, 1884, 1886, 1889, 1890, 1891, 1893, 1895, and 1903. Records since 1904 show that floods and storms occurred in March 1905, November 1905, December 1906, December 1914, January 1915, January 1916, October 1916, November 1919, February 1920, December 1923, September 1926, February 1927, February 1937, March 1938, March 1941, and September 1946. The flood of 1884 was the earliest for which a reasonable estimate of severity can be made. It and the flood of 1891 possibly were somewhat comparable to the greatest flood of record, which was the first flood of January 1916 when a flow of 230,000 cfs was estimated to have occurred at the mouth of the Gila River. Construction of storage reservoirs and other irrigation works along the Salt and Gila Rivers upstream from Phoenix changed considerably the flood flow characteristics of the lower river.

The Corps of Engineers in the above-mentioned report has adopted a standard flood under present conditions that would produce a flow at the Painted Rock Damsite of 320,000 second-feet and 265,000 second-feet at the mouth of the Gila River. The flow through the project under present conditions would be somewhere between these two figures. However, with construction of Painted Rock Dam, which has been authorized by Congress, the Corps of Engineers expects the standard project flood to be reduced to a maximum discharge at the dam of 22,500 second-feet. This discharge would be reduced through percolation in the stream channel to 16,000 second-feet at the mouth of the Gila River. A second storm, assumed by the Corps of Engineers to occur during the time that maximum controlled release was being made at Painted Rock Dam, would result in a peak flow from the area below the damsite of 10,000 second-feet. The total flow at the river mouth would then be 26,000 second-feet.

The construction of Painted Rock Dam would control floods produced by storms centering in the Gila River Basin above the damsite. There is, however, a large drainage area below the Painted Rock Damsite

GILA PROJECT
WELLTON MOHAWK DIVISION

GILA RIVER DISCHARGE AT DOME, ARIZONA

RUN-OFF IN ACRE FEET

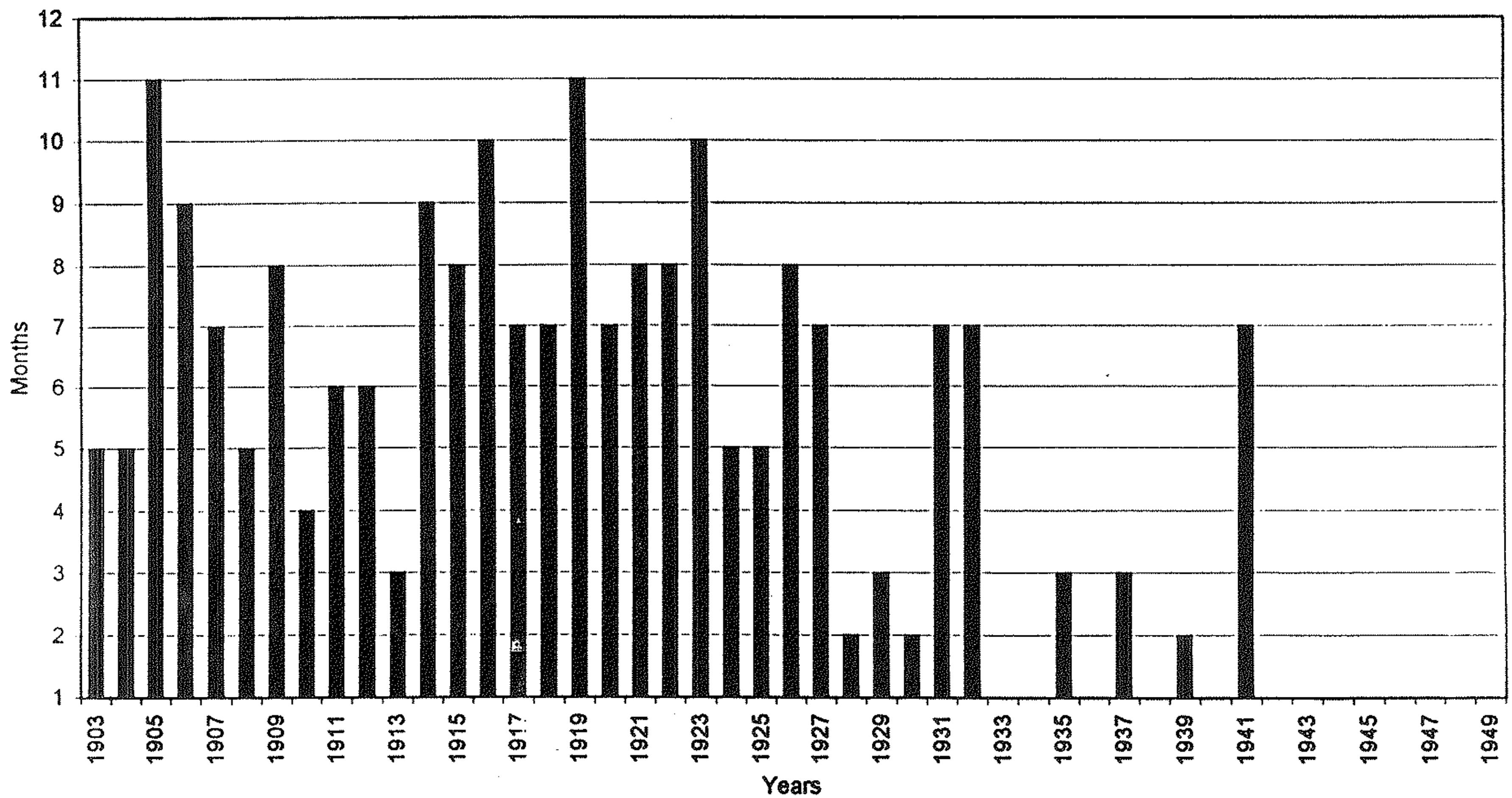
YEAR	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1903	0	0	0	30,230	793	0	0	9,020	7,290	13,650	0	0	60,983
1904	0	0	0	0	0	0	5,790	139,600	41,830	29,160	6,490	0	222,870
1905	189,200	680,500	1,020,000	768,200	299,700	43,120	4,340	0	2,960	10,990	271,100	375,100	3,665,210
1906	136,600	168,000	576,000	422,400	122,200	4,600	0	25,110	4,300	0	0	332,400	1,791,610
1907	141,700	57,920	260,600	0	0	0	0	397	100,600	58,910	13,690	0	633,817
1908	0	405,600	162,600	0	0	0	0	94,710	44,180	0	0	404,000	1,112,090
1909	71,940	175,300	147,400	96,000	14,180	0	21,020	54,550	81,020	0	0	0	661,410
1910	213,000	9,220	248	1,540	0	0	0	0	0	0	0	0	224,008
1911	61,490	40,000	83,900	0	0	0	34,710	0	0	30,050	17,260	0	267,410
1912	0	0	123,000	70,020	595	0	12,500	25,390	0	1,390	0	0	232,895
1913	0	595	57,520	15,670	0	0	0	0	0	0	0	0	73,785
1914	1,190	118,800	17,650	0	0	0	1,980	29,160	11,010	10,350	10,510	357,500	558,150
1915	139,600	694,200	314,600	389,600	367,000	16,920	2,380	21,840	0	0	0	0	1,945,140
1916	2,093,000	861,600	746,800	559,300	26,950	2,530	0	0	70,910	222,300	53,750	27,470	4,664,610
1917	163,800	83,310	132,900	448,300	243,700	466	0	82,310	0	0	0	0	1,154,786
1918	1,590	12,400	243,400	17,180	79	0	0	52,240	0	0	0	2,810	329,699
1919	11,880	24,400	18,910	60,100	3,150	0	42,640	54,290	8,780	21,160	188,000	306,600	739,910
1920	40,070	424,500	190,500	108,200	14,680	0	0	0	0	0	9,450	13,620	801,020
1921	22,970	8,390	1,000	0	0	0	0	341,200	41,100	15,240	5,700	42,940	478,540
1922	331,300	82,410	164,300	34,210	2,780	0	0	0	6,970	95	0	52,070	674,135
1923	16,520	5,530	92,210	1,970	0	0	992	102,300	57,360	2,660	83,240	223,900	586,682
1924	317,200	22,340	4,670	30,480	1,970	0	0	0	0	0	0	0	376,660
1925	0	0	0	0	0	179	0	0	64,740	10,710	420	1,820	77,869
1926	930	206	0	228,300	21,170	0	0	0	6,550	84,790	0	45,140	387,086
1927	36,600	415,500	116,600	8,500	0	0	0	2,030	54,820	1,390	0	0	635,440
1928	0	22,630	278	0	0	0	0	0	0	0	0	0	22,908
1929	0	0	0	0	0	0	0	4	2,980	1,890	0	0	4,874
1930	0	0	1,870	0	0	0	0	11,760	0	0	0	0	13,630
1931	0	78,030	2,110	0	0	0	0	14,520	8,090	4	1,370	6,590	110,714
1932	1,400	168,500	82,190	5,990	204	34	0	0	0	1,150	0	0	25[illegible]58
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	167	0	0	2	0	169
1935	0	3,350	1,800	0	0	0	0	0	758	0	0	0	5,908
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	71,170	75,800	6,740	0	0	0	0	0	0	0	0	153,710
1938	0	0	45,900	0	0	0	0	0	0	0	0	0	45,900
1939	0	0	0	0	0	0	0	0	3,540	0	0	0	3,540
1940	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	676	0	192,100	181,100	211,200	4,430	87	75	0	0	0	0	589,668
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	420	0	0	0	0	420
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0

DATE 5-18-50
DWG. No. 50-308-2516

Gila River Discharge at Dome, AZ

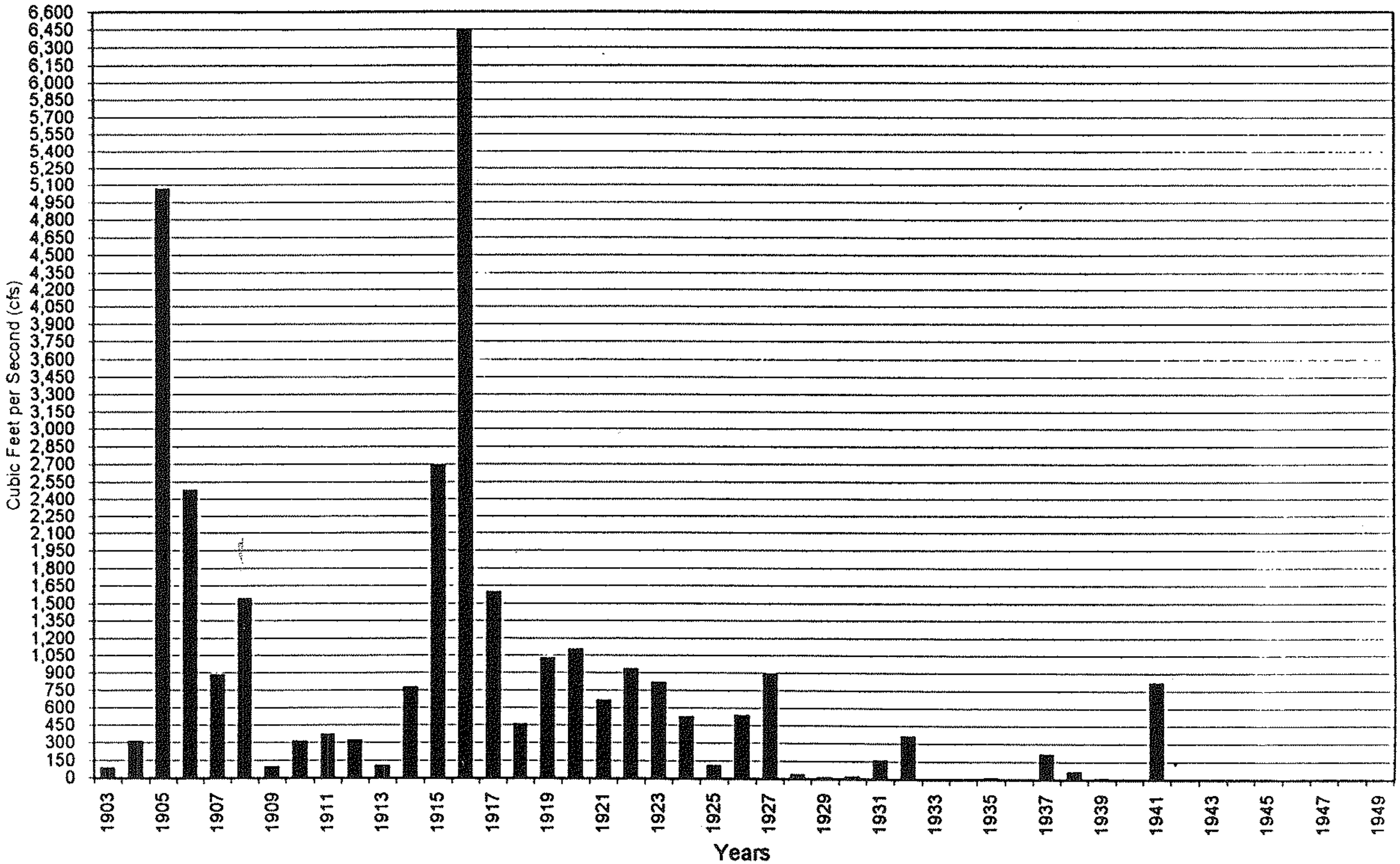
1903 - 1949

Months with flow

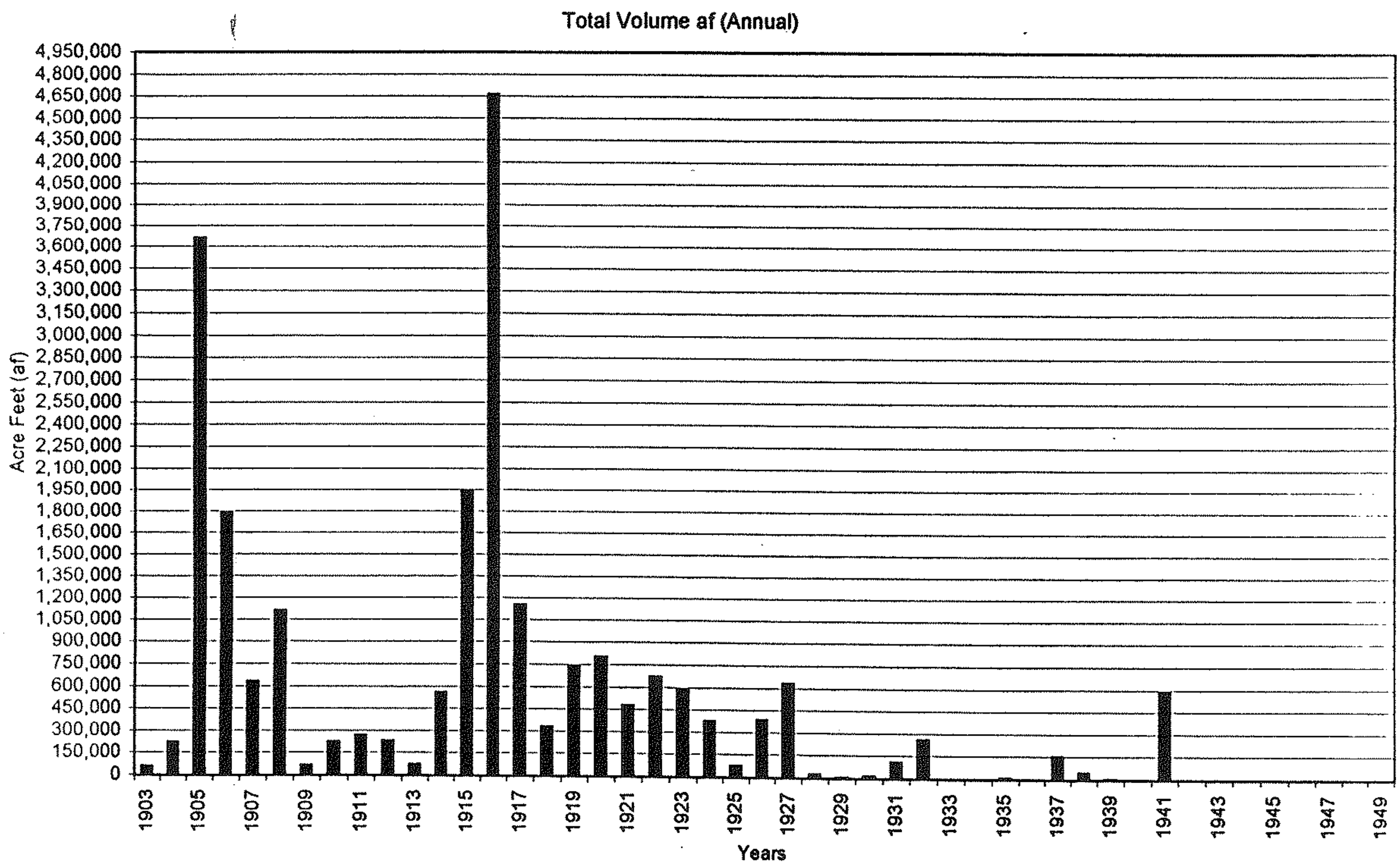


Gila River Discharge at Dome, AZ
1903 - 1949

Average Flow cfs (Annual)

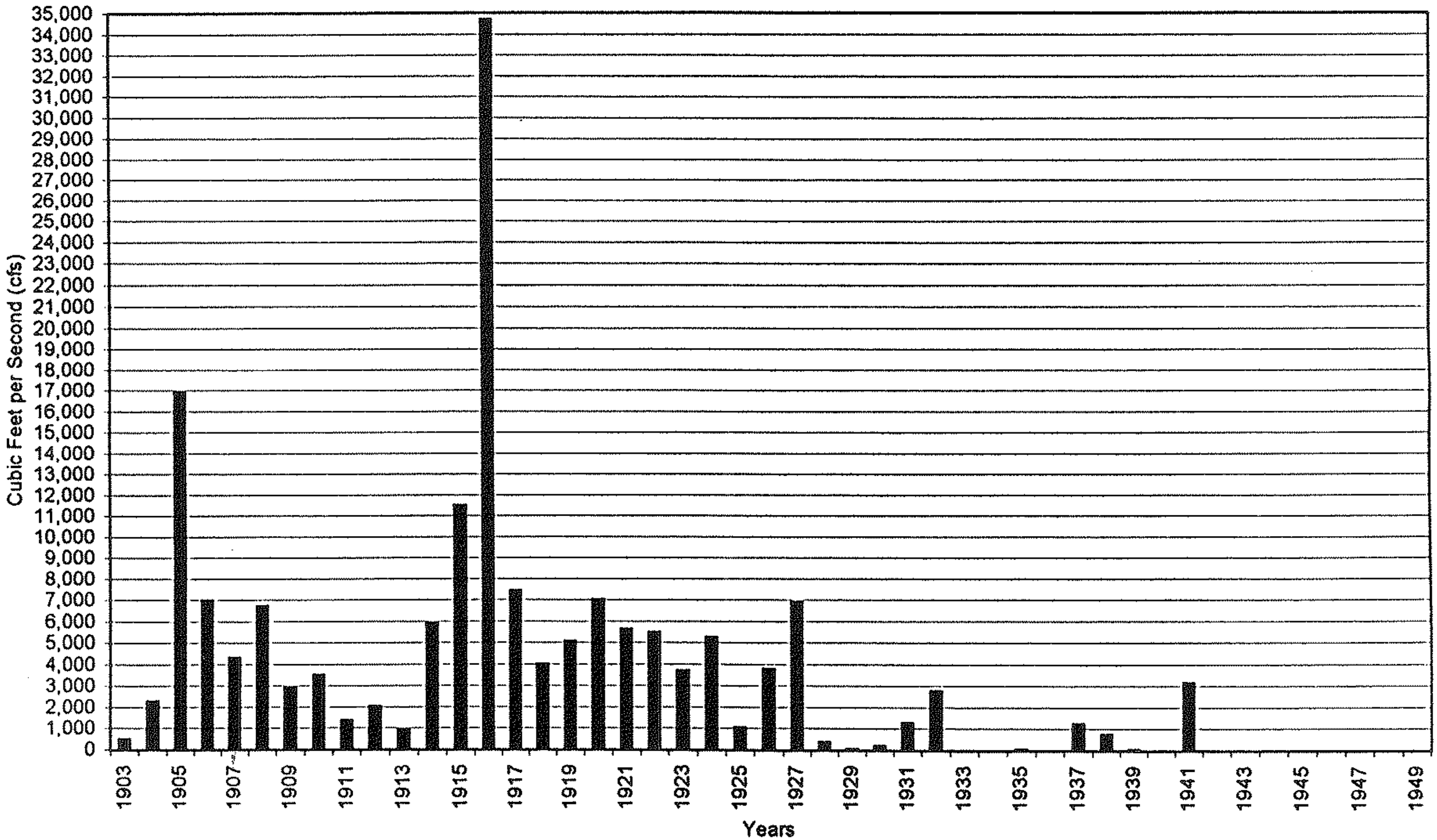


Gila River Discharge at Dome, AZ
1903 - 1949



Gila River Discharge at Dome, AZ
1903 - 1949

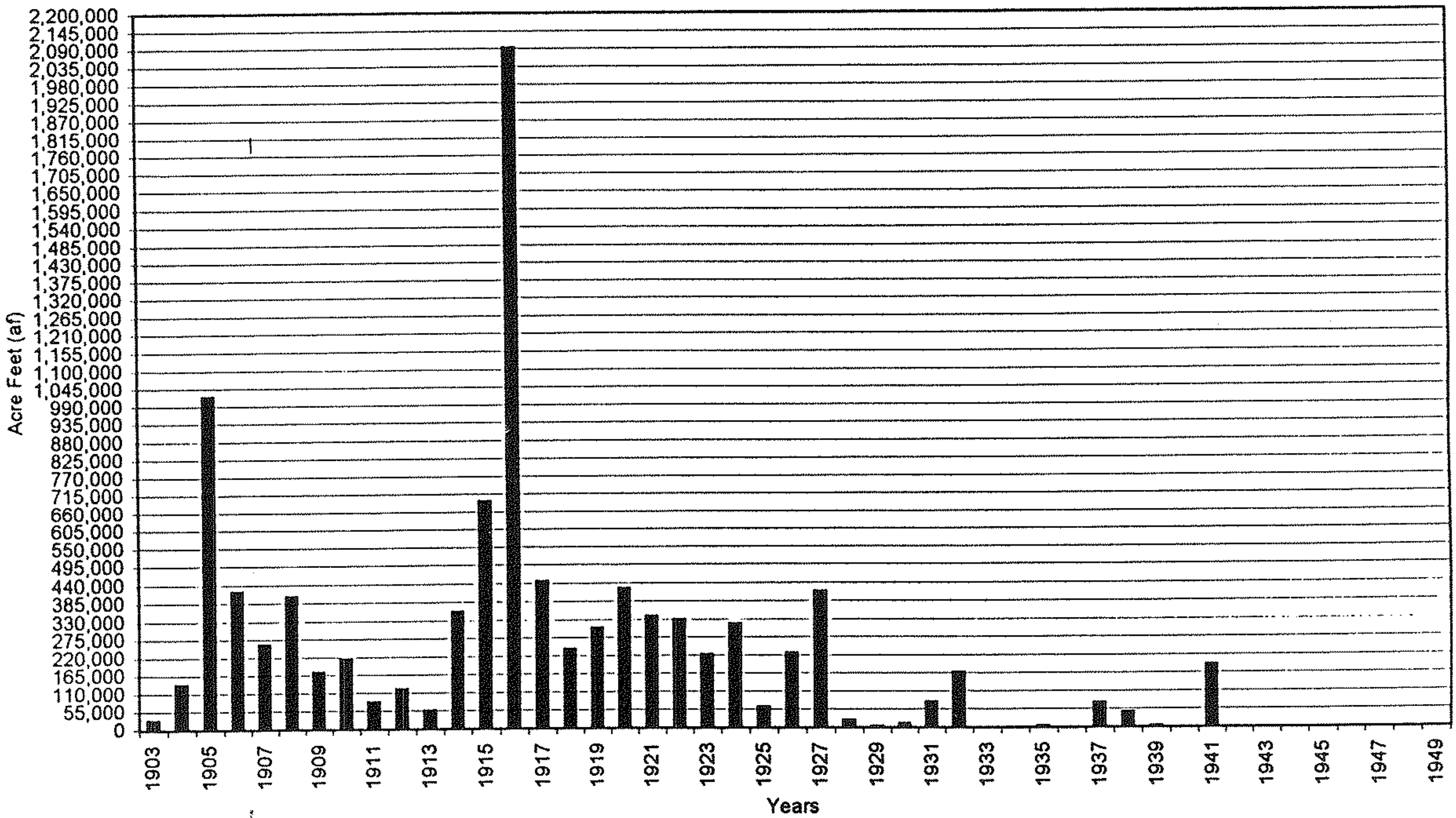
Average Flow cfs (during peak month)



Gila River Discharge at Dome, AZ

1903 - 1949

Volume af (during peak month)



21

ORIGINAL

RECEIVED 9-19-97

LAW OFFICES

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WRITER'S DIRECT LINE
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OUR CLIENT NUMBER
3864-2

September 19, 1997

VIA HAND-DELIVERY

Christina Waddell, Executive Director
State of Arizona Navigable Stream
Adjudication Commission
1700 W. Washington, Room 404
Phoenix, AZ 85007

Re: **Historic Evidence Regarding Statewide Water Course Non-Navigability**

Dear Christina:

On behalf of our clients, various insureds of Chicago Title Insurance Company, we are submitting the following evidence for use and consideration by the Arizona Navigable Stream Adjudication Commission ("ANSAC") in connection with its determinations/recommendations with respect to navigability on the various watercourses which the Commission is addressing pursuant to its authority under A.R.S. § 38-431.01, et. seq.:

1. Seven (7) copies of the relevant portions of a document entitled "Map of the Navigable Waterways of the United States." This map, dated December 14, 1914, was prepared by the Chief of Engineers, USA. We have enclosed copies of both the legend to the map and that portion relating to the State of Arizona. As is readily apparent from examination of the legend and the portion with regard to the State of Arizona, by failing to identify any watercourse in the Arizona with any of the colors indicated in the legend, the Chief of Engineers has indicated his determination that none of Arizona's

waterways were deemed to be "navigable" in accordance with the definition utilized by the Chief of Engineers for purposes of preparing the map.

2. Seven (7) copies of a map entitled "Official Map of the Territory of Arizona" compiled by Richard Gird, C.E. Commissioner, dated October 23, 1864. This map is of significance in that it depicts the alignment of various watercourses at or about the date on which the Territory of Arizona was created. In addition, the members of ANSAC should note that the map contains a specific reference to the "present head of navigation" and "supposed head of navigation" at two locations on the Colorado River in the northwest corner of the then-Territory. Those two notations with regard to navigability are in stark contrast to the absence of any other indications of navigability with respect to the balance of the waterways in the Territory.[1]

We appreciate your assistance in making copies of both of these maps available to the members of ANSAC.

Very truly yours,

MARISCAL, WEEKS, McINTYRE
& FRIEDLANDER, P.A.

By
James T. Braselton

JTB/tg
Enclosures
cc: Richard Marsh (w/out enc.)
Burt Levinson (w/out enc.)
F:\USERS\JTB\-L3864.WAD

[1] For ease of reference, we have highlighted the two notations with regard to navigation in yellow.

ORIGINAL

MAP
OF THE
NAVIGABLE WATERWAYS
OF THE
UNITED STATES

SHOWING IN COLORS THE DEPTHS OF PROJECTS ADOPTED BY CONGRESS

Prepared under the direction
of the
CHIEF OF ENGINEERS, U.S.A.
December 1914

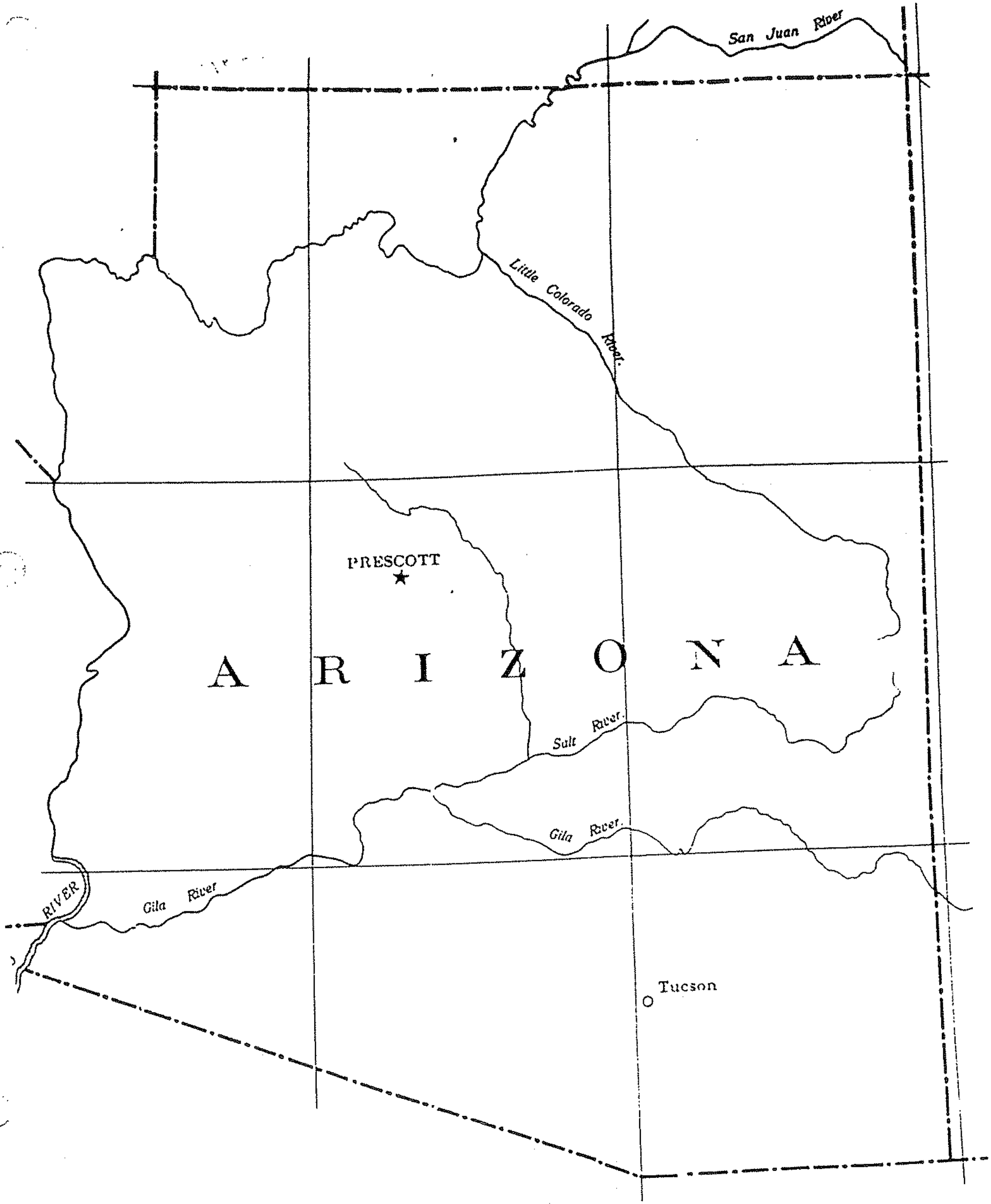
Scale 50 Miles to 1 Inch

50 0 50 100

LEGEND

less than 6 feet deep
6 feet to 12 " "
12 " " 18 " "
18 " " 30 " "
30 " deep and over
Dams completed
" under construction
" projected

ORIGINAL


San Juan River
Little Colorado River.
PRESCOTT
ARIZONA
Salt River.
Gila River.
RIVER
Gila River
Tucson

Stantec Consulting Inc.
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Stantec

11 February 1999

File: 28900081

Drainage and Engineering Section
Arizona State Land Department
1616 West Adams
Phoenix, Arizona 85007

Attention: V. Ottozawa Chatupron, PhD, PE

Dear Ott:

Reference: GILA BACKWATER ANALYSIS
COLORADO RIVER BOUNDARY STUDY
PROJECT NO. A8-0052

Attached is the Technical Memorandum describing the hydrologic and hydraulic analyses performed by Stantec to identify the limits of inundation at the Gila River confluence associated with ordinary high and ordinary low flows of the Colorado River. The Colorado River backwater analysis addresses, in part, the current activities of the Arizona Navigable Stream Adjudication Commission (ANSAC) relating to the determination of navigability for title purposes for the Gila River.

In that regard, ANSAC is preparing to make a final recommendation to the Arizona Legislature as to whether or not the Gila River historically exhibited characteristics of navigability as described in ARS §37-1128. Regardless of the finding, the report forwarded by ANSAC to the Legislature requires a definitive description of the downstream limit of the Gila River. Per our discussion, the limit of backwater upstream of the confluence in the Gila River associated with ordinary high flows of the Colorado River defines the downstream limit of the Gila River. Based on the best available information used in the technical analyses, the limit of the ordinary high watermark for the Colorado River extends approximately 2.5 miles upstream on the Gila River. Therefore, we recommend that the ANSAC's report to the Legislature reference that location as the downstream limit of the finding for the Gila River.

Please advise me if you have questions or need further information.

Reference:

Sincerely,

STANTEC CONSULTING INC.

Patricia Q Deschamps

Patricia Q. Deschamps, PE, RLS
Project Manager
stantec@uswest.net

c. Curtis Jennings, Jennings & Haug
George Menhert, ANSAC Executive Director

document1

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11 February 1999

File: 28900081

To: V. Ottozawa Chatupron, Drainage & Engineering Section Manager
Marlene Shields, Colorado River Boundary Project Manager
Sue Hubbel, Streambed Ownership Program Manager
Arizona State Land Department

Subject: Technical Memorandum
Gila River Backwater Analysis
COLORADO RIVER BOUNDARY PROJECT
Project No. A8-0052

INTRODUCTION

Task 2.5 of the referenced project addresses the backwater analysis of specified Colorado River flows at the confluence with the Gila River. This work task includes the identification of the limits of inundation at the Gila River confluence associated with ordinary high and ordinary low flows of the Colorado River. The work products are a map delineating those inundation limits (Plate 1) and the supporting technical data used in the determination. This technical memorandum describes the hydrologic data, hydraulic analyses, methodology, interpretation of results, and conclusions.

The purpose for undertaking the Colorado River backwater analysis is two-fold. The limit of the backwater is instructive in terms of activities of the Arizona Navigable Stream Adjudication Commission (ANSAC) relating to the determination of navigability for title purposes for the Gila River. This document describes the analyses performed to address the initial question of determination of the downstream limit of the jurisdictional authority of ANSAC relative to the navigability adjudication process.

The backwater delineation also has implications to the question of sovereign ownership of lands beneath navigable waters by the State of Arizona in the arena of Colorado River boundary dispute resolution. That issue falls outside the ANSAC's legislatively mandated function. The implications of the Colorado River backwater analysis at the confluence relative to inundated lands downstream of ANSAC's jurisdictional limit on the Gila River involve very complex legal, survey/ boundary, technical, and historical investigations. That work is ongoing, as part of the referenced project, and the confluence backwater issue requires further assessment in each of the aforementioned disciplines before those findings are presented to the ASLD.

HYDROLOGY

Data Sources

The discharge data used to calculate the water surface elevation at the confluence of the Colorado River with the Gila River were obtained from two different sources. Those sources were discharges evaluated from statistical analyses of US Geological Survey (USGS) streamgage data, and discharge data evaluated on the basis of water delivery schedules and hydraulic geometry as used in the HEC-RAS computer model of the Colorado River provided by the US Bureau of Reclamation (USBR). A summary of those discharge values is provided in Table 1. A discussion of the selection of discharge values used in the hydraulic analysis follows.

USGS Discharge Data

The USGS discharge data were derived from streamgage data at two locations:

- Gage 09521100 – Colorado River below Yuma Main Canal Wasteway, Yuma, AZ
  Period of Record - 1965-1999
  Location - River Mile (RM) 29.1 approximately 5.3 miles downstream of the confluence;

- Gage 09429600 – Colorado River below Laguna Dam, AZ
  Period of Record – 1973-1998
  Location - RM 41.6 approximately 7.5 miles upstream of the confluence.

The RM stationing of both gages appear to correspond with that of cross sections evaluated in the HECRAS computer model developed by USBR.

The USGS estimated the magnitude and frequency of annual minimum D-day low flows by first fitting a Pearson Type III distribution to the logarithms of the annual D-day events. Note that these statistically-derived flow estimates are not published by USGS, rather they were provided to Stantec by the USGS per special request. As such, they are flagged as preliminary computations only. The user is responsible for assessment and interpretation.

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The results of the statistical analyses are tabulated as the non-exceedance probability associated with flow values for 7-day flow duration and 120-day flow duration. The non-exceedance probability, X %, associated with a particular flow value states that the discharge may be exceeded 100-X % of the time within the given flow duration. The flows associated with 10%, 50% (median), and 90% non-exceedance probabilities for the 7-day and 120-day flow durations for the Colorado River gages are shown in Table 1. While these flows do not rigorously define the ordinary high, median, and low flows,

TABLE 1
Colorado River Discharge Data and Evaluated Water Surface Elevations at the Gila River Confluence near Yuma, Arizona

Location Description	River Mile	USBR Flow Data				USGS Flow Data					
		Low Flow		High Flow		Non-Exceedence Probability (7-Day)			Non-Exceedence Probability (120-Day)		
		Q	WSEL	Q	WSEL	10%	50%	90%	10%	50%	90%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Gage # 09521100	**29.1**	1830	116.5	8400	122.4	376	522	1593	539	874	3293
Gila R. Confluence	**33.8**	630	120.2	7200	128.5						
Gage # 09429600	**41.6**	430	124.6	7000	133.4	163	260	1061	217	456	2821

they are indicative of the flows to be expected to be exceeded 90%, 50%, and 10% of the time for the indicated duration, thus estimating the normally expected range of flows in the river at this location.

USBR Discharge Data

The discharge data from the USBR were part of the HEC-RAS model provided to Stantec by that agency. Per Janet Stork, USBR Yuma, two water surface profiles, labeled as "Hi" and "Lo", were considered in the HEC-RAS model to reflect physically-driven flows limits in the channel as follows:

- 'Hi' is defined as the maximum discharge in the Colorado River before overtopping occurs near Laguna Dam in the reach of the Colorado River upstream of the confluence; and
- "Lo" is defined as the minimum discharge in the Colorado River required to meet current water delivery contracts below the confluence.

Interpretation

Given the apparent disparity between the discharges obtained from the statistically-derived USGS streamflow data and the physically-derived USBR flow requirements, some investigation into the definition of the ordinary high and low watermarks is necessary. A selection of the discharges to be used in delineating those watermarks is based on the interpretation of their respective definitions relative to the level of confidence in the source data.

Ordinary High Flow

Methodologies for defining the ordinary high watermark are not rigorously defined. CH2MHill (1993) concludes that resource agencies in Arizona involved in mapping jurisdictional limits associated with the ordinary high watermark have not established definitive, step-by-step procedures for delineating those limits. Instead, agencies have published more open definitions which rely on field-oriented criteria to determine ordinary high watermarks. The three criteria most often cited by agency personnel are the following:

- Destruction of terrestrial vegetation
- Soils characteristics indicative of frequent flow or inundation
- Lines or marks cut into stream banks by flowing water.

Further, CH2MHill (1993) states that agencies are in consensus that the existing conditions, as opposed to historical or pre-channelization conditions, should be used in delineating jurisdictional waters.

Ordinary Low Flow

The estimation of low flow characteristics within the USGS has historically been oriented toward defining the magnitude and frequency of annual D-day events (Thomas and Stedinger, 1991). In these analyses, the D-day events are the minimum arithmetic average over D consecutive days of flow within each year based on the period of record. The 7-day, 10-year low flow is defined as the annual minimum flow for 7 consecutive days that is equaled or exceeded in 9 of 10 years. This value is used by about half of the state regulatory agencies in the United States for the management of water quality in receiving streams (EPA, 1986). Low flows of other durations and frequencies are used in some states. California reports recent use of the 120-day, 10-year low flow in defining ordinary low flow in some basins in the northern portion of that state (GVSCE, 1996). However, California has not located or identified ordinary high or low watermarks with relation to discharge values or water surface elevations for the Colorado River for regulatory purposes (C. Perez and C. Fossum, California State Land Commission, oral communication, Dec 1998).

GVSCE (1996) concludes that, while several methodologies are available for use in quantifying ordinary low flow for unregulated, gaged streams, there is no commonly accepted underlying statistical definition hydrologically of the ordinary low flow. GVSCE reports the optimal approach to defining the ordinary low watermark is applying quantitative methodologies where streamflow data are available, coupled with the evaluation of physical evidence in the field.

Discharge Selection

Normal flows in the Colorado River in the study reach are comprised of controlled releases and agricultural return. Most of the flow in the Colorado River is diverted at Imperial Dam and routed around the confluence site through the All American Canal, except for sluicing flows for the desilting works and a small amount for the few water users. Therefore, it is very important that any discussion of river hydrology and hydraulics must consider the fact that the river is constantly changing as a result of water diversion requirements and dredging activities. The results of hydrologic and hydraulic analyses reflect a snapshot in time as opposed to a static condition.

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The USGS discharge data is instructive in terms of the range of flows to be equaled or exceeded for a given flow duration. It is important to note that the discharge values statistically derived from USGS flow data as shown in Table 1 are not published, quality-checked data. The USGS does not publish such data for regulated streamflow stations where flow is affected to an unknown degree by regulation or diversion (Garrett and Gellenbeck, 1991). As previously noted, the reach of the Colorado River at the confluence is highly regulated by diversions and seasonal water delivery requirements. This fact diminishes the confidence level in the robustness of those statistical discharge values.

Research indicates that the determinations of both ordinary high and low flows are not quantitatively defined by any commonly accepted procedures, so that delineations are technically and legally defensible and not arbitrary. GVSCE (1996) reports legal research discovered few cases involving ordinary low watermark, and very few in the arid southwest. The courts generally concur in requiring an analysis of erosion lines, vegetation, soil characteristics and other physical factors as a basis for locating the ordinary high watermark. A reliance solely on records of flow frequencies and water elevations has not been adopted. That information is not controlling and is only admissible as a method of defining where the ordinary water line might be in reference to physical characteristics.

The literature lends support to a delineation of the ordinary high and low watermarks on the basis of physical evidence and criteria. The high and low discharge values evaluated by the USBR in the HEC-RAS model of the Colorado River at the Gila River confluence are physically based on water delivery schedules and channel hydraulic geometry. There is low confidence in the statistically-derived values for the USGS streamgage records of the highly regulated reach of the Colorado River. Thus, the delineation of the limits of backwater inundation at the Gila River confluence associated with ordinary high and low flows of the Colorado River are based on the USBR discharge values. While these discharge values are known to be temporally dynamic, they come closest to approximating normal operating conditions in the Colorado River in the vicinity of the Gila River confluence.

Gila River Base Flow

Inspection of the discharge data used in the HEC-RAS model by the USBR indicated an increase in Colorado River high and low flows of 200 cubic feet per second (cfs) at the Gila River confluence (RM 33.8). According to Janet Stork, USBR Yuma, this increase accounts for the return flow from the irrigated acreage within the Wellton-Mohawk Irrigation and Drainage District (WMIDD), located directly upstream of the confluence on the Gila River. Mr. Clyde Gould, WMIDD General Manager, stated that the 200 cfs estimate was an order of magnitude higher than flows reintroduced to the Gila River on a normal basis by the WMIDD. Mr. Gould speculated that the time period used by the USBR in estimating the WMIDD return flow to the Gila River would significantly impact the magnitude of that value.

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Further investigation indicated flows of approximately 20 cfs regularly pass the SR 95 bridge, just upstream of the confluence and below that point ground water return and surface agricultural returns add to Gila River flows. However, it is very unlikely that they amount to 200 cfs by the time the Gila flows enter the Colorado River. Gage data indicate the Colorado River is a gaining river between Laguna and Yuma by about 400 cfs and the estimation of the contribution attributable to inflows from the Gila River is uncertain. Further investigation should be made to verify the exact source of Gila River base flow values modeled by USBR.

Lacking resolution of the estimated value of Gila River base flow, a sensitivity analysis of the impact of the 200 cfs return flow value was performed. A Gila River base flow of 200 cfs is relatively small compared to the high flow estimate of the Colorado River at the confluence. The effect of this increase on the water surface elevation at the confluence is relatively minor (about 0.6 ft for the lowest discharge and 0.2 ft for the highest discharge). Given the 2-ft contour interval of the topographic mapping for the confluence area and other issues related to cross section placement and confluence location as discussed below, the 0.6 ft variance in water surface elevation is within mapping accuracy standards.

HYDRAULIC ANALYSIS

Data Sources and Data Issues

The delineation of Colorado River backwater at the confluence with the Gila River is based on the results of hydraulic analyses utilizing the HEC-RAS River Analysis System, version 2.0 (U.S. Army Corps of Engineers, 1997). The HEC-RAS software package computes the water surface elevations of any given river model based on cross-sectional data and hydraulic geometry input.

An existing HEC-RAS model of the Colorado River was acquired from the USBR Yuma, Arizona office. The model was developed in 1998 in conjunction with the aerial mapping coverage prepared for the Colorado River and adjacent areas. The aerial photos for the mapping project were taken in May 1998.

Work maps developed as part of the 1998 river model of the Colorado River were not available and not provided by the USBR to Stantec. The information lacking because of work map unavailability included the relative location of cross sections with river mile stations, among others. Supplemental information was developed by Stantec to address the following data issues:

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- *Confluence River Mile Stationing* - According to a relatively outdated river mile map of the Colorado River (USBR, 1976), RM 34.2 was the station used for the Gila River confluence. The 1998 HEC-RAS model, developed by USBR, indicates RM 33.8 as the location of the Gila River confluence under current conditions. This inconsistency is attributable to major flooding in this reach during the interim between map dates; notably the 1983 Colorado River flood and the 1993 Gila River flood event. The more recent station (RM 33.8) was adopted for use in the backwater analysis and it is consistent with the HEC-RAS river model.

- *Gila River Thalweg Elevations* - A digital topographic map, based on the 9 June 1994 aerial flight made over the North Gila Valley of the Colorado River and the Gila River, was acquired from USBR. This 1994 digital topographic map has a contour interval of 2 ft. Associated with the 1994 topographic mapping effort, the USBR developed a river model of the Gila River. The Gila River model extends from the mouth of the confluence with the Colorado River approximately 10.3 miles upstream at McPhall Bridge. Lacking sufficient channel invert information from the topographic maps, this river model was used to develop thalweg elevation data for the backwater delineation to be performed as described below.

- *Cross Section Locations* – Without work maps, the longitudinal location and lateral alignment of the cross-sections used to develop the USBR HEC-RAS models for both the Gila and Colorado Rivers relative to the topographic map were not easily apparent. In an effort to locate the cross sections on the topographic map as accurately as possible without the benefit of the original USBR work maps, physical features used to describe cross-section stations were noted and longitudinally located with the same features on the map. Without the original work maps, there was also no way to determine exactly how cross sections were laterally aligned relative to the river. Although cross sections are normally placed perpendicular to the main flow channel, there are frequently areas where cross sections may be angled to model river bends or split flow conditions.

  A reasonable degree of accuracy was achieved by locating cross sections longitudinally relative to two features described by the 1994 Gila River HEC-RAS model. These features were the "Mesa Dam", located at Gila River RM 0.1 and the "7-E Bridge", located at RM 3.3. By locating these features on the1994 digital mapping, placement of the cross sections between the two locations was relatively simple. After the cross sections were overlaid onto the in-house digital mapping, elevations observed along each section were compared with those described within the 1994 Gila River HEC-RAS model. Although exact lateral orientation of each cross section relative to the river for the original model by the USBR was still unknown, the results of this comparison were favorable.

- *Data Inconsistencies* - Another data issue was the use of HEC-RAS models and topographic data determined from different mapping dates. Specifically, the hydraulic analysis of the Colorado River to evaluate the water surface elevation at the confluence was based on the 1998 topographic map. However, since the most recent river model based on the 1998 topographic map is not available for the Gila River, an earlier model developed in 1994 is used. The application of the 1994 river model for the Gila River requires that the 1994 topographic

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mapping should be used for the delineation work for consistency. The significance of the inaccuracies, if any, which are introduced into the final outcome of the hydraulic analysis as a result of utilizing data from different map dates is unknown.

Methodology

For the discharge values shown in Table 1, the water surface elevations at the confluence are evaluated from the Colorado River HEC-RAS model. The water surface elevation in the Colorado River for a given discharge is determined and that elevation is projected upstream along the Gila River thalweg profile until it "daylights" at indicated elevation with the channel bottom of the Gila River. This model condition evaluates the extent of the backwater impact of the Colorado River high and low flows upstream on the Gila River.

Based upon the available hydrologic data, eight discharge values were originally modeled in the hydraulic analysis of the Colorado River. These discharge values included the "Hi" and "Lo" discharges from the USBR, and the 10%, 50% and 90% non-exceedance values provided by the USGS for the 7-day and 120-day flow durations. A field visit to the confluence site was conducted on 28 January 1999 to verify preliminary findings. The recommended ordinary high and low watermarks are those associated with the "Hi" and "Lo" flows estimated by the USBR for the Colorado River for reasons previously described. Plate 1 shows the delineation of the inundation limits of backwater associated with those flows at the Gila and Colorado River confluence for the model conditions described above.

RESULTS

The water surface elevation used to determine the Colorado River backwater effect on the Gila River is dependent upon several factors. These factors include accurately locating the HEC-RAS model cross-sections on the topographic map, map resolution, map/ model compatibility, and Gila River thalweg profile accuracy.

- *Cross Section/ Confluence Location* - The accuracy of the Colorado River backwater elevation on the Gila River confluence is influenced by the precise location of the HEC-RAS model cross-sections on the topographic map. In the absence of the original USBR work maps, variation of the confluence river mile stationing can impact the water surface elevation and the location of where that elevation "daylights" along the Gila River channel bottom. For example, if the confluence cross section station is located upstream of its actual location, a higher water surface elevation is calculated at the confluence and a longer reach of the Gila River is inundated by backwater. The Colorado River still has a large sediment deposit resulting from the 1993 Gila River flood. Natural processes are slowly moving the sediment deposit out. More importantly, the USBR has been and plans to further dredge the channel. These natural and man-induced activities strongly influence the backwater computations.

- *Map Resolution* - Since the available mapping has a 2-ft contour interval, this map resolution decreases the accuracy of the delineation along the Gila River reach upstream of the confluence because of the relatively flat terrain. A contour interval less that 2 ft would more accurately describe the terrain and result in a better delineation of inundation limits.

- *Map/ Model Compatibility* - The mapping to be used for the delineation of the Gila River is the 1994 topographic map. This is inconsistent with the source data of the modeling work performed for the Colorado River, which is based on the 1998 topographic map.

- *Gila River Thalweg Accuracy* - The 1994 Gila River maps do not show thalweg elevations along the river; therefore, visual extrapolation was necessary. These thalweg elevations were translated spatially from the HEC-RAS cross-sections to the map. Accuracy of such translation cannot be determined because of the absence of original work maps.

All of the above factors, combined with the inherent hydrologic uncertainties, should be considered in assessing and interpreting the delineation of the limits of inundation of the Colorado River backwater at the Gila River confluence as shown in the final map product (Plate 1).

CONCLUSIONS

The results of the foregoing hydrologic and hydraulic analyses indicate that the limits of backwater associated with ordinary high and ordinary low flows in the Colorado River extend approximately 2.5 and 0.1 miles, respectively, up the confluence of the Gila River based on the best currently available information. It is important to emphasize that the delineation reflects a hydrologic and hydraulic snapshot in time and recognize that the rivers are, and will continue to be, constantly changing.

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(2) Environmental Protection Agency (EPA), 1986, Stream design flow for steady-state modeling: Technical Guidance Manuel for Performing Waste Load Allocation, Book VI, Design Conditions, Chapter 1.

(3) Garrett, J. M. and Gellenbeck, D. J., 1991, Basin characteristics and streamflow statistics in Arizona as of 1989: U.S. Geological Survey Water Resources Investigations, Report 91-4041, 612 p.

(4) George V. Sabol Consulting Engineers, Inc. (GVSCE), 1996, ASLD navigability studies, Ordinary high and low watermark delineation, 9 August 1996 Memorandum to V. Ottozawa Chatupron, Arizona State Land Department, Phoenix, Arizona, 2 p.

(5) George V. Sabol Consulting Engineers, Inc. (GVSCE), 1996, Definition of ordinary low watermark, ASLD navigability studies, Attachment to the 22 July 1996 letter to V. Ottozawa Chatupron, Arizona State Land Department, Phoenix, Arizona.

(6) Pacific Southwest Inter-Agency Committee, 1976, River mile index, Lower Colorado River and selected tributaries, A report of the Water Management Technical Sub-Committee, January 1976.

(7) Thomas, W. O. and Stedinger, J. R., 1991, Estimating low-flow characteristics at gaining stations and through the use of base-flow measurements, Proceedings of the U.S.-People's Republic of China Bilateral Symposium on Droughts and Arid-Region Hydrology, Tucson, Arizona: U.S. Geological Survey Open-File Report 91-244, pp. 197-205.

(8) U.S. Army Corps of Engineers, 1997, HEC-RAS: River analysis system, version 2.0, User's Manual, Hydrologic Engineering Center, Davis, California.

(9) U.S. Bureau of Reclamation (USBR), 1998, 1998 HEC-RAS model of Colorado River from RM 16.7 (below Morelos Dam) to RM 41.6 (Laguna dam), attachment to the letter sent by Donald J. Young, Bureau of Reclamation, Yuma Area Office, dated November 27, 1998.

(10) U.S. Bureau of Reclamation (USBR), 1998, 1994 HEC-RAS model of Gila River from RM 0.0 (confluence with Colorado River) to RM 10.3 (McPhall Bridge), attachment to the letter sent by Donald J. Young, Bureau of Reclamation, Yuma Area Office, dated November 27, 1998.

(11) U.S. Bureau of Reclamation (USBR), 1998, Digital topographic data of the Colorado River from Laguna Dam to the Yuma Territorial Prison (Mile 23), C.I.: 2.0 ft, Scale: 1" = 200', based on aerial photos taken by Koogle and Pouls on May 22, 1998.

(12) U.S. Bureau of Reclamation (USBR), 1998, Aerial photos (color) of the Colorado River near the confluence, taken by Koogle and Pouls on May 22, 1998.

(13) U.S. Bureau of Reclamation (USBR), 1995, Digital topographic data of the North Gila Valley, C.I.: 2.0 ft, Scale: 1" = 400', based on aerial photos taken by CH2MHill, Inc. on June 9, 1994.

(14) U.S. Bureau of Reclamation (USBR), 1976, River mileage index of the Lower Colorado River and selected tributaries in Arizona, California, Nevada, and Utah. Map Nos. X-300-823 to X-300-826, January 1976.

(15) U.S. Geological Survey (USGS), 1998, Statistical analysis of stream gage data for gage nos. 09521100 and 09429600, courtesy of H. Hjalmarson, unpublished.

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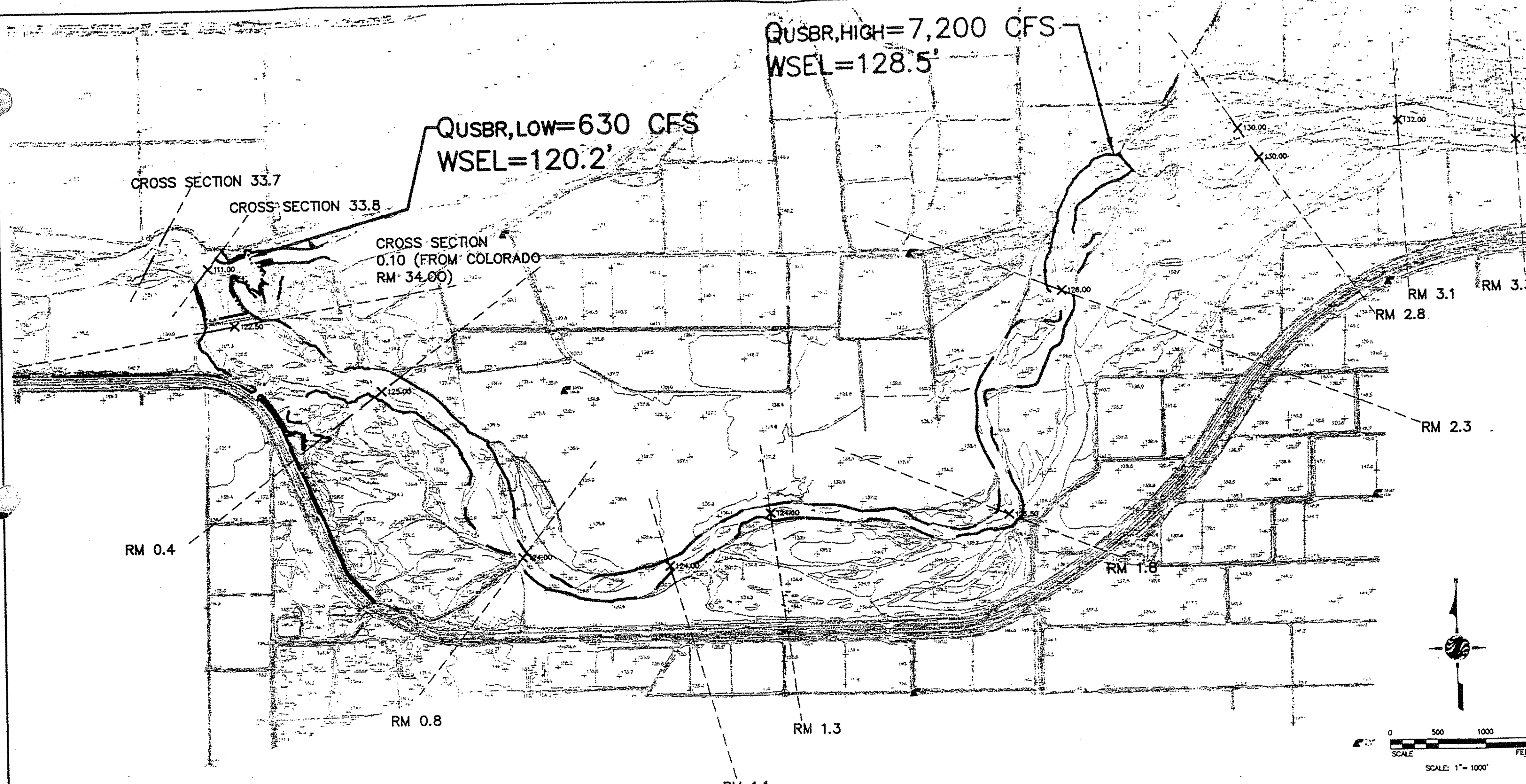

LEGEND:

WATER SURFACE DELINEATION FOR THE QHIGH

WATER SURFACE DELINEATION FOR THE QLOW

APPROXIMATE LOCATION OF USBR FIELD SURVEY PORTION OF HEC-RAS CROSS SECTION

APPROXIMATE LOCATION OF HEC-RAS CROSS SECTION OVERBANK DATA

× APPROXIMATE LOCATION OF THE MINIMUM RIVER BED ELEVATION REPORTED IN THE USBR HEC-RAS MODEL

NOTE: TOPOGRAPHIC MAP OF NORTH GILA VALLEY
BY CH2MHILL, COMPILATION SCALE: 1"=400'
PHOTO DATE: 6/9/94
C.I. = 2'

Stantec Consulting Inc.

ARIZONA STATE LAND DEPARTMENT
COLORADO RIVER BOUNDARY STUDY
JOB #28900081

PLATE 1

Final Report
CRITERIA FOR ASSESSING CHARACTERISTICS OF NAVIGABILITY for SMALL WATERCOURSES IN ARIZONA

Contract No. A7-0109-001

ARIZONA NAVIGABLE STREAM ADJUDICATION COMMISSION

Stantech Consulting Inc.
In Association with
JE Fuller/Hydrology & Geomorphology, Inc.
and the
University of Arizona
Water Resources Research Center

Stantech
Consulting

ARIZONA NAVIGABLE STREAMS ADJUDICATION COMMISSION

FINAL REPORT

CRITERIA FOR ASSESSING CHARACTERISTICS OF NAVIGABILTIY

FOR

SMALL WATERCOURSES IN ARIZONA

CONTRACT No. A7-0109-001

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September 1998

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PREFACE

Pursuant to Arizona Revised Statutes, Title 37, Chapter 7, State Claims to Streambeds (ARS §37-1101 et. seq.), an administrative process is established to gather information and determine the extent of the State's claims to the beds of the watercourses within Arizona arising from a finding of navigability for title purposes. The statute's purpose is to determine a method for assessing if watercourses within Arizona were navigable for title purposes as of the date of Statehood on February 14, 1912.

The Arizona Navigable Stream Adjudication Commission (ANSAC) was established as a State Agency to gather evidence and information regarding navigability or non-navigability of watercourses within Arizona as of Statehood. There are over 13,000 documented watercourse segments within Arizona, the vast majority of which are minor or small watercourses which ANSAC has determined should be considered separately from the major river investigations. ANSAC needs to gather information and develop criteria and methods regarding the study of small and minor watercourses as of February 14, 1912. The content of this report is intended to provide the necessary tools for ANSAC to make findings as to the navigability or non-navigability of minor and small watercourses, and subsequently forward recommendations to the Legislature.

This report was prepared for ANSAC under Contract No. A7-0109-001 by Stantech Consulting Inc.(Stantech) in association with JE Fuller/Hydrology & Geomorphology, Inc. (JEF, Inc.) and University of Arizona Water Resources Research Center (WRRC). The project team consisted of Christina Waddell, MBA, ANSAC, former Executive Director; Pat Deschamps, PE, RLS, Stantech, Project Manager; George V. Sabol, PhD, PE, Stantech, Senior Technical Advisor; Carlos Carriaga, PhD, PE, Stantech, Project Engineer; Jon Fuller, PE, PH, JEF, Inc., Project Hydrologist; Barbara Tellman, University of Arizona WRRC, Project Historian; and Diana Salisbury, Database Programmer.

The progress of this project was monitored and guided by a Technical Review Committee comprised of representatives of various agencies of the State of Arizona. The Committee members included Tom Vogt, ANSAC, Acting Executive Director; John Hathaway, PE, Arizona Department of Environmental Quality; Don Gross, PE, Arizona Department of Water Resources; Bill Werner, Arizona Game and Fish Department; Bob Sejkora, Arizona State Parks; Clyde Anderson, PE, Arizona State Land Department; and Curtis Jennings, ANSAC Legal Counsel.

Executive Summary

INTRODUCTION

The Arizona Navigable Stream Adjudication Commission (ANSAC) is directed by statute to establish administrative procedures, hold public hearings, and make recommendations regarding the navigability or non-navigability of all watercourses in Arizona as of Statehood on February 14, 1912. ANSAC is to set the priorities for investigating and conducting hearings on watercourses and then to report its recommendation as to which watercourses or reaches of watercourses were navigable or non-navigable at Statehood to the Arizona Legislature. The Legislature then makes a finding upon consideration of the ANSAC recommendation and enacts appropriate legislation in response to the determination.

ANSAC is required to complete the legislatively mandated tasks described above by July 1, 2002. The watercourses currently in the process of being assessed only include the major river systems in the state. There are over 13,000 documented watercourse segments in Arizona, the vast majority of which constitute minor or small watercourses ANSAC determined should be considered separately from the major rivers. In order to expedite the evaluation process and meet the target date for completion in the year 2002, ANSAC contracted with the Stantech project team in 1997 to develop an efficient and effective evaluation system to assess the small and minor watercourses within the state for characteristics of navigability, non-navigability, or susceptibility to navigation as of statehood on February 14, 1912. The contract also includes the identification and cataloging of all small and minor watercourses to be evaluated utilizing that system.

The project work products are technical and historical criteria, the evaluation system, the catalog of small and minor watercourses, and a summary report. The application of the evaluation system to each of the small and minor watercourses cataloged is not part of this project scope. It is anticipated that all the cataloged small and minor watercourses will subsequently be assessed utilizing the criteria, the evaluation system, and the watercourse catalog developed under this contract. That work will be performed in a priority to be established in the future by ANSAC and under a separate contract.

TECHNICAL CRITERIA

Historical records of navigability are lacking for the vast majority of small watercourses in Arizona. Therefore, most navigability findings will be decided based on a stream's susceptibility to navigation, rather than its historical record. To determine susceptibility to navigation, certain technical data about the stream are required. Technical information, as defined for this project, includes data relating to the physical characteristics of a watercourse. Physical characteristics include the following interrelated variables:

- Flow rate
- Flow depth
- Flow velocity
- Flow width

For natural streams, these flow characteristics are highly variable - streamflow changes throughout the year, from year to year, and from one point along the stream to the next. Therefore, direct measurement of the changing physical characteristics of every small watercourse in Arizona is not practical or possible. Indirect methods for estimating key flow characteristics are recommended to evaluate whether a watercourse was susceptible to navigation under specific flow conditions.

Criteria and Methodology

The following recommendations are made for estimating the physical characteristics of small watercourses in Arizona:

Navigability Criteria. The navigability criteria addressed in ARS §37-1128 describe actual navigation in fact, leaving the issue of susceptibility to navigation open to interpretation. ANSAC should firmly establish criteria that define susceptibility to navigation. These criteria should include standards for type of boats to be considered, whether ordinary high water vs. ordinary low water flow conditions are to be used, a minimum flow duration for boating, the minimum degree of predictability of flows, and a minimum length of boatable stream reach.

The following are recommended by the project team for ANSAC's consideration in establishing the criteria to be used in evaluating susceptibility of watercourses to navigation:

- Boat Type. Minimum boatable conditions should be based on use of inflatable rafts or canoes, both of which were available at statehood.

- Flow Condition. Ordinary high water conditions, or the mean annual flow rate, rather than ordinary low water conditions should be used to determine susceptibility to navigation.

- Flow Duration. Boatable flows should be defined as those continuously sustained for at least one month of every year.

- Predictability. Boatable conditions should be defined as occurring annually at regularly occurring periods of the year.

- Length of Reach. A boatable reach should be defined as at least one mile in length.

Methodology. A combination of use of stream classification data, engineering methodologies, and engineering judgment is recommended to estimate physical and navigability characteristics of Arizona watercourses. Stream classification data from agency database sources is suitable for initial screening, but cannot provide the level of detail required to estimate actual flow conditions of a specific stream reach. The level of effort required to use the engineering methodologies is not appropriate or warranted for application to all 13,000 stream segments in Arizona. Therefore, a multi-level approach, with varying degrees of effort and types of analyses is recommended, as described in Section 4 of this report.

Diagnostic Technical Criteria/ Analyses

Regardless of the exact evaluation scheme adopted by ANSAC, certain technical data are required to identify non-navigable streams and to determine susceptibility to navigation.

Non-Navigable Stream Technical Criteria. The following technical data are recommended for consideration when identifying non-navigable streams:

- USGS gage data indicate that the stream is ephemeral

- Stream is listed as ephemeral in Arizona State Parks (AZSP), Arizona Game & Fish (AZGF) and U.S. Fish & Wildlife Service (USFW) databases

- Stream is not listed as boating stream by AZSP, AZGF and Central Arizona Paddlers Club (CAPD)

Navigability Susceptibility Technical Criteria. The following technical data are recommended for consideration when determining susceptibility to navigation for Arizona streams:

- Flood peak discharge rates
- Mean annual flow and median flow rates
- Mean monthly or seasonal flow rates
- Channel flow depth, width, and velocity at flow rates
- Channel slope
- Channel bed and bank material
- Channel bank vegetation characteristics

Methods for estimating these recommended technical criteria are described in detail in Section 4 of this report.

HISTORICAL CRITERIA

One objective of this study is to determine what kinds of boats were available in Arizona and vicinity circa Statehood. Investigations involved searching available literature for references to historic boating and visiting museums, libraries and historical societies. General books on the history of boating were examined, along with sources specific to Arizona. Several indexes of newspapers from the turn of the century were examined and appropriate articles located where available. Legal cases were surveyed and relevant sections from the Utah Riverbed Case copied. All of these references appear in Appendix B-1. Photographic collections were examined and relevant photos cataloged. A list organized by type of boat is contained in Appendix B-2.

Boating History

The results of the research into the history of boating in Arizona are described in Section 3.2.

Arizona has a long tradition of boating, despite its desert environment. Prehistoric peoples used boats to cross and travel along the lower Colorado and lower Gila rivers. Ferryboats were used on the Colorado, Gila, Salt, and Little Colorado rivers in historic times, especially in flood situations. Steamboats transported people and goods up and down the Colorado River until the arrival of the railroad. Recreational boating became popular on man-made lakes starting in the 1880s, and accelerated with the construction of large dams such as Roosevelt. Some daring adventurers traveled on the Gila and other rivers throughout the historic period, but rivers were not generally used for recreational travel until the development of new materials such as fiberglass and artificial rubber after World War II. The construction of Glen Canyon Dam increased the feasibility of commercial recreational rafting, boating, and kayaking through the Grand Canyon by reducing very high flood flows downstream of the dams. The sequence of man-made lakes along the lower Colorado has increased recreational use of that area by motorboats, canoes and personal watercraft.

Stream Boatability

Section 3.3 contains a discussion of the boatability of various kinds of watercourses. It is difficult to develop hard and fast rules for boatability of streams in the Arizona context. Water supply varies dramatically throughout the year, but even with enough water, a stream may not be boatable. Boatability depends on a number of factors - water supply, slope of the stream, obstacles such as boulders or sand bars, and width and depth of the channel. The draw of a boat varies with the amount of load, so that a boat used for a single run on the river carrying few supplies draws less than one loaded for a long journey. Rapids are classified on a scale of 1-6, with 6 being unrunnable. A stream with Class 6 rapids or obstacles may be boatable if it is possible to portage around the rapids. There is no simple formula which applies automatically to all streams. However, Table 3.3 provides the range of boatability for various stream types. Information is presented in Table 3.4 regarding some estimates of depth of water and width of stream needed for boating for certain watercraft types.

Court Rulings on Navigability

The U.S. Supreme Court has made rulings on navigability in over one hundred cases, but has never set hard and fast rules on what kinds of boats are needed to show navigability, what stream conditions are required or what length of flow season is necessary for a determination. Excerpts from U.S. Supreme Court rulings on navigability are presented in Section 3.4. Some trends can be determined from rulings in major cases, but any past ruling does not necessarily apply to a particular river.

WATERCOURSE EVALUATION SYSTEM

A primary work product of this project is an evaluation system for assessing characteristics of navigability, non-navigability, and susceptibility to navigation for the small and minor watercourses in Arizona at the time of statehood in 1912. That evaluation system is to be efficient and economical in application, practical in implementation by utilizing readily available information, and technically and historically sound. To that end, a three-level watercourse evaluation system is proposed as shown in Figure 4.1.

The State's definition of navigability addresses both susceptibility to navigation and actual navigation in fact. Therefore, the project team prepared a multi-level screening process designed to identify stream segments least likely to meet the statutory and legal definitions of navigability as follows:

- Levels 1 and 2 of the screening process, described in Sections 4.1 to 4.3, are intended to eliminate non-navigable streams, such as ephemeral washes with no record of historical or current boating, from further consideration by ANSAC. The Level 1 screening process is designed to be completed using only information from existing databases.

- The Level 2 screening process will be completed using a subjective quality assurance review provided by a technical working group familiar with navigability issues, as well as the characteristics of the specific Arizona watercourses identified by the Level 2 screening.

- The Level 3 screening process requires that engineering analyses be performed to estimate flow characteristics for specific watercourses. Section 4.4 summarizes the recommended Level 3 engineering analyses to be used to estimate flow characteristics on specific small watercourses in Arizona.

The multiple levels of the watercourse evaluation system comprise a series of screening tests of increasing refinement and work effort. Only those watercourses that survive the Level 1 evaluation are tested at Level 2, and so on. The benefit of this approach is the economy of effort that is realized in eliminating the need for a full, multiple-level assessment of each watercourse. Little justification exists to undertake more intensive and expensive evaluation at the next level when it is evident that the watercourse does not meet the technical criteria indicative of the susceptibility to navigation and the historical criteria indicative of navigation in fact. This is the only prudent approach to avoid unnecessary, detailed assessment of each watercourse even when basic susceptibility criteria are clearly not met.

WATERCOURSE DATABASE CATALOG

The multi-level evaluation system and the watercourse database catalog function interdependently. The database catalog was compiled from available existing watercourse databases maintained by various agencies. Section 5.4 describes the data fields populated for each documented watercourse segment.

The merged small watercourse database was customized for the Level 1 screening process by programming data queries in the database based upon the six test criteria comprising the Level 1 evaluation - river type, with dam, historical boating, modern boating, with fish, and special status. Section 5.5 contains detailed information regarding the database queries. The database is structured so as to keep a running notation of the results of the testing for each criterion in a narrative format for each stream segment. This feature will provide ANSAC with a full record of information which presents the reasons for the disposition of each watercourse segment as it proceeds through the screening process. Potentially, an individual not in agreement with the disposition of a particular watercourse at any level may challenge that finding based on submitted evidence relative to that watercourse. ANSAC has a ready resource for use in considering further evaluation of the watercourse finding being challenged.

Testing and refinement is an important element in the development of a workable, efficient, and sound evaluation system. To that end, testing was conducted for each of the of various categories of watercourses. Results were instructive in terms of needed modifications to the testing criteria at each level. Section 5.6 contains further discussion of database testing and results.

RECOMMENDED WORK PLAN

Section 6 presents a recommended future work plan for applying the multi-level watercourse evaluation system to the watercourses in the database catalog.

1.0 Project Summary

1.1 PROJECT BACKGROUND

Public Trust principles date back to English Common Law when the King held the beds of rivers affected by tides in Trust for the general public and for the public good. This provision was founded on the principle that there is a public need to use the waterways for commerce. When the United States gained independence from the British Crown, Public Trust principles were recognized so that the lands beneath navigable waters within the original thirteen states became the sovereign property of those states. The Equal Footing Doctrine provided that future states were entitled to sovereign ownership of riverbeds located within those new states on an "equal footing" with the original thirteen states.

At the time of statehood on February 14, 1912, the State of Arizona received sovereign title to the beds of navigable rivers located within state boundaries. Under the Equal Footing Doctrine, the United States government previously held these lands in Trust pending the creation and admission of the State of Arizona to the Union. Although the State owned the land, in order to perfect title to the navigable streambeds, the State was required to make its claim of ownership. From statehood until the mid-1980's, Arizona claimed only the bed of the east half of the Colorado River. The State failed to act on all other claims of streambed ownership and other parties asserted title to certain streambed lands. In assuming ownership of lands located in or near these streambeds, many of the current record title holders constructed projects and improvements to the land, paid property taxes, and altered the stream ecosystems and riparian habitat.

During recent years, the State, as well as a number of private and public entities, asserted claims of ownership of streambeds throughout Arizona. These claims turned on whether or not the streams were navigable or susceptible to being navigable at the time of statehood. The titles held by landowners whose property includes all or a portion of the streambed of potentially navigable streams are clouded. As a result of litigation addressing in-stream sand and gravel mining activities in the Verde River, the Arizona Legislature recognized the economic hardships created by the uncertainty of the State's potential future claims on streambed lands. In 1987, House Bill (HB) 2017 was passed outlining a procedure to quit claim any interest of the State in the beds of the Salt, Gila, and Verde Rivers for a nominal fee, reaffirming the State's claim to the Colorado River, and waiving any claim to all of the other streambeds in the State. A lawsuit challenging the constitutionality of HB 2017 was successful in 1991 and the Court found that one flaw in the bill was that it did not provide for an evaluation of the validity and value of the State's Public Trust interest on the individual watercourses.

In 1992, the Governor signed HB 2594, which repealed HB 2017 and established a systematic administrative procedure for gathering information and determining the extent of the State's ownership of streambeds. The main purpose of the legislation was to confirm State ownership in Public Trust lands located in the beds of streams determined to have been navigable at statehood. HB 2594 also created the Arizona Navigable Stream Adjudication Commission (ANSAC), a five-member board appointed by the Governor. ANSAC was directed to establish administrative procedures, hold public hearings, and make determinations of navigability. The legislation also directed the Arizona State Land Department (ASLD) to facilitate determination of navigability and to act as support staff for the ANSAC.

In early 1994, HB 2589, amending Arizona Revised Statutes (ARS) §37-1101 through 37-1156, was adopted. HB 2589 sets the criteria to be used for determinations of navigability and non-navigability, and establishes an ombudsman office to represent the interests of private property owners in proceedings involving governmental action. HB 2589 requires the ANSAC to set priorities for investigating and conducting hearings on watercourses within this state and then to report its recommendation as to which watercourses or reaches of watercourses were navigable or non-navigable at Statehood to the Legislature. The Legislature then makes a finding upon consideration of the ANSAC recommendation and enacts appropriate legislation in response to the determination.

1.2 PROBLEM STATEMENT

ANSAC is required to complete the legislatively mandated tasks described above by July 1, 2002. The watercourses currently in the process of being assessed only include the major river systems in the state. There are over 13,000 documented watercourse segments in Arizona, the vast majority of which constitute minor or small watercourses ANSAC determined should be considered separately from the major rivers. In order to expedite the evaluation process and meet the target date for completion in the year 2002, ANSAC contracted with the Stantech project team in

1997 to develop an efficient and effective evaluation system to assess the small and minor watercourses within the state for characteristics of navigability, non-navigability, or susceptibility to navigation as of Statehood on February 14, 1912. The contract also includes the identification and cataloging of all small and minor watercourses to be evaluated utilizing that system.

1.3 STUDY OBJECTIVES

- Develop criteria for determining navigability, non-navigability, or susceptibility to navigation for small and minor watercourses in Arizona at the time of statehood on February 14, 1912 which are supported by technical data and historic information.

- Develop and test an evaluation system which addresses the criteria as described above, in addition to the navigability criteria provided in A.R.S. §37-1128, in an efficient and economical manner.

- Identify the watercourses to be assessed utilizing the evaluation system described above and categorize according to a scheme consistent with the navigability criteria, the evaluation system, and the needs of the ANSAC to facilitate future study.

- Catalog the small and minor watercourses according to a categorization scheme including categories such as political boundaries and watershed boundaries, among others.

The project work products are the technical and historical criteria, the evaluation system, the catalog of small and minor watercourses, and a summary report. The application of the evaluation system to each of the small and minor watercourses cataloged is not part of this project scope. It is anticipated that all the cataloged small and minor watercourses will subsequently be assessed utilizing the criteria, the evaluation system, and the watercourse catalog developed under this contract. That work will be performed in a priority to be established in the future by ANSAC and under a separate contract.

1.4 PROJECT METHODOLOGY

The scope of work is comprised of three major work tasks which proceeded concurrently for this project.

Task I - Develop Minimum Criteria and Watercourse Evaluation System

General Description - Task I addresses the development of technical and historical criteria in accordance with the definition of navigability and non-navigability contained in ARS §37-1128 and such other sections of Title 37, Chapter 7, Arizona Revised Statutes, as may be applicable. The criteria are incorporated in the development and testing of an evaluation system for finding that specific minor and small watercourses have characteristics of navigability. The work product for Task I includes the technical and historical criteria and the watercourse evaluation system. The evaluation system is to be subsequently applied to each of the watercourses listed in the database catalog (Task II) as part of a separate contract.

Work Plan - The specific work tasks for Task I are listed below:

1. Literature Search/ Data Collection

Technical Data

- Identified various information sources for the hydrologic criteria.
- Completed literature search for hydrology and geomorphology criteria tasks.
- Researched engineering methodologies.

Historical Information

- Researched information sources for the historical boating criteria.
- Contacted museums and appropriate groups.
- Collected approximately 200 books and journal articles and another 25 newspaper articles dealing with boats used in or near Arizona before about 1925.
- Located and copied, or arranged for copying, close to 100 photos and drawings of boats in Arizona and vicinity before about 1925.
- Researched previous legal decisions, with emphasis on the Utah Riverbed Case (1930).
- Performed additional literature and photo searches at the University of California at Berkley.
- Completed a literature review.
- Compiled a bibliography of over 225 books, manuscripts and articles, and approximately 135 photographs dealing with boats in Arizona up to the 1920's.
- Drafted a literature search summary.

2. Criteria Development

Technical Data

- Reviewed, evaluated, and recommended appropriate methodologies.
- Prepared draft criteria and decision flow charts.
- Prepared summary of recommendations on engineering methodologies for advanced level screening of watercourses.

Historical Information

- Reviewed the findings of the preliminary research into the historical boating criteria.
- Evaluated alternatives for structure and content of historical, boating, and navigation criteria.
- Searched records to determine what kinds of watercraft were used at Statehood and under what conditions.
- Researched the criteria used for special status designations for watercourses by various entities.
- Drafted a short history of boating in Arizona, a glossary of boating terms and boat types, a list of available Arizona boating photos, a list of types of boats and classification of boating requirements for various kinds of streams.

3. Watercourse Evaluation System

- Evaluated implications of technical and historical criteria development upon the conceptual design of the watercourse evaluation system.
- Reviewed the data fields available within the existing watercourse databases for applicability to criteria and evaluation system development.
- Worked to develop a decision flow chart for evaluating watercourses using readily available data from the databases and the technical and historical criteria.
- Revised decision flow charts through several iterations of development.
- Refined the evaluation system to include three levels of screening for characteristics of navigability of watercourses.
- Determined the appropriate data fields to apply to various levels of the evaluation system.
- Programmed the database queries for the watercourse evaluation system.
- Tested the watercourse evaluation system using a sample set of watercourses.
- Modified the decision flow charts based on those sample test results.
- Further refinement of the three levels comprising the evaluation system.

Task II - Identify and Catalog Watercourses

General Description - Task II addresses the identification and cataloging of all minor and small watercourses within the State of Arizona. Watercourse databases obtained from various agencies are compiled. Data fields are selected appropriate to the technical and historical criteria and the evaluation system being developed concurrently. Data queries for the initial screening level of the watercourse evaluation system are programmed into the database catalog and a categorization system incorporated. The work product for Task II is the small watercourse database.

Work Plan - The specific work tasks for Task II are listed below:

4. Watercourse Database Catalog

- Contacted several state and federal agencies and obtained information regarding the existing databases for small watercourses in Arizona.
- Acquired the Arizona Land Resource Information System (ALRIS), Arizona State Parks (ASP), and Arizona Department of Water Resources (ADWR) watercourses databases in digital format.
- Evaluated content and format of the databases.
- Merged the databases based upon the hydrologic unit code and/or stream name data field, as available.
- Determined the data fields most applicable to the criteria under development in Task I.
- Reviewed the available, substantially populated data fields within the existing watercourse databases for use in the further refinement of the watercourse evaluation system.
- Completed the collection of all available watercourse data fields for the database catalog.
- Provided information for populating some additional data fields of the watercourse database.
- Developed a conceptual categorization system as part of the watercourse evaluation system.
- Compiled database queries for the initial Level 1 screening components of the watercourse evaluation system.
- Tested the database using sample watercourse data.

- Performed programming and data processing work tasks to merge all data tables, refine the Level 1 data queries in the database, and various data processing tasks to customize the database utility for this application.
- Tested the database using actual watercourse records.

Task III - Coordination and Reporting

General Description - Task III addresses the communication of the project work and study findings between the project team and ANSAC. The project team works in conjunction with the professional staff of ANSAC, the Commission itself, other state agencies, and the Technical Review Committee to achieve the study objectives and perform the scope of work for this project. The work product for Task III includes monthly progress reports and the final report summarizing findings.

Work Plan - The specific work tasks for Task III are listed below:

5. Coordination and Reporting

- Coordinated all project activities with ANSAC professional staff and reported project status monthly in written Progress Reports.
- Attended all ANSAC public hearings during the performance time for this project and provided informal project updates, as needed.
- Provided a prepared presentation to the ANSAC addressing project status, small watercourse database catalog, the watercourse evaluation system, upcoming work tasks, project schedule, and project deliverables. ANSAC reached consensus agreement regarding the design of the watercourse evaluation system.
- Held four Technical Review Committee Meetings to report project status, assess alternative options for the watercourse evaluation system, and review the database catalog and test results. The Technical Review Committee reached consensus agreement regarding the design of the design of the watercourse evaluation system.
- Prepared the final report.

2.0 Technical Criteria

Historical records of navigability are lacking for the vast majority of small watercourses in Arizona. Therefore, most navigability findings will be decided based on a stream's susceptibility to navigation, rather than its historical record. To determine susceptibility to navigation, certain technical data about the stream are required. Technical information, as defined for this project, includes data relating to the physical characteristics of a watercourse. Physical characteristics include the following interrelated variables:

- Flow rate
- Flow depth
- Flow velocity
- Flow width

For natural streams, these flow characteristics are highly variable - streamflow changes throughout the year, from year to year, and from one point along the stream to the next. Therefore, direct measurement of the changing physical characteristics of every small watercourse in Arizona is not practical or possible. Indirect methods for estimating key flow characteristics are recommended to evaluate whether a watercourse was susceptible to navigation under specific flow conditions.

2.1 TECHNICAL LITERATURE/DATA SEARCH

2.1.1 Reference List

A literature search was conducted to identify technical methodologies for estimating existing and historical flow characteristics. The key literature sources appropriate for Arizona streams are identified below. The following types of literature are listed:

- Descriptions of existing river uses, including boating
- Lists of Arizona streams
- Lists of Arizona boating streams
- Records of Arizona stream gaging stations
- Methods for estimating flood peak discharges
- Methods for estimating average annual flow rates
- Methods for estimating stream channel geometry

Discussion of these publications is provided in Section 2.2 of this report. A reference list is provided in Appendix A-1 of this report.

2.1.2 Definitions

In addition to the references cited above, the literature supports the following definitions of flow regime. Note that a change of regime could occur as a result of man-made or natural causes.

Ephemeral. An ephemeral stream is one that flows only in direct response to precipitation, and whose channel is at all times above the water table. An ephemeral stream has measurable discharge less than 10% of the time, no sustained snowmelt discharge, and no sustained discharge from springs or seepage (Meinzer, 1923; Hedman & Osterkamp, 1982).

Intermittent. An intermittent stream is one which flows only at certain times of the year when it receives water from springs or some surface source such as melting snow in mountainous areas. An intermittent stream experiences measurable discharges between 10% and 50% of the time (Meinzer, 1923), and has a seasonal period of continuous flow at least one month in duration (Hedman & Osterkamp, 1982).

Perennial. A perennial stream flow continuously, except during period of extreme drought, and has measurable flow more than 80% of the time (Meinzer, 1923; Hedman & Osterkamp, 1982).

Interrupted. An interrupted stream has short perennial reaches interspersed among intermittent stretches (Meinzer, 1923).

2.2 EVALUATION OF AVAILABLE METHODOLOGIES

The available methodologies for estimating the physical characteristics of Arizona watercourses were evaluated relative to the following objectives of this project:

- To identify streams that have no characteristics of susceptibility to navigation, given the broadest reasonable definition of navigability.
- To identify streams that have no characteristics of susceptibility to navigation, using the definition of navigability given in ARS §37-1128.

2.2.1 Limitations and Assumptions

Susceptibility to Navigation. The following questions have not been clearly and definitively addressed in the legislation, by court decision in Arizona, or by ANSAC:

1. *Type of Boat.* ARS §37-1128 identifies specific types of boats to be considered in obtaining evidence of navigability. However, historical research indicates that several types of boats other than those listed in ARS §37-1128 were available at the time of Arizona statehood (See Section 3.2). Also, there is some dispute whether case law supports restricting the types of boats to be considered. For instance, if all states enter on an "equal footing," can different boat types be used as the standard of susceptibility for each state (e.g., Would hard shell kayaks or inflatable rafts be the standard if Puerto Rico were to become a State?).

2. *Ordinary High Water vs. Ordinary Low Water.* Is annual low water to be considered the flow rate at which navigation must occur, or is the low water mark only to be used to define the limits of the State's claim if the stream is found to be navigable? In the latter case, should ordinary high water conditions be used to determine navigability, or should some other flow rate/condition be used?

3. *Flow Duration.* Is there a time period over which the stream must remain navigable? For example, is a stream that has regular, predictable annual high flows that could be boated a navigable stream if annual low flows on that stream are not usually boatable?

4. *Predictability.* Must regular periods of boatable flows be relatively predictable (e.g., spring snowmelt runoff) or can boating conditions be more opportunistic (e.g., boating in floods or during rainfall-runoff events)?

5. *Interrupted Streams.* Numerous streams have short reaches of perennial flow interspersed between intermittent or ephemeral reaches. Over what length of stream could boating occur to make a stream boatable? Meters? Kilometers? In Arizona, most interrupted streams have low flow rates and correspondingly low flow depths.

Existing Conditions. For most streams, the available data only describe existing or recent conditions. The assumption must be made, lacking data to the contrary, that existing conditions are representative of conditions as of the time of statehood. It is noted that, in general, this is not a conservative assumption with respect to non-navigability since many Arizona streams experienced higher average flow rates as of the time of Statehood. The exception to this assumption is for the effluent-dominated stream reaches that occur on watercourses such as the Santa Cruz River and Salt River.

2.2.2 Sources of Data

Data Source Criteria. The data used to assess the physical characteristics of a stream and its susceptibility to navigation must have the following characteristics:

1. *Available*. The data must be readily available to facilitate its practical use.
2. *Accurate.* The data must be published by an organization with internal and external quality control measures, and must reasonably depict actual field conditions.
3. *Published.* The data and methodologies used should be documented in juried publications.

Data Sources. The following data sources were identified:

1. US Geological Survey (USGS) Gage Summaries
2. USGS Topographic Maps
3. Flood Control District Streamflow Gage Records
4. Published Reports. See literature search summary (Section 2.1)
5. Boater Surveys - e.g., Central Arizona Paddlers Club Member Survey

Required Data Types. The following categories of physical data types could be required for estimating navigability criteria on different stream types:

Hydrologic Data.

- Streams with USGS Streamflow Summaries
- Streams Tributary to Streams with USGS Streamflow Summaries
- Sources of Flow - springs, precipitation, snowmelt, tributaries
- Flow Regime- ephemeral, perennial, and intermittent

Hydraulic Data

- Flow width, depth & velocity at Mean Annual Discharge
- Flow width, depth & velocity at Median Annual Discharge
- Flow width, depth & velocity at 10% & 90% discharge
- Flow width, depth & velocity at lowest monthly average discharge

- Flow width, depth & velocity at highest monthly average discharge
- Flow width, depth & velocity at 2-year peak discharge

Geomorphic Data.

- Channel Slope
- Channel Materials - bedrock, boulders, and sand
- Channel Width

Watershed Characteristics.

- Snowfall/Snowmelt Potential
- Elevation
- Watershed Area

Stream-Specific Published Information.

- USGS Studies & Engineering Reports
- Arizona State Parks Riparian Classification
- Arizona Game & Fish Stream Classification
- Fishery Designation / Fish Habitat - No fish may indicate no permanent water
- Recreational Classification - Classified for boating, swimming, or wading
- ADEQ Water Quality Classifications - Full body contact, drinking, limited use

2.2.3 Potential Methodologies

Three potential methodologies for considering the physical navigability characteristics are described and evaluated below:

Classified Streams vs. Unclassified Streams. ANSAC could simply make a policy statement that only the streams listed in some combination of lists of watercourses (ASP, USF&W, AZGF, etc) will be considered for characteristics of navigability. Any stream not listed is assumed to be too small to have characteristics of navigability, and would therefore be declared non-navigable. ANSAC could make a declaration of this statement in each county, asking for evidence of navigability for any streams not on the list. If no new evidence is received, then forward the recommendation of non-navigability to the legislature.

Advantages:

a. Limits consideration to a finite number of streams, albeit a large number.
b. Eliminates consideration of the N^{th} tributary, as in the Corps of Engineers definition of "waters of the United States."

c. Eliminates discussion of what constitutes a "watercourse".
d. Logical. If a stream is too small to have been noticed by any State or Federal resource agency, its probably too small to have significant flow, and therefore too small to boat. In an arid state like Arizona, any stream with significant flow is likely to have been noticed by some agency.

Disadvantages:

a. May be challenged for not explicitly considering each individual stream's public trust values, like the original Streambed Bill (HB 2017).[1]
b. Does not address the issue of boating ephemeral streams (opportunistic boating).

Data Bases:

a. AZ State Parks lists 74 stream segments in the *Arizona Rivers and Streams Guide* (1989), which includes 47 individual rivers. Of these, 9 are listed for whitewater boating, 1 for flat water boating, 10 for low water boating, 45 for cold water fishing, and 20 for warm water fishing (categories overlap).
b. AZ State Parks SCORP document (1989) lists 42 boating stream segments on 17 different rivers in Arizona. Only 13 of these stream segments (10 rivers) have not had detailed navigability reports prepared for ANSAC already, excluding the Colorado River (navigable by statute).
c. AZ State Parks (1995) lists 149 rivers in Arizona that provide sport fisheries, with another 35 rivers that have the potential for development as sport fisheries.

Template Methodology. The Arizona State Parks/ Arizona Game & Fish/ U.S. Fish & Wildlife Master List of Rivers divides streams into three overlapping categories: (1) boating streams, (2) fishing streams, and (3) streams with riparian habitat. USGS gage data and streamflow summaries are available for approximately 250 watercourses in Arizona. The USGS data are probably available for a number of watercourses within each of the three AZSP/ AZGF/ USFW categories, as illustrated in Figure 2.1. A relationship showing measured flow characteristics, such as flow duration, minimum monthly flow, seasonal flow, and flood peaks, could be established for each watercourse category. These relationships could then be applied to other listed watercourses within each category to assess their susceptibility to navigation.

[1] Although the challenger would first have to prove that a stream left off the master list exists, since there is no public record of such streams, and then that that stream had some public trust value.

Arizona State Parks/Arizona Game & Fish/U.S. Fish & Wildlife Master List

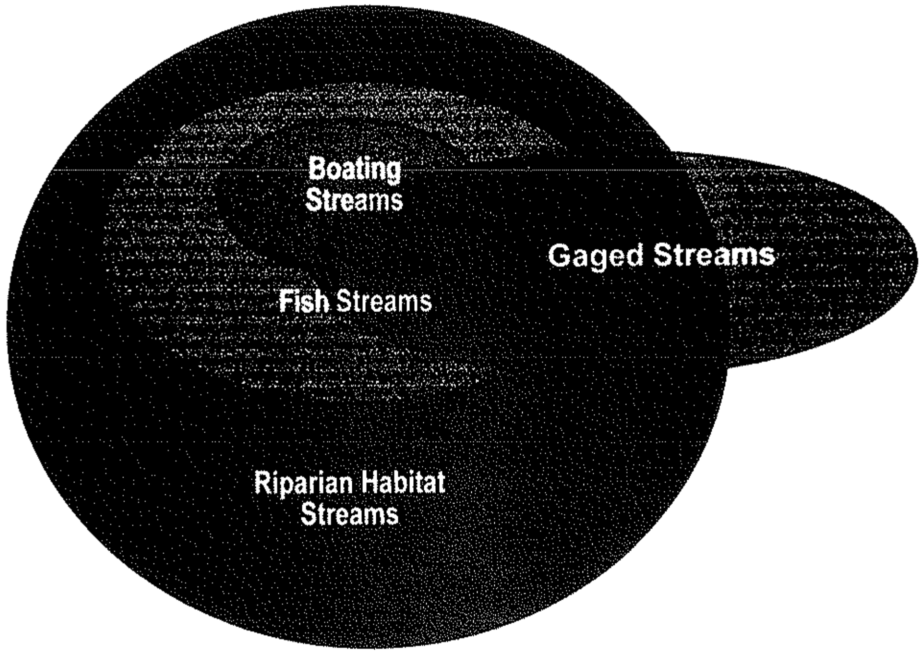

Figure 2.1 - Illustration of overlap between stream master list and gaged streams.

Advantages:

a. Uses published gage data and does not require use of regression equations for discharge and stream geometry.
b. Provides a physical description of flow characteristics of streams known to be boatable.

Disadvantages:

a. Does not address the issue of boating ephemeral streams (opportunistic boating).
b. USGS streamflow data may not be diagnostic between the three stream classifications. That is, there may be a high degree of similarity between the physical characteristics of boating, fishing, and riparian habitat streams.

Engineering Methodology. A variety of engineering methodologies are available from which physical characteristics of streams may be estimated. A list of publications potentially applicable to Arizona streams is provided in Appendix A-1. Published regression equations could be used to estimate flood peak discharge rates. Assumed peak to volume relationships could then be used to estimate average flow conditions. Finally, regression equations or regime relationships could be used to estimate flow depth, width, and velocity at specific flow rates, such as the mean annual flood or the mean annual discharge.

Advantages:

a. Provides specific numbers for specific watercourses that can be compared to boating criteria established to define susceptibility to navigation.
b. Considers physical characteristics of stream and reaches.
c. Does not rely on classification systems done by other agencies.

Disadvantages:

a. Requires many levels of assumptions to achieve an estimate of flow conditions. The accuracy of discharge regression equations is typically +/- 50%. The accuracy of regime equations typically are no better than +/- 50%. The combined accuracy estimates made using both discharge regression equations and regime geometry equations could be off by a factor of two or more.
b. Hydraulic geometry equations generally are not accurate in semi-arid regions like Arizona because: (1) they assume a relatively constant channel forming discharge, (2) they assume floods are essentially non-erosive, and (3) they are most accurate for cohesive bank materials with high silt/clay content.
c. The engineering methodology requires extensive computations and effort to obtain estimates for each stream, each stream reach, and each concentration point. Data required for each estimate could include drainage area (planimetering watersheds), mean elevation, mean annual precipitation, and/or mean annual evaporation. Given that there are more than 10,000 stream segments recognized in the available databases for Arizona, an effort as low as one hour per stream segment would take five person-years to complete.
d. The methodology requires direct knowledge of the flow characteristics of the stream (perennial, intermittent, ephemeral).
e. Regime equations generally not applicable to non-alluvial streams (bedrock channels, channels in urban areas, channels downstream of dams, etc.), and may not be appropriate for braided or distributary systems. Many Arizona streams are either bedrock controlled, or are braided/distributary systems.
f. Mean annual or peak flow data may not accurately depict boatable conditions on streams that flow for brief, regular periods, such as snow melt streams.
g. Many streams that may not be boatable due to boulders, vegetation, frequent waterfalls, or significant natural hazards may have average annual flow rates or flood peaks that, when combined with hydraulic geometry relationships, indicate that boating could occur.[2]

[2] For example, using Thomas et. al. (1994) 2-year peak flow regression equation, a 450 acre watershed in Region 13 (Pima County) draining to a 10 ft wide ephemeral stream will indicate at 2-year flow depth of 1.7 ft, which would be boatable by a canoe. Using Hedman & Osterkamp (1982) mean annual discharge equation, the same channel would indicate a mean annual flow rate of 0.001 cfs, which would be non-navigable by any boat type. However, Hedman & Osterkamp's equation for ephemeral streams in the desert southwest, the stream would

h. Does not address the issue of boating ephemeral streams (opportunistic boating).

2.2.4 Summary

The following recommendations are made for estimating the physical characteristics of small watercourses in Arizona:

Navigability Criteria. The navigability criteria addressed in ARS §37-1128 describe actual navigation in fact, leaving the issue of susceptibility to navigation open to interpretation. ANSAC should firmly establish criteria that define susceptibility to navigation. These criteria should include standards for type of boats to be considered, whether ordinary high water vs. ordinary low water flow conditions are to be used, a minimum flow duration for boating, the minimum degree of predictability of flows, and a minimum length of boatable stream reach.

The following are recommended by the project team for ANSAC's consideration in establishing the criteria to be used in evaluating susceptibility of watercourses to navigation:

- Boat Type. Minimum boatable conditions should be based on use of inflatable rafts or canoes, both of which were available at statehood.
- Flow Condition. Ordinary high water conditions, or the mean annual flow rate, rather than ordinary low water conditions should be used to determine susceptibility to navigation.
- Flow Duration. Boatable flows should be defined as those continuously sustained for at least one month of every year.
- Predictability. Boatable conditions should be defined as occurring annually at regularly occurring periods of the year.
- Length of Reach. A boatable reach should be defined as at least one mile in length.

Methodology. A combination of use of stream classification data, engineering methodologies, and engineering judgment is recommended to estimate physical and navigability characteristics of Arizona watercourses. Stream classification data from agency database sources is suitable for initial screening, but cannot provide the level of detail required to estimate actual flow conditions of a specific stream reach. The level of effort required to use the engineering methodologies is not appropriate or warranted for application to all 13,000 stream segments in Arizona. Therefore, a

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need to be 72,000 feet wide to predict a mean annual flow rate of 100 cfs. Compare these numbers to Rillito near Tucson (#09486000): (1) USGS Gage Data: Q2=5,120 cfs; Qav=14 cfs; Q50%=0.01 cfs; W=400 ft; (2) Hedman & Osterkamp Qav=0.24 cfs, (3) Thomas et. al. Q2=3,400 cfs.

warranted for application to all 13,000 stream segments in Arizona. Therefore, a multi-level approach, with varying degrees of effort and types of analyses is recommended, as described in Section 4 of this report.

2.3 IDENTIFICATION OF DIAGNOSTIC TECHNICAL CRITERIA/ANALYSES

Regardless of the exact evaluation scheme adopted by ANSAC, certain technical data are required to identify non-navigable streams and to determine susceptibility to navigation.

2.3.1 Non-Navigable Stream Technical Criteria

The following technical data are recommended for consideration when identifying non-navigable streams:

- USGS gage data indicate that the stream is ephemeral
- Stream is listed as ephemeral in AZSP/ AZGF/ USFW databases
- Stream is not listed as boating stream by AZSP/ AZGF/ CAPD

2.3.2 Navigability Susceptibility Technical Criteria

The following technical data are recommended for consideration when determining susceptibility to navigation for Arizona streams:

- Flood peak discharge rates
- Mean annual flow and median flow rates
- Mean monthly or seasonal flow rates
- Channel flow depth, width, and velocity at flow rates
- Channel slope
- Channel bed and bank material
- Channel bank vegetation characteristics

Methods for estimating these recommended technical criteria are described in detail in Section 4.4 of this report.

3.0 Historical Criteria

3.1 INTRODUCTION AND METHODOLOGY

One objective of this study is to determine what kinds of boats were available in Arizona and vicinity circa statehood. Investigations involved searching available literature for references to historic boating and visiting museums, libraries and historical societies. General books on the history of boating were examined, along with sources specific to Arizona. Several indexes of newspapers from the turn of the century were examined and appropriate articles located where available. Legal cases were surveyed and relevant sections from the Utah Riverbed Case copied. All of these references appear in Appendix B-1. Photographic collections were examined and relevant photos cataloged. A list, organized by type of boat, is contained in Appendix B-2.

The results are summarized in Section 3.2. Section 3.3 contains a discussion of the boatability of various kinds of watercourses, including some excerpts from U.S. Supreme Court cases dealing with navigability. A glossary of terms appears as Appendix B-3.

A listing of the historical information sources follows:

- **Historical Societies and Museums**

  Arizona Historical Society - Tucson, Arizona
  Arizona State Museum - Tucson, Arizona
  Caballeros Historical Museum - Wickenburg, Arizona
  Colorado River Indian Tribes Museum - Parker, Arizona
  Gila Bend Historical Society - Gila Bend, Arizona
  Mohave County Historical Society - Kingman, Arizona
  Oklahoma Historical Society - Norman, Oklahoma*
  Pinal County Historical Society - Florence, Arizona
  Quechan Indian Museum - Winterhaven, California
  Sharlot Hall Museum -Prescott, Arizona
  Utah State Historical Society - Salt Lake City, Utah*
  Yuma County Historical Society - Yuma, Arizona

- **Libraries**

  Arizona Historical Foundation - Tempe, Arizona
  Arizona State Library and Archives - Phoenix, Arizona
  Arizona State University Library, Arizona Collection and Indian Collection - Tempe, Arizona
  Huntington Research Library - San Marino, California
  National Archives and Records Administration Library - San Bruno, California
  National Guard Library - Phoenix, Arizona*
  Phoenix Historical Society - Phoenix, Arizona
  University of Arizona Library, Special Collections - Tucson, Arizona
  University of California at Berkeley, Bancroft Library - Berkeley, California
  Water Resources Center Archives, University of California - Berkeley, California

- **Other Sources**

  Arizona State Land Department - Phoenix, Arizona
  Central Arizona Paddlers' Club - Phoenix, Arizona*
  Center for Law in the Public Interest - Tucson, Arizona
  Lynne Clark Photography (Historic photos) - St. George, Utah

* Contacted by mail to obtain photos or information, not visited.

3.2 A BRIEF HISTORY OF BOATING IN ARIZONA

> *"... Then one day Montezuma's friend Coyote, came by and told him he should build a big dugout canoe. Montezuma could make anything, but didn't know why he needed a canoe. Coyote told him to build it anyway, so he did, and kept in on a mountaintop. Coyote made himself a little boat out of a hollow log.*
>
> *Before long, Montezuma found out why he needed the canoe. A great flood engulfed the land, and Montezuma and Coyote floated on its surface while everything else perished. The two friends tried to find dry land, and when they scouted out the north, they found it. The Great Mystery had already begun to make more people and animals there, and he put Montezuma in charge again, telling him to teach the people all the things they would need to know to survive. ..."*
> *Tohono O'odham Creation Story.*

3.2.1 Introduction

The following is a brief overview of the history of boating in Arizona. Appendix B-2 contains a list of boat illustrations available in libraries and museums and other sources. Appendix B-4 consists of a series of quotes describing boating in Arizona.

3.2.2 Chronological Summary

Prehistoric Boating - Flood stories are common throughout the world from the Hebrews to the Tohono O'odham, Pima and other Arizona Indian tribes. Many of those stories include boats, as does the story quoted above. The Apache flood story, on the contrary, has people going on foot to the top of the mountain to be saved. Whether or not boats were actually used by those peoples, it seems clear that the concept of boating was prevalent in some Arizona prehistoric societies.

Boats were used on the Colorado River long before the arrival of the Spaniards. One of the names the Spanish explorers gave the Colorado River was "Rio del las Balsas" because of the large number of rafts (balsas) Indians were using on the river. These rafts were made of reed-like materials, wood, or a combination. Rafts were sometimes made of bundles of reeds, agave stalks, or willows fastened together either so that one or both ends was pointed and the sides elevated - in the shape of a canoe or so the raft lay flat in the water. Such rafts are known from California, all along the coast and inland to South America. The Seri Indians who lived on the coast about 100 miles south of the Colorado River delta built reed rafts of highly sophisticated design, well suited for open-water travel on the Sea of Cortez. Rafts were propelled by paddles, poles or swimmers.

Wooden rafts were flat, made of stems or trunks attached horizontally. Both were propelled by poles or swimmers. The first Spaniards reported seeing and traveling on rafts of both types. The rafts were highly maneuverable. There is no evidence that either type of raft was used prehistorically in Arizona beyond the Colorado River and lower Gila River, although it seems possible that such rafts were used on the middle Gila and Salt at some times. Because of the perishability of the materials, proof is unlikely to be found, but archaeologist, Frank Cushing, is reported to have found remains of a canoe in a Hohokam site from the Salt River Valley.

Other prehistoric vessels were made of woven twigs (usually willow) in the shape of a basket and made waterproof with what the Spaniards described as "a bitumen-like substance." Similar boats from southern California were made watertight with tar, probably from the tar pits in the area. Sap from agaves was used to waterproof smaller baskets and may also have been used for these larger vessels. Basket-type boats are reported to have been used by Apaches on the Gila River.

The Quechan made ceramic vessels large enough to carry goods, children and even wives. These vessels were propelled by swimmers. One writer described these as nearly flat vessels, while others describe them as "ollas," rounded vessels for carrying water. There is some evidence of the use of dugout canoes, but these were never as popular as they were farther north all the way to what is now British Columbia where plenty of trees of appropriate wood of fir, cedar, or pine could be easily found.

Beaver trapper, George Yount, said that he built a dugout canoe "after the manner of the Mohave Indians" in the 1820s.

The Arrival of the Spaniards - Several groups of Spaniards arrived by sea along the California coast and the Sea of Cortez in large sailing ships. They proceeded up the Colorado River probably not much farther than the mouth of the Gila River in their ships or in smaller ship's boats of various types - rowboats or canoes. The tidal bore "burro" was often a major problem, but they were able to deal with it. The Spaniards are not known to have used boats on other Arizona rivers as their exploration inland was on horseback and on foot. Most of the missions were established and served by routes inland from Mexico and New Mexico. One description has Father Kino felling a large cottonwood tree in Caborca to provide lumber for a boat to explore the coast and to determine whether Baja California was a peninsula or an island, and determine the character of the Colorado River, but the boat was not completed.

Anglo Trappers - Anglo trappers came to Arizona from the north and east. They were traveling on horseback and on foot, but sometimes constructed boats to get across and down rivers. The most common type of boat was the "bullboat" developed by plains Indians. Originally these boats were made of one bull buffalo hide stretched over a framework of willows or similar wood. In Arizona where there were no buffalo, elk or horse hides were stitched together for this purpose. These boats were propelled with paddles or poles were sturdy but were not very maneuverable and were usually abandoned after serving a particular purpose. In one exploration from Idaho to the Sea of Cortez, two of the trappers' horses were killed for their hides on the first Colorado River crossing and another two later for the return journey. Some trappers used these boats for some distance downstream on the Colorado and Gila Rivers. Trappers sometimes built dugout canoes where they could find appropriate wood along the upper Gila and upper Colorado rivers. There are no appropriate trees in Arizona for the kinds of birchbark canoes common in the eastern parts of the continent.

American Exploration and Surveys along the Lower Colorado River - After 1850 the U.S. Government sponsored a number of surveys of the new territory. Most of these were cross-country trips involving crossing the Colorado River by ferry, but some were designed to explore the river itself by boat. Joseph Ives took a steamboat up the river in 1861 as far as Vegas Wash. The Wheeler Expedition used rowboats (with the occasional addition of sails) to explore parts of the lower Colorado River as far as what they considered the limits of practical navigability - somewhere around the present Hoover Dam. Jacob Hamblin explored the lower Colorado River in the vicinity of the mouth of the Virgin River and in the Lee's Ferry region, usually on foot, but also using rafts and rowboats over a period of about twenty years at the end of the nineteenth century. The first inflatable boat was used in Arizona in 1854 to cross the Colorado River somewhere near Needles on the second Ives Expedition. Balduin Mollhausen drew a picture of this boat and humorously described how the Indians on their easily maneuvered rafts laughed at the Anglos trying to get their clumsy raft across the river. A few years later Edward Beale used an inflatable raft with slightly more success. Use of inflatables, however, did not become common until the development of artificial rubber in the 1940s.

Godfrey Sykes spent many summers boating on the Colorado River, exploring the Delta, often with his family. He conducted scientific explorations along the Colorado and to the Salton Sea for the Carnegie Institution's Tumamoc Hill facility in Tucson. He sometimes hauled lumber to the shore and built his boat on the spot. His boats were generally rowboats or a combination of oar and sails.

Ferryboats - The California Gold Rush, California statehood and acquisition of Arizona in the 1840s and 1850s increased the demand for cross-river travel on the Colorado. At first the demand was met by Quechan and Mohave Indians who ferried travelers across the river for a fee. The business became so lucrative that Anglo entrepreneurs soon challenged Indian domination of the river. Several outright battles ensued, especially at the Yuma crossing. For a while Anglos dominated the passenger-freight business while Indians ferried and swam animals across the river. Farther north at the Mohave crossing, Indians bitterly resented Anglos who cut down their sacred and valuable cottonwood trees to build rafts for single crossings. Here, too, Indians crossed travelers for a fee, especially if convinced that the travelers were moving on, not settling nearby. In nearly all cases, wood rafts were used as ferries, though travelers report seeing Indians using reed rafts.

For the most part, cross-country travelers came on horseback, covered wagons, on foot, or, later, stagecoach, fording rivers such as the San Pedro and Gila. Some travelers attempted travel down the Gila by converting their wagons to boats or by building rafts. In several cases, when the river was high, they did travel for some distance along the Gila from Gila Bend to the Colorado. One pioneer designed his wagon to be easily convertible as he crossed the country, but seldom used that feature in the West.

Anglo ferries originally were rowboats or flatboats, but later often developed into more complex structures. By the early twentieth century, boats were large enough to carry six or more automobiles. Many of the early ferries were operated by cables for stability in crossing changeable rivers. Some of these were propelled by people on the ferry pulling the cable while others were operated from the shore. In most cases the boat was in the water, but some ferries were suspended above the river. Many of the ferries were operated by Mormons to facilitate travel by Mormons between Salt Lake City and the Arizona communities. The Mormon ferries at the mouth of the Virgin River and Lee's Ferry were the most long-lived as they were major points along the Mormon Trail. The ferries at Yuma were used more than any others because of the many people wanting to cross to the gold fields. Hayden's ferry was an important crossing of the Salt River in Tempe. There were other ferries in the Phoenix area as far downstream as Maricopa. One ferry operated across Roosevelt Lake to connect with the road to Young. A suspended cable ferry crossed the Little Colorado River, serving Mormon settlers.

The arrival of the railroad and highway bridges led to the demise of the ferry business. With the development of gas engines, ferries in areas without railroads or bridges became larger and much easier to maneuver than the old ones powered by oars. In more recent times, gas-powered ferries have taken gamblers and tourists across the Colorado River to Nevada casinos.

Figure 3.1 shows a map of the major ferryboat stations in Arizona.

> *"The watercraft most commonly used in commercial navigation have been row boats of 16-18' in length, drawing 6-12"; row boats 18-22' long, drawing 14-18"; steel rowboats 18' long, drawing 7-19"; motor boats of 20-27' length drawing 10" - 2'; rowboats 16-18' length, propelled by outboard motors drawing 15-18"; scows 32'-8', and 24'-6', drawing 8"; and rafts."*
>
> *Summary from the Utah Riverbed Case (1931).*

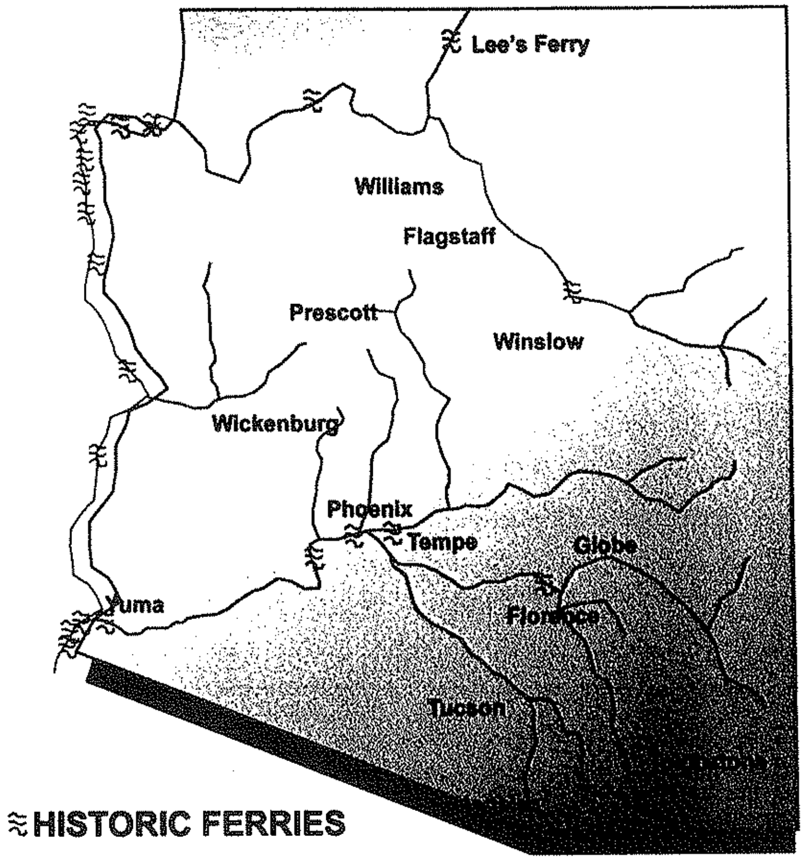


Figure 3.1 map of major ferryboat stations

The Steamboat Era - After the end of the California Gold Rush, many miners sought and found treasure along the Colorado River. After the Civil War, several forts were established along the river. Getting supplies in and ore out and supplying the forts offered new opportunities for boating entrepreneurs. Surveyors were needed to establish boundaries and explore the new territory. The history of steamboats on the Colorado is thoroughly described in Lingenfelter's *Steamboats on the Colorado*. The first steamboats were only partially successful, but were followed by a series of commercial steamboats which could travel during the high water months of spring and early summer. Captains developed techniques for getting their boats off the sandbars so common along parts of the river.

Before the arrival of the railroad, most commercial freight along the Colorado River was transported by steamboat. The limit of navigation was considered to be in the vicinity of the present day location of Lake Mead, as far upstream as the mouth of the

Virgin River (Callville and Rioville) in many years. The Mormons were interested in developing a network of communities, roads, and ferries all the way from Salt Lake City to the coast. At one time they had great hope for a steamboat-land route to carry freight from California or the East to Salt Lake City, along the Virgin River alignment.

One steamboat operated for a while in the Lee's Ferry area and others in the Upper Basin of the Colorado, but steamboats are not known to have been used on other Arizona rivers.

Boat Use by Settlers and Prospectors - People who traveled through Arizona on their way to someplace else used ferries, but were not usually involved in travel up and down rivers. Settlers sometimes used boats, especially during spring snowmelt periods or other flood times. People in rural areas depended on horses to a large extent and seldom needed boats as their horses or wagons could easily ford the rivers. In more urban areas along the Gila and Salt rivers, especially the Florence-Kelvin and Phoenix-Tempe areas, boats were slightly more common. While boats are seldom mentioned either in journals or newspapers, they were clearly available for use when needed in situations such as flood rescue, suggesting they may have been used at other times for uses such as hunting or fishing.

The Colorado River and some of its tributaries were used by prospectors in the late 19th and early 20th centuries. Various kinds of rowboats are reported traveling extensively in the Lee's Ferry area and surrounding areas, but most of the prospecting activity was in the lower Colorado from somewhere around present day Needles to Yuma. Marshall Bond, a gold prospector, was one of the few prospectors who described his travels on the Colorado River in the early years of the twentieth century. In 1912, he took his wife and children down the river from Needles to Yuma in a canoe and a 20-foot scow which he described as a "luxury." He also described travels by boat in the delta region and up the Alamo River to Imperial Valley.

Flood Rescue and Travel at Flood Time - Water flowed in the Salt and Gila rivers in urban areas almost every year until the construction of upstream dams. Regular ferry service operated during several high-water months of the year in Tempe, Phoenix on the Salt River, and Maricopa, Kelvin, Florence, Dome and other places on the Gila River. At low-water times the river could be forded. At some times, however, the rivers flowed too strongly for even the ferries to operate. At one point, cross country train travelers headed for Phoenix had to embark at Casa Grande, take the stage to Florence where they were ferried across and from then one went by stage.

During the winter and spring of 1905, heavy flooding occurred along the Gila River. Bridges went out at several places and the ferry business thrived at Florence and Kelvin. Each issue of the weekly paper described the lengths people went to transport passengers and freight and keep the Ray Mine at Kelvin supplied. Extracts from Editor Tom Weedin's humorous descriptions of the competition, and the trials and tribulations experienced are briefly excerpted in Appendix B-4. Two "navigation companies" were in fierce competition for three months until the completion of cable "cages" and subsidence of the flood waters in May. These rescue boats are seldom well described except as "rowboats" or "flatboats" sometimes large enough to transport a horse and buggy. The editor, tongue-in-cheek, spoke of the "Gila Fleet" and of an important person he called "Admiral of the fleet" that operated near Florence, but it seems probable that the fleet was much less grandiose than described. But it is clear that a number of boats, some of which were large enough to haul tons of freight were in use there.

Exploring the Grand Canyon - The history of river running in the Grand Canyon and the development of boat types and boat skills are discussed in great detail in Lavendar's River Runners of the Grand Canyon. John Wesley Powell was undoubtedly the first American to travel from the Green River through the Grand Canyon, although there are unproven reports of an earlier traveler through the Grand Canyon. Powell's first boats were made of sturdy oak of a typical rowboat design of the period. His boats were propelled by an oarsman facing backward in the traditional rowing fashion, providing power as the oars were pulled forward. Nathan Galloway changed this traditional method to one in which the oarsman faced forward going through the rapids, making it possible to clearly see exactly what the obstructions were and how the rapids were behaving. This revolutionized Grand Canyon travel at least as much as the new boat design, also developed by Galloway. He was a trapper who traveled alone in the Grand Canyon in the late 1800s and early 1900s for months at a time. His boat was lightweight and easily maneuverable - ideal for one man. Airtight compartments were built into the boat fore and aft, allowing both for waterproof storage areas and increased buoyancy.

Later explorers, especially those doing official surveys for the railroad and the government used variants on Galloway's design. In 1909 Julius Stone brought

Galloway to Ohio to design boats for a trip on the Colorado. These boats had to be larger than the traditional Galloway design to hold several men and heavy supplies, including survey and photographic equipment. Because they were much larger and heavier they were much less maneuverable in the rapids, but were adequate for the purpose as long as they were built of sturdy materials. One explorer ordered boats built in the Galloway-Stone pattern, but they were constructed of lightweight cedar which was far too fragile for the Grand Canyon and some were even broken in transit before they reached the river. From then on until the development of modern materials, Grand Canyon boats were built of oak or pine, not cedar. While later explorers modified the designs, the most successful boats were the Galloway-Stone type made of sturdy wood until the development of modern materials after World War II.

In 1938 Buzz Holmstrom took the first modern-type inflatable raft (provided by Goodyear) through the Grand Canyon with mixed results. In the 1940s the development of artificial rubber made it possible to design durable, maneuverable rafts which did well in the Grand Canyon, due largely to experiments with war surplus rafts, conducted on the river by Georgie White. It was not until after construction of Glen Canyon Dam that rafting the Grand Canyon became relatively safe and popular for tourists. Today boats of many kinds are used in the Canyon, including kayaks, canoes, inflatable rafts, and rowboats made of various materials from wood to fiberglass.

Boats in the Dam-Building Era - Boats were used in the process of building dams, first for exploring for appropriate dam sites and later for moving people and material to the sites. Such boats ranged from rowboats to barges. Dignitaries were taken to the dams by boat. Once the reservoirs were in place, the lakes became popular boating areas. Photos of boats on reservoirs are available from the 1880s and later. After construction of Roosevelt Dam, boating was a popular pastime. One photo shows a tour boat at a boat landing there, while another shows people in a tourboat on the lake. Murl Emery and others operated tunnel-stern motorized boats in the Needles/Hoover Dam area both before and after dam construction, serving both dam workers and tourists.

Recreational Boat Use - Recreational boating was popular in Arizona as early as the 1880s. The first man-made lakes made the use of boats for hunting, fishing, or daily adventures common. A picture of the lake formed by the Walnut Grove Dam near Wickenburg shows a number of boats under full sail in the late 1880s. Other photos show boats on lakes Mary and Rogers near Flagstaff in the late 1800s. The Granite Dells Lake near Prescott opened in 1907 offering both boating and swimming. A 1900 promotional pamphlet by the Phoenix Chamber of Commerce talks about opportunities for boating "nearby." One photo shows eight men in a rowboat on the San Francisco River at Clifton, while another shows men in a rowboat traveling down a Salt River canal and a third shows people in a boat on Clear Creek near Winslow in the late 1800s.

Newspapers describe several adventuresome trips down the Salt and Gila Rivers in the 1880s and 1890s. In some cases, the adventurers sent a letter to a newspaper part way through a journey reporting progress, but there is no record of whether the journey was completed. Godfrey Skyes' brother Sydney built a canvas boat around 1910 which he used for an only moderately successful winter low-water trip down the Gila from somewhere downstream of Phoenix to the Colorado, having to tow the boat much of the way.

Even in the early 1900s, people took boats down to Mexico for fishing and recreation. One description in the Florence Blade Tribune describes some men from Florence taking a "yacht" to the gulf in 1905 and not finding good hunting and fishing proceeded 500 miles to Tiburon Island.

In the 1930s Bus Hatch and Norman Nevill began commercial river trips on the San Juan and upper Colorado rivers, using wooden boats and charging $65 per trip. After World War II, inflatable rafts made of the new artificial rubber (neoprene) developed during that war, became popular on Arizona rivers. The development of fiberglass in the 1950s led to the popularity of river recreation on rivers such as the Verde, Gila, Salt and Colorado, although wooden canoes and rowboats continue to be used. More recently the development of one-person lightweight kayaks and "rubber duckies" has made it possible to boat shallow rivers previously thought unboatable.

Lake recreation also increased about the same time with the increase in large man-made reservoirs throughout the state. Today more than 150,000 boats are registered in Arizona, almost all for recreational use on lakes, for uses such as fishing and water skiing. Small "personal watercraft" have become popular on dammed rivers such as the Colorado. It is often stated that Arizona has more boats registered per capita than any other state. While Arizonans do own a large number of boats, this statistic is somewhat misleading since Arizona requires registration of all boats no matter how small, while other states such as Michigan only require registration above a minimum size, skewing the comparison. Watercraft registration increased from 20,866 in 1959, the first year registration was required, to 241,280 in 1997 (of which 161,061 are "active" registrations.) See Table 3.1 for a breakdown of registered watercraft in Arizona by boat type in 1998.

TYPE OF BOAT	ACTIVE	INACTIVE	TOTAL
Runabout	66,413	30,817	97,230
Day Cruiser	9,039	3,899	12,938
Cabin Cruiser	4453	2505	6955
Houseboat	991	433	1,424
Pontoon Boat - Cabin	8073	2141	10224
Sailboat	2,857	2,174	5,031
Catamaran	788	828	1,616
Sailboard	538	1,159	1,697
Utility	26,542	14,864	41,406
Canoe	9,154	5,460	14,614
Inflatable	3,118	3,430	6,548
Kayak	1,899	981	2,880
Personal Watercraft	26,268	10,314	36,582
Airboat	35	14	49
Hovercraft	18	30	48
Amphibious	7	2	9
Other	848	1,171	2,019
Total	161,061	80,219	241,280

Table 3.1 - Arizona boat registration in 1998

"Runabout" includes fishing and ski boats, usually motorized.
"Utility" includes rowboats and small outboard motor boats.
"Inactive" means that the boat was registered at one time, but the registration was not kept up. AGF does not know whether the boat is still in use in Arizona.

> *"... A desert, yes. But Arizonans own and use twice as many boats per capita as Californians. Our waterways offer exciting variety and adventure, the dramatic complement of water to an already majestic land. We're proud of our remarkable variety which ranges from quiet coves on calm lakes to the pounding excitement of white water; from the thundering might of unlimited hydroplane races to the pastoral relaxation of a solitary canoe resting in a tree-shaded lagoon. ..." Gov. Raul Castro, 1976. Introductory letter in McDannel's Guide to Arizona's Waterways.*

Summary of the Availability of Boats in the First Decades of the 20th Century - Table 3.2 provides a summary of boat types in Arizona before 1913. Prior to about 1900, most small boats were homemade from lumber or driftwood and of many shapes and sizes. Boat-building manuals gave detailed plans for making canoes, row boats, hunting boats and small sailboats. There are no commercial boat builders listed in the census for river towns such as Yuma or Phoenix but there are several examples of private boatbuilding.

Boat Type	Size Range (Length)	Materials	Primary Historic Uses in and Near Arizona	Known Areas of Use by 1912
Reed Raft	4' - 15'	Reeds, Agave, Willow	Fishing, open sea, cross and up/down river travel	Pacific coast, Baja, Colorado River, lakes, etc.
Olla Raft	3' - 5'	Ceramic	Transport goods, children across river	Colorado River
Basket Boat	3' - 5'	Willows, etc.	Transport goods, children across river	Colorado, Gila Rivers
Wooden Raft	5' - 25'	Logs	Travel across and up/down river travel	Colorado, Gila Rivers
Bullboat	6' - 25'	Hides	Cross and down river travel	Colorado River
Canoe	8' - 25'	Wood	Lakes and calm rivers for fishing, recreation, travel	Many rivers, canals, lakes.
Rowboat	6' - 22'	Wood, Steel	Lakes and calm rivers for fishing, recreation, travel up/down rivers- also ferrying	Many rivers, canals, lakes.
Canvas Boat	5' - 12'	Canvas/framework	Hunting, recreation	Many rivers, canals, lakes.
Scow	8' - 32'	wood, metal	Transport goods up/down rivers, also ferrying.	Colorado, Gila and Salt Rivers
Duckboat	4' - 6'	steel, canvas, wood	Hunting	Lakes, marshes
Flatboat	8' - 30'	wood, steel	Ferrying, transport goods up/down rivers	Colorado, Gila and Salt Rivers
Sailboat	6' - 35'	wood	Exploration, recreation	Colorado River, lakes
Dory	8' - 22'	wood	Fishing, adapted for whitewater boating	Colorado River
Aerial Ferry	6' - 35'	wood, steel	Cross-river travel	Colorado, Gila, Little Colorado Rivers
Ferry Boat	6' - 35'	wood, steel	Cross-river travel	Colorado, Gila Rivers
Steamboat	25' and up	wood, steel	Transport good and people up/down river	Colorado River
Galloway Boat	8' - 12'	wood	Whitewater travel	Colorado River
Galloway-Stone Boat	16' - 22'	wood	Whitewater travel	Colorado River
Gas-powered	10' - 27'	wood, steel	Travel up/down rivers, recreation, fishing ferrying.	Colorado River, lakes

Table 3.2 - Boat types in Arizona before 1913

By 1900 it was possible to order boats from the Sears and Wards catalogs. Rowboats, canoes, and duckboats for hunting (along with oars and other equipment) were offered at low prices for many years. These were available in wood, canvas and steel. The rowboat is the most common small boat seen in historic photos, sometimes with provisions for sails.

Kayaks, although common in the arctic regions for thousands of years, were apparently not used in Arizona until after World War II. Inflatable boats were available as early as the 1850s, but these boats were awkward, difficult to maneuver, and not very durable and it was not until artificial rubber was developed during World War II that inflatables became feasible.

Gas-powered boats were available as early as 1900, but were not very powerful or reliable until the 1920s. A major problem with gas power in sandy rivers, such as the Colorado River near Needles, was solved by the invention of the "tunnel-stern boat" which filtered the sand out so it didn't clog the motor.

By 1910 the U.S. Rescue Service (later the Coast Guard) was using gas–powered engines in its sea-going rescue boats and soon after in its inland boats. By the 1920s gasoline engines had developed so that there were choices of inboard and outboard motors and engines developed that could power larger and larger boats.

Recreational Boating after World Water II - Commercial recreational rafting started in the 1930s, but developed in the 1970s, on the Colorado River (especially upstream in Utah) and later on the Salt, Gila, and Verde Rivers. The development of durable small boats - plastic, fiberglass and other modern types of canoes and kayaks, inflatable boats for single paddlers and for groups - all contributed to the rising popularity of river running in Arizona especially on rivers not previously considered boatable, or boatable only very rarely because of low water.

Twenty rivers are reported to be used frequently in the spring high water season by boaters and a few more are boated occasionally. Use of boats on reservoirs is especially popular for speedboating, water skiing, fishing and other recreation. Boats became popular and boat registration climbed rapidly. Arizona is reported to have more boats per capita than any other state, but this statistic is misleading since Arizona requires registration of smaller boats than many other states, skewing the statistics.

In 1994, Arizona State Parks surveyed the popularity of various recreational activities by residents and found that boating was practiced at least occasionally by more than

25% of the population, with rafting and motorboating being the most popular. They also found that out-of-state tourists boated in Arizona in significant numbers, especially on the lower Colorado River and through the Grand Canyon. More than 15,000 people raft the Grand Canyon annually and more would undoubtedly participate if the numbers were not limited by the Park Service to protect the Park.

3.2.3 Conclusions

Arizona has a long tradition of boating, despite its desert environment. Prehistoric peoples used boats to cross and travel along the lower Colorado and lower Gila rivers. Ferryboats were used on the Colorado, Gila, Salt, and Little Colorado rivers in historic times, especially in flood situations. Steamboats transported people and goods up and down the Colorado River until the arrival of the railroad. Recreational boating became popular on man-made lakes starting in the 1880s, and accelerated with the construction of large dams such as Roosevelt. Some daring adventurers traveled on the Gila and other rivers throughout the historic period, but rivers were not generally used for recreational travel until the development of new materials such as fiberglass and artificial rubber after World War II. The construction of Glen Canyon Dam increased the feasibility of commercial recreational rafting, boating, and kayaking through the Grand Canyon by reducing very high flood flows downstream of the dams. The sequence of man-made lakes along the lower Colorado has increased recreational use of that area by motorboats, canoes and personal watercraft.

3.3 WHEN IS A STREAM BOATABLE?

Historically, people have used boats in Arizona for many purposes, such as exploration, transport of goods, travel, fishing and trapping. Today, however, the primary reasons for boating in Arizona are recreation-related. Whitewater boating was practiced only by a small number of explorers and adventurers before 1912, but is commercially important today in some areas, such as the Grand Canyon and Salt River Canyon. Canoeing and kayaking on rivers have gained in popularity in the past ten to twenty years, but many people canoed even before 1912. Lakes are used for motorboating, water skiing, fishing and other recreational purposes today as they were in 1912.

When determining boatability, the intended kind of boat and purpose need to be considered. A river that is boatable by a neoprene raft or fiberglass canoe may not be boatable by wooden rowboats, for example. Man-made lakes in Arizona are boatable by sailboats, but small streams are not. Table 3.3 shows the range of boatability of streams in terms of their suitability for different kinds of boating.

It is difficult to develop hard and fast rules for boatability of streams in the Arizona context. Water supply varies dramatically throughout the year, but even with adequate water, a stream may not be boatable. Boatability depends on a number of factors - water supply, slope of the stream, obstacles such as boulders or sand bars, and width and depth of the channel. The draw of a boat varies with the amount of load, so that a boat used for a single run on the river carrying few supplies draws less than one loaded for a long journey. Rapids are classified on a scale of 1-6, with 6 being unrunnable. A stream with Class 6 rapids or obstacles may be boatable if it is possible to portage around the rapids. (Figure 3.2.) There is no simple formula which applies automatically to all streams.

3.3.1 Water Supply

Water supply varies greatly by season, usually being highest in the spring when snow melts in the mountains. Some rivers are only boatable for a few weeks a year while others may be boatable for several months. Amounts also vary from year to year. Estimates vary on the amount of water needed for boating. The usual measure of water supply is in cubic feet per second (cfs). The amount of water needed depends primarily on the width and depth of the channel and danger from obstacles such as rocks. For example, BLM estimates that the Virgin River is runnable by rafts in some segments with 1,000 cfs, but in another segment, 2,000 - 3,000 cfs is required. In one segment BLM considers 400 cfs minimal for kayaks, while 500 cfs is needed in the rest of the river. Having enough water, however, is not the entire picture. Too much water can also cause problems. Generally above certain flow levels, rivers can become hazardous, although that too is not the entire picture. At low water, a rock may be clearly seen and avoided; at somewhat higher levels it may be possible to float over the rock; at really high levels the rock may create a reversal (hole) that must be avoided; and at maximum levels, the rock may again become insignificant as a barrier.

3.3.2 Channel Configuration

All natural rivers curve and twist to some extent, but some are so contorted as to make river running very difficult if not impossible. A narrow winding stream , especially if strewn with boulders, may be boatable by personal inflatable watercraft but nothing larger, for example, or it may be completely unboatable.

Stream description	Example	Boatability
Not Boatable		
In high mountain regions, small watershed, less than 5' wide in many places, very steep slope, major rapids, major obstacles, rocky bottom.	Minor creeks high in the White Mountains.	Not boatable and not boated historically.
In low desert regions, small low elevation watershed, usually dry except in rare flood events, sandy or rocky bottom, very shallow, low slope, possible sand bars.	Washes in the Cabeza Prieta.	Not boatable except possibly briefly with inflatables or kayaks during very rare and unpredictable flash floods. Probably never boated historically.
Boatable Occasionally Under Highly Unusual Circumstances		
In mid-to-high mountain regions with moderate watershed, steep slope in places, major rapids, no more than 6' wide in most places, adequate water during snowmelt periods.	Clear Creek	Not boatable except very rarely for brief stretches during rare flood events with very skilled paddlers in 1-person boats such as modern inflatable kayaks or plastic canoes. Probably never boated historically.
Boatable Seasonally		
Mountain stream, mid elevation, more than 6' wide in most places, moderate rapids (Class 1-3), few major obstacles, rocky or gravelly bottom, at least 6" of water most places for at least 1 month of the year.	San Francisco River	Boatable for several weeks most years, with some possible portages in kayaks, canoes, inflatables by skilled boaters. Probably never boated historically.
Mid to low elevation stream, more than 10' feet wide, no major rapids, at least 12" of water for at least one month of the year.	Gila River below Coolidge Dam	Easily boatable in wooden rowboat, skiff, flatboat, canoe. Probably boated historically.
Mid to low elevation stream, more than 8' wide in most places, occasional Class 1-3 rapids, sandy or gravelly bottom, only occasional obstacles, at least 5" of water most places for at least one month of the year.	Verde River below Camp Verde	Easily boatable for at least one month of the year with canoes, kayaks, inflatables, rowboats. Possibly boated historically in rare situations
Mountain stream, mid elevation, more than 8' wide in most places, major rapids (Class 3-5), rocky or gravelly bottom, few major obstacles, at least 3" of water most places for at least 1 month of the year.	Burro Creek	Boatable for several weeks possible some years, with portages in 1 person inflatable kayaks or canoes, by highly skilled boaters. Probably never boated historically.
Boatable Most or All of the Time		
Mid to low elevation stream or lake, more than 10' wide, low slope, at least 24" of water most of the year, no rapids, no major obstacles, sandy or gravelly bottom	Lower Colorado River from Needles to Yuma	Easily boatable by rowboats, motorboats, sailboats, canoes, kayaks, inflatables year round.

Table 3.3 – Range of boatability of streams

Class I Still or moving water with few (if any) riffles or obstructions
Class II Small rapids with waves up to 3 feet high and obvious clear channels not requiring scouting.
Class III Powerful rapids with waves up to 5 feet high. Some maneuvering required to miss obstacles. Generally speaking Class II is the upper limit for open canoes.
Class IV Long difficult rapids requiring intricate maneuvering in turbulent waters. Scouting often necessary. Rescue difficult.
Class V. Extremely difficult, extremely violent rapids, requiring difficult and precise maneuvering to avoid numerous serious obstacles. Rescue difficult at best, impossible at worst.
Class VI The most extreme whitewater, generally synonymous with unrunnable. It is a common practice to upgrade to Class V if someone succeeds in running it.
All classes can change depending on season.

Figure 3.2 – The international whitewater rating scale

"There is a bit of revolution in river running going on in the state that makes it hard to give definitive information.. Boaters who aren't content to resign themselves to a few days of fun per year on most of the state's rivers have started using durable plastic canoes and single person inflatables to run them at levels well below what in the past has been considered boatable. These seemingly stubborn individuals may end up dragging their boats over a riffle too shallow to float once in a while but to pay that small inconvenience for the reward of a day in the river is well worth it in their eyes." Arizona State Parks (1989)

3.3.3 Width and Depth

Charts are available which indicate minimum width and depth for various kinds of boats, but there is little agreement on the actual figures. Arizona State Parks, for example, considers that a canoe or kayak needs 6" in depth and 4' in width, while Jim Slingluff, of the Central Arizona Paddler's Club, claims that 2-3" in depth is adequate. Professional river guides with High Desert Adventures, St. George Utah, say they would not choose to take a canoe very far in less than one foot of depth because of the need to control the boat by dipping the paddles deeply into the water without obstructions. They also point out that depth needed depends on how heavily the boat is loaded. With two paddlers and some goods, a canoe can sink 6" deeper than with one paddler and few supplies. See Table 3.4 for some claims on width and depth. See the Appendix B-4 for quotes from the Utah Riverbed Case and other sources on how much "draw" various kinds of boats had (i.e., how far they sank when fully loaded). Draw is a good indication of required depth, but not equivalent to it, as the needs of the paddler must be considered as well as the ability to avoid rocks on the bottom.

3.3.4 Slope

The slope (determined by average number of feet per mile the river drops) determines how fast the river flows downstream - the faster the flow, the more difficult rapids are to maneuver. The slope of rivers usually changes throughout the river, with nearly flat calm areas intermixed between moderate or extreme rapids. Where a slope suddenly becomes close to vertical, a waterfall occurs which few would dare to run. While average slope gives quite a bit of information, it does not tell the whole story since sharp drops in a river with low average gradient can make a river hazardous.

3.3.5 Rapids

Rapids occur when the slope of the river suddenly increases, often because of increased slope, decreased width, and/or the presence of rocky areas (sometimes due to landslides). Rapids increase the excitement and thrill of river running, but can be so dangerous as to make a river unrunnable. The International Whitewater Rating Scale in Figure 3.2 was developed to give river runners guidelines for difficulty of various rivers. In Arizona, the amount of water in the stream can vary so greatly throughout the year that the scale is difficult to apply, as a river may be Class I at some times of year and Class II - IV at others, for example, while at some times there is little or no water at all. The scale in Figure 1. is only a general guideline to boatability.

3.3.6 Obstacles

Obstacles include boulders, overhanging branches, beaver dams, sand bars or man-made obstacles such as dams or barbed wire fences. Some of these obstacles are more of a problem at some times of year than others. On the Virgin River, for example, whether or not one large boulder is visible or submerged is considered a test of boatability during spring runoff. Boulders that are fully submerged by plenty of water can be avoided, while boulders emerging from the water can lead to crashes. Sandbars can make the river unrunnable if too extensive. Even a small man-made dam can be a severe hazard to boats.

Boat type	Depth (ft.)	Width (ft.)	Source	Other
Canoe	0.5	4.0	USFWS[1]	
Canoe	0.3 - 0.5		Slingluff[2]	4" for flatbottomed; 6" for round-bottomed
Canoe	3.0 - 6.0	25.0	Cortell[3]	
Canvas Boat	0.2		Sears Catalog 1910	Hunting in calm water
Drift Boat	1.0	50.0	Cortell	
Duck Boat	0.2	3.0	Sears Catalog 1910	
Innertube	1.0	15	Cortell	
Innertube	1.0	4.0	USFWS	
Kayak	0.5	4.0	USFWS	
Kayak	0.15	4.0	Brosius[4]	Can go anywhere there's a little water.
Low-power boat	1.0	25.0	Cortell	
Plastic canoe/ 1-person inflatable	Very shallow		ASP[5]	Can go places previously thought nonboatable.
Neoprene Raft	1.0	6.0	USFWS	
Neoprene Raft	1.0	50.0	Cortell	
Rowboat/Drift Boat	1.0	6.0	USFWS	

Table 3.4 - Some estimates of depth of water and width of stream needed for boating

1. U.S. Fish and Wildlife Service (1978): Methods of Assessing Instream Flow for Recreation. FWS/OBS
2. Slingluff, Jim (1987): Testimony in Maricopa County et al. v State of Arizona et al.
3. Cortell and Associations (1977): Recreation and Instream Flow Vol. 1 Flow Requirements BORD6429
4. Brosius, Jack (1978): Canoes and Kayaks: A Complete Buyer's Guide.
5. Arizona State Parks (1989): Arizona Rivers and Streams Guide. Phoenix.

3.3.7 Portages

Obstacles can be surmounted in many cases by portaging the boat around the obstacle. This is possible where the floodplain is wide enough, and clear enough of vegetation and rocks to make walking possible. If there are only a few portages needed, the river remains boatable. When, however, the canyon walls rise steeply from the river, the area is too rocky or vegetation too dense for long stretches, the river becomes unboatable. "Lining" is similar, except that boatmen attach ropes to the boats and let them float while the people keep hold of it from the shore, walking the boat down the river. Lining can be difficult and dangerous in strong currents.

3.4 SOME PAST SUPREME COURT RULINGS ON NAVIGABILITY

3.4.1 General Rulings

The U.S. Supreme Court has made rulings on navigability in over one hundred cases, but has never set hard and fast rules on what kinds of boats are needed to show navigability, what stream conditions are required or what length of flow season is necessary for a determination. The following are excerpts from U.S. Supreme Court rulings on navigability. Some trends can be determined from rulings in major cases, but any past ruling does not necessarily apply to a particular river.

In U.S. v Utah extensive research was done into past boating on the Colorado River and its Utah tributaries. Many people who had boated the rivers appeared as expert witnesses. Boating history was summarized by Frederick Dellenbaugh who had himself boated the Colorado and had thoroughly researched other boating for his two books on the subject. The range of boats described by witnesses appears as Table 3.5.

U.S. v. Utah - Non-navigability of a river is not established by comparison of conditions with those of other rivers which have been held to be non-navigable, but each determination as to navigability must stand on its own facts.

U.S. v Holt State Bank - Streams and lakes which are navigable in fact must be regarded as navigable in law

U.S. v The Montello - The capability of use by the public for purposes of transportation and commerce affords the true criterion of the navigability of a river, rather than the extent and manner of that use. If it is capable in its natural state, of being used for purposes of commerce, no matter in what mode the commerce may be conducted, it is navigable in fact, and becomes at law, a public river or highway.

U.S. v Appalachian Elec. Power Co. - The navigability of a stream is not depended upon the continuity or extent of its use for navigation, although these factors must be considered in determining, on all the facts, the question of navigability.

U.S. v Appalachian Elec. Power Co - .The navigability of a stream is to be determined on the basis, not only of its natural condition, but also of its possible availability for navigation after the making of reasonable improvements, and it is not necessary that such improvements should be actually completed or even authorized.

U.S. v Appalachian Elec. Power Co - Lack of commercial traffic does not negate navigability where personal or private use by boats demonstrates the availability of a stream for the simpler types of commercial navigation.

U.S. v Utah - Absence of existing commerce does not show a river not to be navigable, but its susceptibility in it ordinary condition to use as a highway of commerce, rather than the real manner and extent of actual use if the test. The question remains one of fact as to the capacity of the river to meet the needs of commerce as they may arise in connection with the growth of the population, the multiplication of activities, and the development of natural resources; and this capacity may be shown by physical characteristics and experimentation as well as by the uses to which the stream has been put.

3.4.2 Physical conditions of rivers

U.S. v. Utah - The mere fact of presence of sand bars causing impediments to navigation does not establish the character of a river as non-navigable.

U.S. v Cress - The test of navigability in fact is to be applied to a stream in its natural condition, not as artificially raised by dams or similar structures.

Economy Light & P. Co. v. U.S. - The fact that artificial obstructions in a stream exist, capable of being abated by due exercise of the public authority, does not prevent the stream from being regarded as navigable in law, if, supposing them to be abated, it be navigable in fact in its natural state.

Economy Light & P. Co. v. U.S. - Navigability in the sense of the law is not destroyed because the watercourse is interrupted by occasional natural obstructions or portages, nor need the navigation be open at all seasons of the year or at all stages of water.

U.S. v. Holt State Bank - A lake 3 to 6 feet deep which is an expansion of a river connected with navigable water, and which is used by merchants and settlers in transportation of persons and supplies by boats is navigable, although in times of drought navigation is difficult, and sand bars and vegetation at times interfere with navigation.

U.S. v Utah - A finding that a particular stretch of river is non-navigable is not sustainable where it does not differ in characteristics from the streams which unite to join it, which are found to be navigable above the point of confluence.

U.S. v Appalachian Elec. Power Co. - A stream may be navigable despite the obstruction of falls, rapids, sand bars, carries or shifting currents.

3.4.3 Characteristics of boats

U.S. v The Montello - Vessels of any kind that can float upon the water, whether propelled by animal power, by the wind, or by the agency of steam, may be the instruments of such commerce, although in order to give it the character of a navigable stream, it must be generally and commonly useful for some purpose of trade or agriculture.

U.S. v Rio Grande Dam & Irrig. Co. - The mere fact that logs, poles, and rafts are floated down a stream occasionally and in times of high water does not make it a navigable river.

Leovy v U.S - The mere capacity to pass in a boat of any size, however small, from one stream or rivulet to another, is not sufficient to constitute a navigable water of the United States.

U.S. v Utah - The true test of navigability of a stream does not depend on the mode by which commerce is, or may be, conducted, nor the difficulties attending navigation. It would be a narrow rule to hold that in this country, unless a river was capable of being navigated by steam or sail vessels, it could not be treated as a public highway.

U.S. v Holt State Bank - navigability does not depend on the particular mode in which such use is or may be had - whether by steamboats, sailing vessels, or flatboats.

Year	Person	Boat Type	Length	Width	Draw	Other
1869	John Wesley Powell	rowboat	21'			
1869	John Wesley Powell	rowboat	16'			
1881	Frederick Dellenbaugh	rowboat	22'	18"		
1889	Franklin Nims/Stanton	rowboat	16'	3.5'	keel bottom	
1889	Joseph Ross	skiff	15'16'	6"	flat bottom	
1891	John Best	rowboat	22'	4.5		
1893	Joseph Ross	flatbottom	16'	5-6"		500 lb. load
1893-1895	William Nix	rowboat	22'	3.5'	24"	
1896	George Flavell	flatbottom				
1900	A.V. Stevenson	rowboat	18'	5'	8"	
1900	Edward Wolverton	rowboat			9"	
1901	Edward Wolverton	rowboat	18'	3'	24"	fully loaded
1902	W.F. Reeder	rowboat	16'	4'		
1903	H.T. Yokey	rowboat	15'	3.5'		
1901-1902	A.L. Chaffin	rowboat	28'	8'	2 cylinder auto engine	
1907	Bert Loper	rowboat	16'	4'	7"	steel
1908	M. Oppenheimer	motorboat	30'	5'	18"	gasoline propeller
1908	Albert Anderson	rowboat			10-12"	
1909	Julius Stone	rowboat	16'	4'	6'8"	Galloway
1910	Henry Howland	rowboat	18'		12-14"	
1911	Ellsworth & Emery Kolb	rowboat	16'	4'	8"	Galloway
1914	Bert Loper	rowboat			7"	steel
1921	George Frantz	motorboat	24'	5-6'		6 hp engine
1921	Leigh Lint	rowboat	16'			
1921	Leigh Lint	motorboat	16'	4'	10"	Evinrude motor
1921	Frederick Dellenbaugh	rowboat	22'	5'	14-18"	Galloway type
1921	Frederick Dellenbaugh	rowboat	16'		14-18"	Galloway type
1926	John Galloway	rowboat	16'	5'	4"	
1925-1928	Virgil Baldwin	motorboat	27'	5'	10'	6 cylinder auto engine
1925-1928	Virgil Baldwin	motorboat	20'	4'	6-8"	Ford motor
1925-1928	Virgil Baldwin	rowboat	18'	3.5'	10'	
1926	Carroll Dobbin	motorboat	16'			

*Includes tributaries, mostly in Utah from the Green River many going through the Grand Canyon. where information is not listed, that information was not provided in the evidence.

Table 3.5 Examples of the small boats described as evidence of navigability in U.S. v Utah*

4.0 Watercourse Evaluation System

4.1 OVERVIEW OF THE 3-LEVEL WATERCOURSE EVALUATION SYSTEM

A primary work product of this project is an evaluation system for assessing characteristics of navigability, non-navigability, and susceptibility to navigation for the small and minor watercourses in Arizona at the time of statehood in 1912. That evaluation system is to be efficient and economical in application, practical in implementation by utilizing readily available information, and technically and historically sound. To that end, a three-level watercourse evaluation system is developed as shown in Figure 4.1.

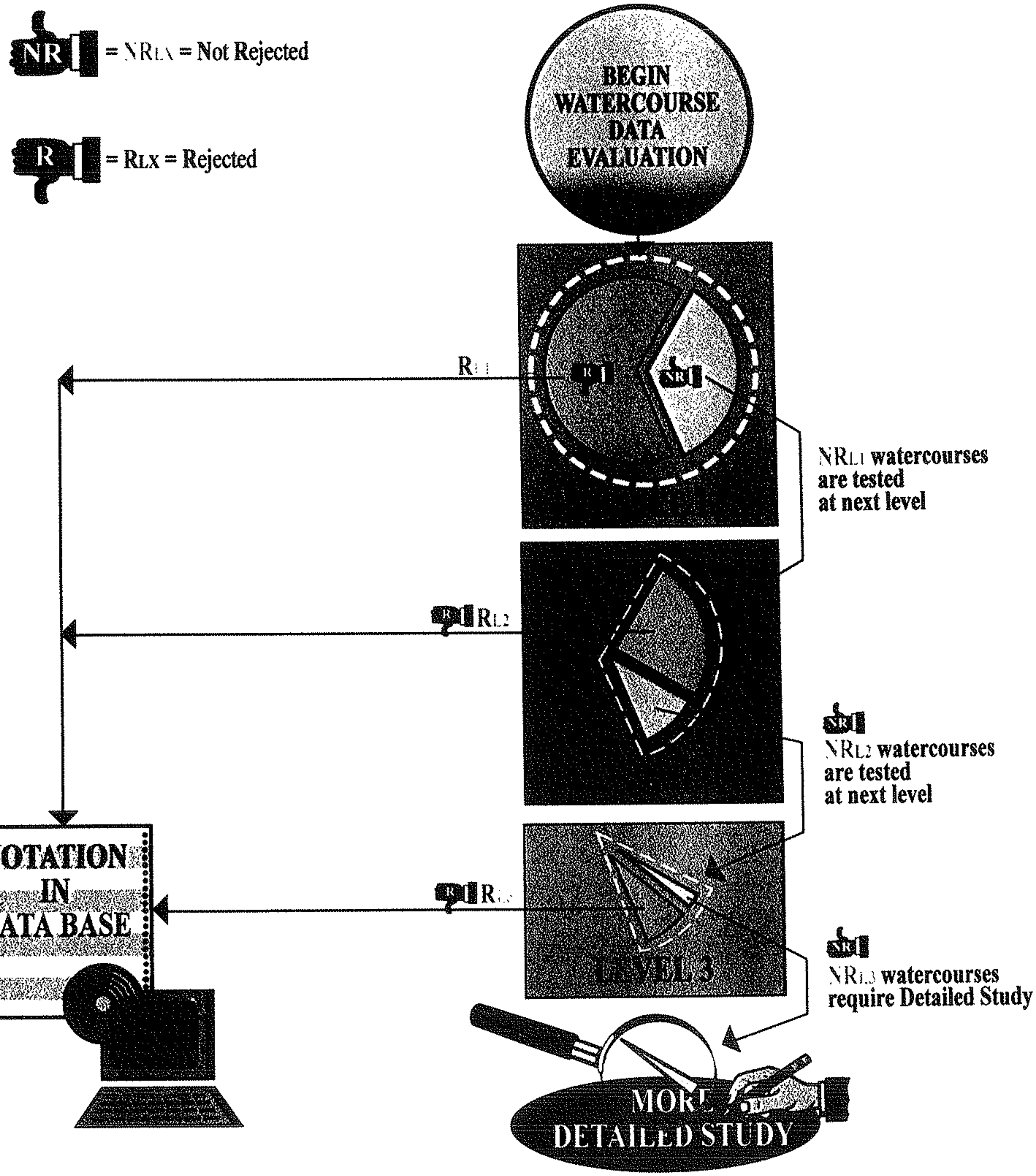
The State's definition of navigability addresses both susceptibility to navigation and actual navigation in fact. Therefore, the project team prepared a multi-level screening process designed to identify stream segments least likely to meet the statutory and legal definitions of navigability as follows:

- Levels 1 and 2 of the screening process, described in Sections 4.1 to 4.3, are intended to eliminate non-navigable streams, such as ephemeral washes with no record of historical or current boating, from further consideration by ANSAC. The Level 1 screening process is designed to be completed using only information from existing databases.

- The Level 2 screening process will be completed using a subjective quality assurance review provided by a technical working group familiar with navigability issues, as well as the characteristics of the specific Arizona watercourses identified by the Level 2 screening.

- The Level 3 screening process requires that engineering analyses be performed to estimate flow characteristics for specific watercourses. Section 4.4 summarizes the recommended Level 3 engineering analyses to be used to estimate flow characteristics on specific small watercourses in Arizona.

Three-Level Watercourse Evaluation Procedure



The multiple levels of the watercourse evaluation system comprise a series of screening tests of increasing refinement and work effort. Only those watercourses that survive the Level 1 evaluation are tested at Level 2, and so on. The benefit of this approach is the economy of effort that is realized in eliminating the need for a full, multiple-level assessment of each watercourse. Little justification exists to undertake more intensive and expensive evaluation at the next level when it is evident that the watercourse does not meet the technical criteria indicative of the susceptibility to navigation and the historical criteria indicative of navigation in fact. This is the only prudent approach to avoid unnecessary, detailed assessment of each watercourse even when basic susceptibility criteria are clearly not met.

The multi-level evaluation system and the watercourse database catalog function interdependently. The data fields of the database catalog are populated only enough to make the necessary decisions for each test. The database is structured so as to keep a running notation of the results of the testing for each criterion in a narrative format for each stream segment. This feature will provide ANSAC with a full record of information which presents the reasons for the disposition of each watercourse segment as it proceeds through the screening process. Potentially, an individual not in agreement with the disposition of a particular watercourse at any level may challenge that finding based on submitted evidence relative to that watercourse. ANSAC has a ready resource for use in considering further evaluation of the watercourse finding being challenged.

Testing and refinement is an important element in the development of a workable, efficient, and sound evaluation system. To that end, testing was conducted for each of the various categories of watercourses. Results were instructive in terms of needed modifications to the testing criteria at each level. Section 5.6 contains further discussion of database testing and results.

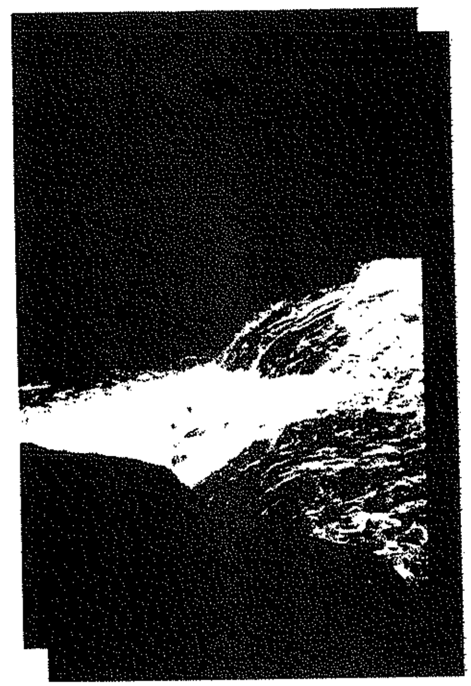
4.2 LEVEL 1

Figure 4.2 summarizes the pertinent features of the Level 1 screening of stream segments for characteristics of navigability.

Goal - The goal of Level 1 of the watercourse evaluation procedure is to perform a first-cut screening of the catalog of stream segments. The purpose is to eliminate the watercourses most likely to be non-susceptible to navigation and which exhibit no evidence of actual navigation in fact.

Level 1 Evaluation

- Coarse Sort
- Eliminate Watercourses Most Likely to be Non-Susceptible to Navigation



- Quantitative Screening Analysis
- Binary Database Queries

- Stream Type
- Dam Information
- Historical Boating
- Modern Boating
- Fish
- Special Status

- Apply full test to all watercourses in the database catalog

- RL1: Watercourses which are most likely non-susceptible to navigation
- NRL1: Watercourses which require qualitative evaluation at Level 2

Methodology - The Level 1 analysis is a binary, quantitative sorting process utilizing the data queries programmed into the database catalog. Those data queries are the digital expression of the technical and historical criteria considered diagnostic for evaluating watercourses for susceptibility to navigation and navigation in fact, respectively.

Data Requirements - Figure 4.3 shows the decision flow chart for the Level 1 watercourse evaluation. All watercourse segments are tested against the full set of data queries. A text record of the results of the testing for each segment is so noted in the database catalog. Only one affirmative answer to any one data query test is enough justification to advance that segment to Level 2 evaluation. A watercourse must test negative for all six queries to be eliminated at Level 1. A brief description of the content of each of the data queries follows.

Stream Type - The typical flow characteristics for a stream segment are highly significant in addressing susceptibility to navigation. As previously described in Section 2.1.2, the categories of possible stream type include ephemeral, intermittent, interrupted, and perennial. Based upon the criteria used to categorize stream type in the source databases, the Level 1 stream type data query is programmed to separate all non-perennial stream segments from the perennial ones. Perennial segments are tested for the remaining five queries, but they will advance to Level 2 evaluation regardless since they already test to the affirmative for stream type.

Non-perennial segments include those that are ephemeral, intermittent, and interrupted. These watercourses are still tested for all remaining five screening tests. However, if they do not result in the affirmative to any other tests (i.e. dam, historical or modern boating, fishery, and/or special status), they are considered unlikely to support navigation and do not advance to Level 2 evaluation.

The statutory justification for the elimination of non-perennial segments with no other features tested at Level 1 lies in the interpretation of ARS §37-1128 C. The legislation states:

> *"The Commission shall find and recommend that a watercourse was non-navigable if, as of February 14, 1912, the watercourse either:*
> *1) Was not used or susceptible of being used for both commercial trade and travel. 2) Flowed only in direct response to precipitation and was dry at all other times."*

Level 1 Screening Procedure

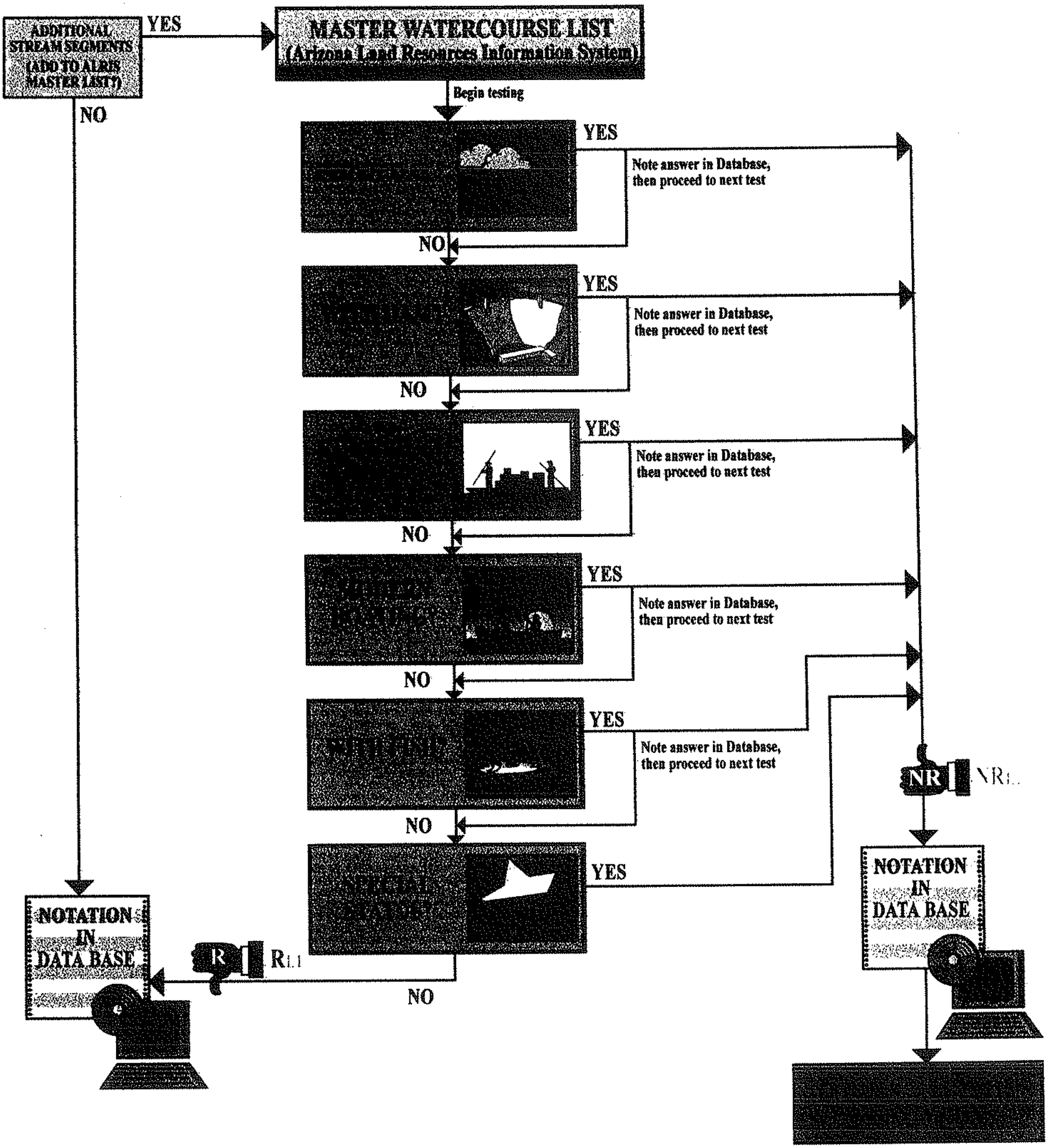


Figure 4.3
Level 1 Screening Procedure

ARS §37-1128 C.2. is the classic definition of ephemeral streams, justifying the screening out of the segments designated ephemeral in the database. Watercourses which are temporally varied in flow (intermittent) or are spatially varied in flow (interrupted) are unlikely to be navigated for commercial purposes. ARS §37-1128 C.1. addresses susceptibility to commercial trade and travel justifying the elimination of intermittent and interrupted segments.

With Dam - The location of a dam on a watercourse is significant in addressing susceptibility to navigation and navigation in fact. A dam can impact that stream segment and adjacent upstream and downstream segments to the extent that the flow regime is altered making it non-susceptible to navigation. In addition, certain dams can present impediments to actual navigation in fact. It is noted that the database catalog contains information for dams which are within the jurisdiction of the Dam Safety Section of the Arizona Department of Water Resources (ADWR). Small irrigation diversion works and stock ponds which do not meet the jurisdictional criteria of the ADWR dam safety program are not included. This is justified based on the fact that the smaller diversion dams can probably be portaged and that most stock ponds are located on ephemeral or intermittent streams. Additionally, no complete inventory of these smaller structures exists and the effort to compile one is impractical to consider.

Historical Boating - The project team researched several historical sources as described in Section 3.1. One work product of that research is the population of the data field which contains the record of documented cases of historical boating. An affirmative test result for the historical boating data query is very significant since it documents actual navigation in fact. A segment which tests affirmatively will advance to Level 2. A segment with no documented accounts of historical boating is assumed to have not been historically navigated, resulting in a negative test result for that query. Even though the segment tests negatively for historical boating, it will still be tested for the other five Level 1 data queries.

Modern Boating - Modern boating is considered of sufficient importance as to be included in the initial Level 1 screening. An inventory of watercourse segments considered boatable is readily available from various sources. Modern boating is indicative of susceptibility to navigation. Generally speaking, the changing conditions along Arizona's rivers and streams have decreased their susceptibility to navigation with time as a result of the construction of engineering works and the overdraft of the groundwater table. If a watercourse is boatable in recent time, it is possible that it would also have been susceptible and even actually boated in historic time as well. An affirmative test result for a modern boating account will advance that watercourse to Level 2 evaluation which will verify the type of boating and the conditions under which such boating occurred. A segment with no documented accounts of modern boating is assumed to not be currently boatable, resulting in a negative test result for that query. That segment will still be tested for the other five Level 1 data queries.

With Fish - While the biological factor of documented evidence of the existence of fish in a particular segment is not salient to the navigability question, their presence is generally indicative of a dependable supply of water. Watercourses with dependable water are more likely to be susceptible to navigation. An affirmative test result for the existence of fish will advance that watercourse to Level 2 evaluation which further addresses the presence and duration of dependable flow on the basis of the species of fish which are present. A segment with no documented accounts of the presence of fish is assumed to be currently not considered a fishery, resulting in a negative test result for that query. That segment will still be tested for the other five Level 1 data queries.

Special Status - The last data query considers whether or not a segment is listed by various agencies for a special class or special watercourse designation. The data query for special status designations includes Instream Flow Rights, Unique Waters, Wild and Scenic Rivers, Riparian Areas, and Preserved Areas such as Wildlife Refuges and State Parks, among others. This information is significant to the navigability question in that it is indicative of a watercourse segment with a set of special characteristics such that it should be evaluated at a more refined level of inspection. A segment which tests affirmatively for special status designation advances to Level 2 analysis which is a review of the basis of the particular special status designation for that segment relative to any bearing it may have on the issue of navigability. A segment with no documented special status is assumed to have no unique or outstanding characteristics that would require a more detailed check at the next level. That segment will still be tested for the other five Level 1 data queries.

<u>Application</u> - The data queries are applied to the entire catalog of watercourses contained in the database master list. That list is a compilation of several already existing watercourse databases from various agencies, as described in more detail in Section 5.2 of this report. A watercourse not listed in the database catalog may be

brought before ANSAC for consideration. That watercourse may be reviewed by a technical review committee for verification of documented evidence. It can either be added to the list for Level 1 evaluation, or determined insignificant and so noted in the database catalog.

Resulting Datasets - The Level 1 screening process results in two datasets of watercourses. The segments that have negative responses to all six of the data queries are most likely to be non-susceptible to navigation and; therefore, are considered low priority for further review. Those segments form dataset RL1(i.e., Rejected Level 1). The segments that have one or more affirmative responses to the any of the data queries require further evaluation at Level 2. Those segments form dataset NRL1 (i.e., Not Rejected Level 1).

4.3 LEVEL 2

Figure 4.4 summarizes the pertinent features of the Level 2 screening of stream segments for characteristics of navigability.

Goal - The goal the Level 2 watercourse evaluation procedure is to perform a more refined screening of the catalog of stream segments to eliminate the watercourses unlikely to be susceptible to navigation.

Methodology - The Level 2 screening process is completed using a subjective quality assurance review provided by a technical working group familiar with navigability issues, as well as the characteristics of the specific Arizona watercourses identified by the Level 2 screening.

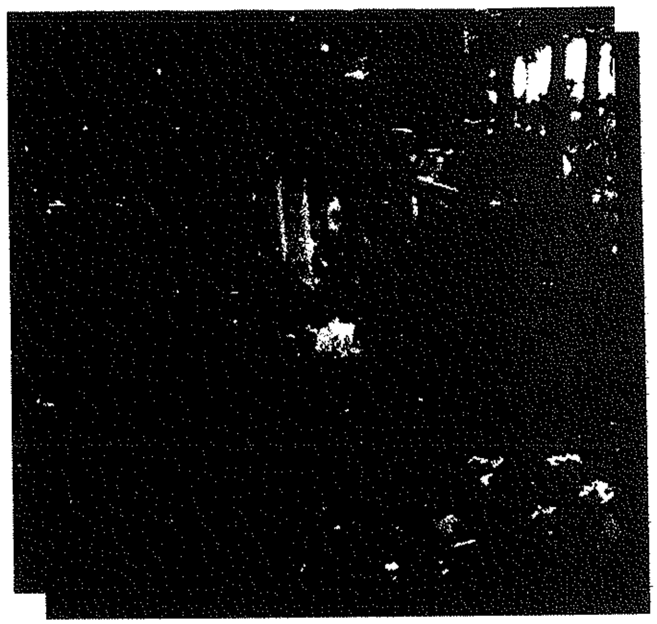
Data Requirements - Level 2 review involves the qualitative review of watercourse segment location, typical watershed characteristics, typical watercourse characteristics, among other features, for verification and interpretation of the reason(s) which caused them to advance from Level 1. The following are examples of the type of quality control checks envisioned.

Fish Categories - The segments with documented fisheries are further investigated as to the fish species present. Arizona Game & Fish Department (AZGF) input is sought to categorize fish by species which require a certain volume and duration of flow to survive. This information is used to assess the potential flow characteristics for that watercourse that are indicative of susceptibility to navigation.

Level 2 Evaluation

- Refined Sort
- Eliminate Watercourses Unlikely to be Susceptible to Navigation

- Qualitative Approach
- By Inspection
- Quality Control Check



- Fish Categories
- Boating Account Verification
- Special Status Specifics
- Outlier Verification

- Apply to NRL1 watercourses in the database catalog

- RL2: Watercourses which are unlikely to be susceptible to navigation
- NRL2: Watercourses which merit quantitative engineering analysis at Level 3

Boating Account Verification - The documented evidence of actual navigation of any of the segments is verified as whether or not the boating was opportunistic (during a high flow event) or was a regular occurrence. If available, the purpose of the boating occurrence is also investigated.

Special Status - The segments of special status are reviewed to determine if the particular designation for each watercourse relates to navigation in any way. For example, a watercourse with a Unique Water classification on the basis of exemplary water quality alone does not relate to navigability question.

Outlier Verification - The Level 2 review also looks for inconsistencies in the results of the Level 1 screening process between adjacent segments of a watercourse. The database can be searched on the basis of the hydrologic unit code to obtain a count of segments by river type (or any data field) to facilitate outlier verification.

Application - The Level 2 quality assurance review is applied only to the watercourses contained in the database catalog that advanced from the Level 1 screening process (NRL1 dataset). As in Level 1, a text notation is made in the database as to the disposition of the watercourse following Level 2 analysis.

Resulting Datasets - The Level 2 evaluation results in two datasets of watercourses. The segments that are unlikely to be susceptible to navigation form dataset RL2 (i.e. Rejected Level 2). The watercourses which merit quantitative engineering analysis at Level 3 form dataset NRL2 (i.e. Not Rejected Level 2).

4.4 LEVEL 3

Figure 4.5 summarizes the pertinent features of the Level 3 screening of stream segments for characteristics of navigability. The Level 3 screening process requires that engineering analyses be performed to estimate flow characteristics for specific watercourses. This Section summarizes the recommended Level 3 engineering analyses to be used to estimate flow characteristics on specific small watercourses in Arizona.

Level 3 Evaluation

Goal

- Fine Sort
- Eliminate Watercourses Non-Susceptible to Navigation

Methodology

- Quantitative Engineering Methodologies
- Detailed Hydrologic and Hydraulic Analysis

Requirements

- Flow Rate
- Flow Characteristics
- Obstacles

Application

- Apply to NRL2 watercourses in the database catalog

Resulting Datasets

- RL3: Watercourses which are not susceptible to navigation
- NRL3: Watercourses which are susceptible and merit more detailed study

Goal - The objective of this project is to develop minimum criteria for determining navigability, non-navigability, or susceptibility to navigation for small and minor watercourses in Arizona as of the time of statehood. The primary objective of the Level 3 engineering methodologies is to provide technically sound data from which typical channel characteristics and flow rates for each stream segment can be estimated and used to determine *susceptibility* to navigation.

Simply stated, the objective of the recommended engineering analyses is to provide enough information to answer the following question: "Could this stream be boated?"

Methodology - To answer the question, "Could someone boat this stream?" the following questions must also be answered:

- What type of boat(s) are to be considered? Different boats have different minimum flow depth and width requirements.
- What flow frequency or recurrence interval is to be considered? Streamflow on every natural stream varies considerably throughout the year, as well as from year to year.
- Over what time period(s) must the stream be boatable? Many Arizona streams dry up completely during the summer and fall, but support commercial boating operations in the winter and spring.
- What is the expected flow depth, width, and velocity at the specified flow rate(s)?
- What obstacles exist that might prevent boating? Permanent high flow conditions do not guarantee that a stream can be boated.

Engineering methodologies cannot provide answers to the first three questions. The Arizona legislature has provided limited guidance regarding the types of boats to be considered. However, the boats specified in ARS §37-1128D.3 exclude certain low-draft boat types known to be in use as of the time of statehood, and exclude all modern low-draft boats from consideration. Consideration of only the types of boats specified in this legislation may not be supported by most navigability case law.

Flow Rate - ARS §37-1101ff (HB 2589) provides no guidance on a flow frequency or flow duration that defines susceptibility to navigation, except that ephemeral streams[3] are non-navigable. Lacking statutory guidance, the following are flow rates and/or flow frequencies that could be used to estimate flow characteristics to determine susceptibility to navigation:

[3] HB2589:37-1127.C.2 - "flowed only in direct response to precipitation and was dry at all other times."

- *Average Annual Flood Peak.* The average annual flood has a recurrence interval of about 2.3 years, and represents the largest peak flood flow rate in an average year.
- *Average Annual Flow Rate.* The average annual flow rate in cubic feet per second, or mean annual flow, is estimated by dividing the average total flow volume in cubic feet by the number of seconds in a year.
- *50% Flow Duration Rate.* The 50% flow duration rate, or median flow rate, is the flow rate that is exceeded 50% of the time.
- *Monthly Average Flow Rates.* Monthly flow data reflect the average seasonal variation in flow rate due to watershed conditions such as snowmelt or monsoon rainfall.

Table 4.1 summarizes possible sources of methodologies or data from which to estimate the flow rate and frequency information summarized above.

Evaluation. As shown in Table 4.1, there are several possible flow frequencies that could be used to estimate flow characteristics and navigability criteria.

Table 4.1
Level 3 Engineering Methodology - Flow Rate Methodologies & Sources of Data

Flow Rate Frequency	Source of Estimate
Average Annual Flood	USGS Regression Equations - USGS OFR 93-419 USGS Gage Records – USGS OFR 91-4041
Average Annual Flow	USGS Publications - USGS OFR (Not numbered, 1970) USGS OFR 87-535 USGS WRIR 90-4053 NRCS - ARS Publications Renard, 1977 USGS Gage Records – USGS OFR 91-4041
50% Flow Duration	USGS Gage Records – USGS OFR 91-4041
Monthly Average Flow Rates	USGS Gage Records – USGS OFR 91-4041

References Cited:
1. Thomas, B.E., Hjalmarson, H.W., & Waltemeyer, S.D., 1994, Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States, USGS Open File Report 93-419.
2. Garrett, J.M., & Gellenbeck, D.J., Basin Characteristics and Streamflow Statistics in Arizona as of 1989, USGS Water Resources Investigations Report 90-4041.[4]
3. Mooseburner, O, 1970, A Proposed Streamflow-Data Program for Arizona, USGS Open File Report, Tucson, Arizona (unnumbered).
4. Krug, W.R., Gebert, W.A., Graczyk, D.J., 1989, Preparation of Average Annual Runoff Map of the United States, 1951-80, USGS Open File Report 87-535.
5. Baldys and Bayles, 1990, Flow Characteristics of Streams That Drain the Fort Apache and San Carlos Indian Reservations, East-Central Arizona, 1930-1986, USGS Water Resources Investigations Report 90-4053.
6. Renard, K.G., 1977, "Past, Present, and Future Water Resources Research in Arid and Semiarid Areas of the Southwestern United States." Australian Institution of Engineers 1977 Hydrology Symposium, p. 1-29.

[4] An updated version of Garrett and Gellenbeck (1989) is expected for release by the USGS in October 1998. The most recent version of the USGS streamflow summary should be used.

- *Average Annual Flood.* The average annual flood peak is the easiest flow rate to estimate most accurately, given the number of methodologies available and the large number of crest stage gauges compared to continuous flow record stations. However, because of the nature of floods on most Arizona streams, the average annual flood peak rate usually does not reflect "typical" flow conditions. Therefore, if the average annual flood rate is used to estimate flow characteristics, most streams will appear to have flow depths and widths that could support navigation by a wide variety of boat types.[5] To estimate the average annual flood, the following methodologies are recommended:

  1. Ungaged Streams:
     Thomas, B.E., Hjalmarson, H.W., & Waltemeyer, S.D., 1994, Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States, USGS Open File Report 93-419.[6]

  2. Gaged Streams:
     Garrett, J.M., & Gellenbeck, D.J., Basin Characteristics and Streamflow Statistics in Arizona as of 1989, USGS Water Resources Investigations Report 90-4041.

- *Average Annual Flow.* Several methodologies have been developed to estimate the average annual flow rate on ungaged streams in Arizona. With the exception of the flow estimates based on the regional maps shown in Krug et. al. (USGS OFR 87-535), none of the available methodologies are applicable to the entire state of Arizona. Because of the large volume of runoff that occurs during floods compared to low flow events, average annual flow rates tend to be skewed upward on many Arizona streams. This tendency can be illustrated by comparing average annual and median (50%) flow rates.[7] Therefore, flow characteristics estimated

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[5] For example, the average annual flow peak for an ephemeral wash with a 5.0 square mile watershed in eastern Yuma County would be about 300 cfs, using the USGS regression equations for Arizona Region 13. Assuming a roughly rectangular channel with a 20 foot topwidth, a Manning's N of 0.035, and a slope of 0.01 ft/ft., the estimated flow depth and velocity would be 2.3 feet and 6.5 ft/sec., respectively.

[6] This methodology may not be appropriate for streams in urbanized or agricultural watersheds, on alluvial fans or distributary flow areas, or downstream of dams.

[7] For example, the estimated long-term average annual and median flow rates for the Salt River at Granite Reef Dam are 1,689 cfs and 1,230 cfs, respectively (Thomas, B.W. & Porcello, J.J., 1991, Predevelopment Hydrology of the Salt River Indian Reservation, East Salt River Valley, Arizona. USGS Water Resources Investigations Report 91-4132.)

using the average annual flow rate may tend to overestimate typical flow depths and widths. The average annual flow rate may be estimated using the following methodologies:

1. Ungaged Streams.
   Moosebumer, O, 1970, A Proposed Streamflow-Data Program for Arizona, USGS Open File Report, Tucson, Arizona (unnumbered). Applicable to most of Arizona.

   Krug, W.R., Gebert, W.A., Graczyk, D.J., 1989, Preparation of Average Annual Runoff Map of the United States, 1951-80, USGS Open File Report 87-535. Applicable to all of Arizona.

   Baldys and Bayles, 1990, Flow Characteristics of Streams That Drain the Fort Apache and San Carlos Indian Reservations, East-Central Arizona, 1930-1986, USGS Water Resources Investigations Report 90-4053.

   Renard, K.G., 1977, "Past, Present, and Future Water Resources Research in Arid and Semiarid Areas of the Southwestern United States." Australian Institution of Engineers 1977 Hydrology Symposium, p. 1-29.

2. Gaged Streams
   Garrett, J.M., & Gellenbeck, D.J., Basin Characteristics and Streamflow Statistics in Arizona as of 1989, USGS Water Resources Investigations Report 90-4041.

- *50% Flow Rate*. The median flow rate may be the most representative flow rate for use in estimating flow characteristics since it is not skewed by floods and occurs (or is exceeded) at least half of the time. Unfortunately, flow duration data are not available for most stream segments in Arizona, and methodologies to generate flow duration data from watershed characteristics have not yet been developed.[8] However, there are 138 continuous record USGS gaging stations in Arizona that have sufficient data from which average flow duration statistics can be derived. These continuous-record stations are spread throughout the State. Therefore, existing methodologies could be used to transfer gaged flow records to the adjacent ungaged watersheds, although extrapolation of flow data between

[8] The USGS-Phoenix is currently considering a proposal to develop methodologies for estimating mean annual flow and median flow for Arizona streams.

watersheds significantly increases the level of uncertainty in the estimated flow rates. The median flow rate may be estimated using the following methodologies:

1. Ungaged Streams
   Obtain Streamflow (Gauge) Data from: Garrett, J.M., & Gellenbeck, D.J., Basin Characteristics and Streamflow Statistics in Arizona as of 1989, USGS Water Resources Investigations Report 90-4041.

   Transfer Methodology from: Linsley, R.K., Kohler, M.A., and Paulhus, J.L.H., 1982, *Hydrology for Engineers, 3rd Edition*. McGraw Hill Book Company, New York.

2. Gaged Streams
   Garrett, J.M., & Gellenbeck, D.J., Basin Characteristics and Streamflow Statistics in Arizona as of 1989, USGS Water Resources Investigations Report 90-4041.

- *Monthly Average Flow Rate*. Monthly average flow rate data are particularly useful for intermittent and perennial streams which flow seasonally and reliably at navigable rates, due to snowmelt or seasonal precipitation, but are dry or are not boatable during other seasons. Unfortunately, monthly average flow data are not available for most stream segments in Arizona, and methodologies to generate flow duration data from watershed or stream characteristics have not yet been developed. However, there are 138 continuous record USGS gaging stations in Arizona that have sufficient data from which monthly average flow statistics can be derived. These continuous-record stations are spread throughout the State. Therefore, existing methodologies could be used to transfer gaged flow records to the adjacent ungaged watersheds, although extrapolation of flow data between watersheds significantly increases the level of uncertainty in the estimated flow rates. Monthly average flow rates may be estimated using the following methodologies:

  1. Ungaged Streams
     Gage Data from: Garrett, J.M., & Gellenbeck, D.J., Basin Characteristics and Streamflow Statistics in Arizona as of 1989, USGS Water Resources Investigations Report 90-4041.

Transfer Methodology from: Linsley, R.K., Kohler, M.A., and Paulhus, J.L.H., 1982, *Hydrology for Engineers, 3rd Edition*. McGraw Hill Book Company, New York.

2. Gaged Streams

   Garrett, J.M., & Gellenbeck, D.J., Basin Characteristics and Streamflow Statistics in Arizona as of 1989, USGS Water Resources Investigations Report 90-4041.

- *Other Methodologies.* The USGS has developed methodologies for estimating average flow rates from stream channel or watershed characteristics in other western states. The following publications are examples of these methodologies:

  Hedman, E.R., and Osterkamp, W.R., 1982, Streamflow Characteristics Related to Channel Geometry of Streams in Western United States. USGS Water-Supply Paper 2193.

  Parrett, C., and Carter, K.D., 1990, Methods for Estimating Monthly Streamflow Characteristics at Ungaged Sites in Western Montana. USGS Water-Supply Paper 2365.

  Parrett, C., Omang, R.J., and Hull, J.A., 1983, Mean Annual Runoff and Peak Flow Estimates Based on Channel Geometry of Stream in Northeastern and Western Montana. USGS Water-Resources Investigations Report 83-4046.

  Parrett, C., Hull, J.A., and Omang, R.J., 1987, Revised Techniques for Estimating Peak Discharges from Channel Width in Montana. USGS Water-Resources Investigations Report 87-4121.

In general, these types of channel characteristic methodologies are not accurate when applied to most streams in Arizona because the influence of floods (rather than median flow) on channel geomorphology, low unit water yields, and unique soil and vegetative characteristics along Arizona streams. A nationwide study[9] of these methodologies concluded:

> *"Results of the regression analyses indicate that streamflow characteristics can be defined more accurately in the humid Eastern and Southern regions than in the more arid Western and Central regions, that medium flows can be more accurately defined than high flows, and that low flows can be only weakly defined."*

[9] Thomas, D.M., and Benson, M.A., 1970, Generalization of Streamflow Characteristics From Drainage-Basin Characteristics, USGS Water-Supply Paper 1975, p. 1.

Therefore, the channel and watershed characteristic methodologies cannot be relied on to universally provide the level of accuracy required for making navigability or non-navigability decisions.

Recommended Flow Rate Methodology. The following methodologies are recommended to estimate a flow rate from which navigability flow characteristics may be estimated:

1. Ungaged streams.

   Step 1 - Estimate the mean annual flow using one of the publications cited above. Compare the flow estimate to the mean annual flow rate for similar nearby gaged watersheds.

   Step 2 - Extrapolate nearby gaged watershed data to obtain likely median (50%) flow rate.

   Step 3 - Extrapolate nearby gaged watershed data to obtain likely monthly fluctuation in flow rates.

   Step 4 - Use engineering judgment to select the median (50%) and/or seasonal average flow rates to estimate "typical" flow characteristics, depending on stream characteristics.

2. Gaged streams.

   Step 1 - Collect the USGS streamflow statistics summarized in Garrett and Gellenbeck (1990)[10] to obtain estimates of the median (50% duration) and monthly average flow rates

   Step 2 - Use engineering judgment to select either the median (50%) and/or seasonal average flow rates to estimate "typical" flow characteristics, depending on stream characteristics.

The flow rates obtained from the methodologies listed above should be used to estimate flow characteristics, as described below.

Flow Characteristics - The primary objective of identifying a representative flow rate for each stream segment is to estimate the following flow characteristics, which can then be compared to specific navigability criteria:

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[10] An updated version of Garrett and Gellenbeck (1989) is expected for release by the USGS in October 1998. The most recent version of the USGS streamflow summary should be used.

- Flow Depth
- Flow Width
- Average Velocity

Two alternative methodologies are typically used to estimate flow characteristics

1. *Regime Equations*. Regime, or regime-type, equations relate channel geometry to flow rate. For the purposes of the Level 3 navigability screening, regime equations could be used to estimate the expected channel width, depth and velocity for a given flow rate. However, regime equations are most accurate for steady flow conditions, where the "channel-forming" discharge can be readily identified. Most streams in Arizona cannot be considered as "in regime" due to the influence on stream geomorphology of flood flows, historic watershed changes, urbanization impacts, episodes of channel entrenchment, or upstream impoundments and diversions. Attempts by the USGS and others to develop reliable regime-type equations relating channel characteristics to discharge or to watershed characteristics have not been successful for most streams in Arizona (cf. Hedman & Osterkamp, 1982) or have resulted in unacceptably large standard error.[11,12]

   Therefore, application of regime-type equations is not recommended for Arizona stream navigability adjudication.

2. *Manning's Ratings*. Use of Manning's equation to perform hydraulic ratings of channel cross sections is standard engineering practice in Arizona, and is the basis of most floodplain mapping and hydraulic analyses performed in the United States. To apply Manning's equation to a given stream reach, the information summarized in Table 4.2 is needed.

As shown in Table 4.2, use of Manning's equation to estimate flow characteristics for a stream segment requires a significant level of effort. To reduce the number of streams that the full level of effort is required, the following approach is proposed:

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[11] Methodologies have been proposed to estimate bankfull width and depth, and average width and depth, from mean annual discharge, peak discharge, or bankfull discharge on Arizona streams. However, given the error inherent in these methodologies, in conjunction with the error possible in the discharge estimates, the resulting predicted flow characteristics probably would not be accurate enough to withstand legal scrutiny, and may not meet the Arizona Supreme Court's requirement that each stream be analyzed to determine the public trust value and navigability characteristics.

[12] For example, Hedman & Osterkamp's (1982) equations indicate that standard error of estimate for ephemeral sand channels in the desert Southwest is approximately 75%, compared to 28% for perennial alpine channels. Average annual flow data from the USGS Rillito Creek near Tucson station indicate that an active channel width of 1,224 feet would be required to obtain the gaged average annual discharge of 14 cfs. The actual natural active channel width at this station was generally less than 400 feet.

Step - 1. Estimate the average annual flood discharge using the USGS regression equations using the procedures outlined above.

Step - 2. Estimate the mean annual discharge using the procedures outlined above. If the mean annual discharge is less than 15 cfs and the average annual flood discharge is less than 250 cfs, proceed to Step 3. If the mean annual discharge is greater than 15 cfs or the average annual flood discharge is less than 250 cfs, a full analysis of discharge and a Manning's rating is required.

Step - 3. Estimate an average channel width and slope from a USGS topographic map. Estimate a conservative Manning's 'n' value based engineering judgment.

Step - 4. Perform a Manning's rating using the mean annual discharge, and the channel width and slope from the USGS topographic map, assuming a rectangular channel.

Step - 5. Compute the flow depth for the assumed conditions. If the calculated depth is less than 0.5 foot (the minimum canoe threshold depth), the stream probably is not navigable at the estimated flow rate. If the calculated depth is greater than 0.5 foot, a more detailed cross section should be obtained from field data, detailed topographic mapping, or other sources.

Table 4.2
Level 3 Engineering Methodology - Flow Characteristic Data Needs

A	B	C	D
Flow Characteristic	**Data Needed For Column A**	**Data Needed For Column B**	**Data Needed For Column C**
Flow Depth Flow Width Velocity	Discharge	Gage Records Extrapolation of Gage Data Regression Equations	Topographic Map - Watershed Annual Precipitation Map Annual Evaporation Map Miscellaneous Watershed Data
	Cross Section	Field Survey Topographic Map - Channel Aerial Photographs USGS Rating Curves	
	Channel Slope	Field Measurement Topographic Map - Channel Aerial Photographs	
	Manning's N	Field Photograph Topographic Map - Channel Aerial Photographs	
Natural Obstacles	Aerial Photographs Topographic Map Field Inspection		
Man-made Obstacles	Aerial Photographs Topographic Map Field Inspection List of Dams		
Note: For streams gaged by the USGS or other agencies, obtain the most recent rating curve to relate discharge to flow depth for the stream reach with the gaging station.			

Obstacles - The following may constitute obstacles to some forms of commercial boating:

- Diversion dams
- Rapids (steep slope)
- Waterfalls
- Shallow Water
- Fences

The following do not constitute obstacles that would completely prevent use of modern boat types:

- Diversion dams
- Waterfalls
- Rapids
- Shallow Water
- Fences

All boating must become impracticable at some threshold of channel slope, although this threshold has never been defined, either by case law or by boaters.[13] Some kayak specialists combine paddling and rappelling techniques to traverse reaches with tall waterfalls. Therefore, obstacles cannot adequately be defined by engineering methodologies.

Summary - A review of the available methodologies for estimating flow characteristics indicates that a choice must be made between readily-applied, low level of effort, inaccurate procedures and more accurate procedures that require a significant level of effort. For the Level 3 screening process, the higher level of effort approach is recommended to meet the requirements of the adjudication process. The following methodologies are recommended:

- *Discharge*. The mean annual flow, median flow and monthly average flow should be estimated using USGS streamflow records, or USGS regression-type methodologies based on streamflow records.

- *Flow Characteristics*. Flow depth, width and velocity should be estimated using USGS rating curves or Manning's ratings.

<u>Resulting Datasets</u> - The Level 3 analysis results in two datasets of watercourses. The watercourses which are not susceptible to navigation form dataset RL3 (i.e. Rejected

[13] The steepest slope of the Arizona boating streams listed by Arizona State Parks is about 1.5% (79 ft/mi).

Level 3). The watercourses which are susceptible and merit more Detailed Study form dataset NRL3 (i.e. Not Rejected Level 3).

4.5 DETAILED STUDIES

Figure 4.6 summarizes the pertinent features of the Detailed Studies of stream segments for characteristics of navigability.

Goal - The goal of the Detailed Studies component of the watercourse evaluation procedure is to perform a final sort of the stream segments remaining following Level 3 evaluation. The purpose is to perform a detailed fact-finding study addressing both susceptibility and actual/historic navigation.

Methodology - The methodology for the Detailed Studies are similar to that used for the previously studied major river navigability studies. The previous major river studies employed qualitative and quantitative methods for evaluating susceptibility to navigation and actual navigation in fact. However, since the Level 3 quantitative analysis investigates watercourse susceptibility, the Detailed Studies for small watercourses under this watercourse evaluation system test for actual navigation in fact.

Data Requirements - ARS §37-1128 D. presumes a watercourse to be non-navigable unless there is clear and convincing evidence that it was navigable. The statute lists test criteria to be applied for a finding of non-navigability. An affirmative response to any one criterion is enough to support a recommendation by the Commission of non-navigability. Available technical data and historical information are required of sufficient detail to test the statutorily mandated criteria; the data requirements and the level of effort are extensive.

Application - The Detailed Studies are applied only to the watercourses contained in the database catalog that advanced from the Level 3 analysis (NRL3 dataset). As in Level 3, a text notation is made in the database as to the disposition of the watercourses following Detailed Studies.

Resulting Datasets - The Detailed Studies evaluation results in two datasets of watercourses. The watercourses which, upon further evaluation, are not susceptible to navigation, and support no evidence of actual/ historical navigation form dataset RDS (i.e. Rejected Detailed Study). The watercourses which are susceptible and/or show evidence of actual/ historical navigation form dataset ADS (i.e. Accepted Detailed Study).

Detailed Study

Goal

- Final Sort
- Perform Detailed Fact-Finding Study Addressing Susceptibility and Actual/Historical Navigation

Methodology

- Same as for Major River Studies
- Qualitative and Quantitative Detailed Study
- Test for Navigation In Fact - Actuality
- Apply the criteria contained in ARS 37-1128 (D)

Data Requirements

- Extensive
- Technical Data
- Historical Information

Application

- Apply to NRLS watercourses in the database catalog

Resulting Datasets

- RDS: (Rejected Detailed Study)- Watercourses which are not susceptible to navigation, and with no evidence of actual/historical navigation
- ADS: (Accepted Detail Study)- Watercourses which are susceptible and/or show evidence of actual/historical navigation

5.0 Watercourse Database Catalog

5.1 OVERVIEW OF THE DATABASE ORGANIZATION

5.1.1 Hardware and Software Requirements

In order to access the ANSAC database (file size: 4898 KB), the following are the minimum hardware and software system requirements:

- Personal or multi-media computer with a 486 or higher processor.
- 12 MB of memory for use on Windows 95 or 16 MB of memory for use on Windows NT Workstation.
- VGA or higher-resolution video adapter (Super VGA, 256-color recommended).
- Microsoft Mouse, Microsoft IntelliMouse, or compatible pointing device.
- Microsoft Access 97 database software
- Microsoft Windows 95 operating system or Microsoft Windows NT Workstation 3.51 Service Pack 5 or later (will not run on earlier versions).

5.1.2 Application Capabilities and Features

The ANSAC database of small watercourses was developed with built-in queries capable of analyzing, evaluating, and classifying the data in the database. The database has front-end interfaces that were developed for the purpose of aiding the user in navigating or browsing through the results of the analysis. In conjunction with these interfaces, the built-in queries are designed to provide the following information:

- Statistical summaries of the records in the database
- NRL1 data set
- RL1 data set

Also, the ANSAC database is designed with a main switchboard form that provides users various options as follows:

- Enter and Edit Data
- View Data and Query Results
- Show Query Results
- Preview Reports
- Change Switchboard Items

5.1.3 Compatibility Issues

Data formats that are supported by Microsoft Access provide direct import, export and links to the following application softwares:

- Microsoft Excel (Version 3.0 or later)
- Microsoft FoxPro (Version 2.x or later)
- Microsoft SQL Server
- Borland dBASE III Plus
- Borland dBASE IV
- Borland dBASE Version 5.0
- Borland Paradox (Version 3.0 to 5.0)
- ASCII text
- All ODBC-compliant databases.

In addition, the database can be directly imported and exported to Microsoft Visual FoxPro (Version 3.0) and Lotus 1-2-3.

5.1.4 Application Limitations

The database of small watercourses cannot be accessed by earlier version of Microsoft Access 97 (i.e., Microsoft Access Version 7.0 or earlier). This indicates that the database file, which was developed using Microsoft Access 97, is not downward-compatible.

5.1.5 Recommended Future Improvements of the Database

- Full and complete population of all defined fields in the ANSAC database.
- Addition of some useful '*for information only*' fields such as: LATITUDE and LONGITUDE, SECTION, TOWNSHIP, and RANGE to identify watercourse locations.
- Incorporation of dam-impacted segments field into the database to evaluate watercourses that are impacted by dams. This information may resurrect some watercourses from RL1 data set to NRL1 data set for evaluation in Level 2.
- Quality control capability to check every watercourse against nearby watercourses for consistency in river type classifications.
- Forms to list and provide statistical and summary information for all watercourses in a given hydrologic unit or county.
- Improvement of front-end interfaces to provide summary results of various queries or analyses.
- Add previous items created for reports.

5.2 DATABASE SOURCES

The main sources of data for the ANSAC database include existing watercourse databases from the Arizona Department of Water Resources (ADWR), U.S. Army Corps of Engineers, Arizona Land Resources Information System (ALRIS), and Arizona State Parks (ASP). Some additional data that cannot be supplied by above databases were gathered and collected from private, federal, and state agencies by the project team to complete the data set required for Level 1 Evaluation.

The Arizona Department of Water Resources (ADWR) maintains the databases for all jurisdictional and non-jurisdictional dams in Arizona; while the Corps of Engineers maintains the national inventory of dams, which lists both the jurisdictional and non-jurisdictional dams. Currently, there are 215 jurisdictional dams and about 100 non-jurisdictional dams in Arizona that are listed in the dam databases. Some dams in the non-jurisdictional database are currently being considered for jurisdictional status pending results of verification and study by the Arizona Department of Water Resources. Dams, whether classified as jurisdictional or non-jurisdictional, are considered to alter the natural flow in the stream and are considered to impact downstream and immediate reaches.

The Arizona Land Resources Information System (ALRIS) maintains a watercourse database that is linked and interfaced with the agency's Geographic Information System (GIS). The database is derived from the original U.S. Environmental Protection Agency's (EPA) Reach Files which comprise of a series of hydrographic databases of surface waters of the continental United States and Hawaii. The structure and content of the EPA Reach File databases were created expressly to establish hydrologic ordering, to perform hydrologic navigation for modeling applications, and to provide a unique identifier for each surface water feature.

The Arizona State Parks or (ASP) database of Arizona rivers was developed in conjunction with the River Assessment Study completed by the agency in 1995. The ASP database was intended to be a planning tool for resource management agencies, organizations, and decision makers for the future of Arizona's river and riparian heritage.

In addition to the databases supplied by the above agencies, the project team also compiled relevant data and information that include:

1. Historical and Modern Boating information obtained from the Greenlee County Historical Society, Coconino Historical Society, Mormon Archives, Apache County Historical Society, Arizona State Parks, Central Arizona Paddlers Club, Arizona Game and Fish Department, and professional river rafting companies.

2. Fish and fishery information obtained mainly from Arizona State Parks and Arizona Game and Fish Department (AGFD).

3. Special Status Data: (a) Instream Flow data were obtained from Arizona Department of Water Resources (ADWR); (b) Unique Waters from Arizona Department of Environmental Quality (ADEQ); (c) Wild and Scenic data from Bureau of Land Management (BLM), American Rivers, and National Forest Service (NFS); (d) Preserved Area from Arizona State Parks, Arizona Game and Fish Department, Nature Conservancy, U.S. Fish and Wildlife Service, and National Park Service; and (e) Riparian data from Arizona State Parks and Arizona Game and Fish Department.

5.3 CUSTOMIZATION OF THE DATABASE

5.3.1 ALRIS Database

The surface water database provided by ALRIS was used as the main source of data for the ANSAC database considering its extensive coverage and identification of watercourse segments. These watercourses in the ALRIS database are identified by their unique identification system of hydrologic unit code and segment number. The fields from the ALRIS database that were considered relevant to the ANSAC database are: (a) hydrologic unit, (b) segment number, (c) mileage, (d) river type, (e) descriptive attribute feature, and (f) reach name.

The hydrologic unit (HU) and segment number (SEGNO) comprise a unique identification system that are assigned to every documented watercourse segment. A river segment or watercourse, however, transcends county boundaries and limits, and thus it is not extraordinary for some watercourses in the database to flow in two or three different counties. Although the original ALRIS database identifies mile markers (called mile index or MI) along river segments, the field was used to identify the length of the watercourse in miles. All river segments that have zero MI's were deleted from the database considering their insignificant reach length.

The only river types that were considered in the ALRIS database are: (a) non-perennial, and (b) perennial river types. This classification system indicates that other river types such as ephemeral, interrupted, and intermittent river are included under the non-perennial category.

The descriptive attribute features for watercourses that were used in the ALRIS database include: (1) natural watercourse, (2) artificial watercourse, (3) shoreline, (4) containment (e.g., dams), and (5) closure lines. Attribute features (1), (2), and (4) are important descriptive attributes for watercourses because they describe the nature of watercourses (whether they are man-made or not), or if water is being contained or not. All watercourses that have feature attributes (2) and (3) are dropped from the database while those with feature attribute (4) are identified to have dams or stock ponds in them. The existence of dams or stock ponds in the watercourse indicates that natural flows are disturbed and impeded. Although this feature attribute (4) will not be used in the query system, the data will be used as a quality check for the dam information provided by ADWR. Records with attribute feature (5) were created artificially in the GIS database to simply link two adjacent watercourses with slightly mismatched ending points. They are not actual watercourse segments and thus were deleted.

The reach names that have been assigned for the watercourses are used as official stream names for the watercourses in the database. Databases that do not employ or use hydrologic units and segment numbers (like the ADWR database) can be linked with ALRIS database using the stream name field which is the common field element for all the databases.

5.3.2 ASP Database

The most relevant information from the Arizona State Park (ASP) database is the river type classification of watercourses. The database has the same unique identification system as the ALRIS database but that the system merges together the hydrologic unit and segment number. Some of the watercourses are provided with alphanumeric extensions that describe additional reach segments. To be able to link the ASP database with the ALRIS database, the identification system used was separated into three fields: hydrologic unit, segment number, and the added reach.

The important fields from the ASP database that would be useful for the ANSAC database include the following: (a) hydrologic unit (HU), (b) segment number (or SEGNO), (c) added reach, (d) river type, and (e) instream flow data.

The hydrologic unit and segment number fields are the linkage to ALRIS database. Despite other added reach fields in the ASP database, only those river segments with "L" or "Lake" extension were considered important as this would indicate whether lakes or reservoirs are formed by the damming of existing streams. For the river type field, ASP provided finer river type classification for watercourses than the river type classification provided by ALRIS. The river types used in the ASP database are more descriptive in scope which include: ephemeral, perennial, intermittent, and interrupted. These river types were defined by ASP according to flow characteristics as follows:

- Ephemeral - streams flow in direct response to precipitation.
- Perennial - streams flow continuously
- Intermittent - streams flow seasonally from springs or surface sources.
- Interrupted - streams have alternating segments of the above river types.

The instream flow field identifies whether a watercourse has an instream flow permit or not. These data compiled by Arizona State Parks will be used as a quality check for the instream flow data that would be compiled by the project team from Arizona Department of Water Resources (ADWR).

5.3.3 ADWR Database

The most relevant data from the ADWR database to be incorporated into the ANSAC database are the dam information. The ADWR database identifies the location of dam in reference to any stream or tributaries. Flow impediment by the existence of dam in the stream identifies the watercourse to be disturbed and thus, merits further investigation. If watercourses are not in their natural state due to the existence of a dam, they advance to Level 2 and are further studied for their possible impact on downstream and immediate reaches. Also, equally important to the evaluation is the time when such disturbance began relative to the date of Arizona's statehood in 1912. Since the ADWR database does not employ the hydrologic unit and segment numbering system that were used in the ALRIS and ASP databases, the reach names identified in the ADWR database with dams are used as the linkage with other databases.

The only field pertinent to the ANSAC database from the ADWR database is the stream name that identifies where dam structures are built and located.

5.3.4 Data Compiled by the Project Team

Other important data that have been compiled by the project team for the ANSAC database include information on the following: (a) Historical Boating, (b) Modern Boating, (c) Fish and fishery, and (d) Special Status information of streams such as Instream Flow, Unique Water Classification, Wild and Scenic information, Preserved areas, and Riparian status.

5.4 DATA FIELD DESCRIPTIONS

The database of watercourses developed for ANSAC is comprised of fields identified to be vital for Level 1 Evaluation. The Level 1 Evaluation is the first stage of a multi-level analysis designed to identify those watercourses that have characteristics of navigability or those that are susceptible to navigation. In addition to the fields described above, there are fields included in the database that are used for information (such as mileage and county data) and quality control (such as instream flow and dam data that were taken from sources other than the primary sources of such data).

The fields defined for the ANSAC database and their descriptions are:

a. HU - Hydrologic unit of the watercourse which is identical to the USGS cataloging unit.
b. SegNo - Segment number of the watercourse which is similar to EPA's river segment.
c. Miles - Length of river segment in miles.
d. StreamName – The name given to the watercourse
e. County - The location of the watercourse by county.
f. PER - The river type of the watercourse. The classifications used are:
    - 1 - Ephemeral
    - 2 - Perennial
    - 3 - Interrupted and Intermittent
    - 4 - Unclassified
g. WithDam - Identifies if watercourse has a dam built in it or not.
h. DamImpact – Identify if river segment is impacted by the existence of dam.
i. WithDam (ALRIS) - Dam information is from ALRIS database associated with a descriptive attribute feature of a containment (e.g. dam). The field is used to check dam information provided in (g).

j. WithDam (ASP) - Dam information is from ASP database associated with "Lake" extension used to indicate the formation of a lake or a reservoir as a consequence of damming a stream. Like WithDam (ALRIS) field, this field is used to check dam information provided in (g).

k. Historical Boating - Identifies whether the watercourse has a documented record of historical boating or not.

l. Modern Boating - identifies whether the watercourse is identified to have a record of modern boating or not.

m. Fish - Field identifying if watercourse has fish or not.

n. InstreamFlow - Identifies if watercourse has (or has applied for) an instream flow permit or not.

o. InstreamFlow (ASP) - The data are taken from ASP Database that identifies the streams that have an instream flow permit. The information provided by this field will be used as a quality check on the data provided by (m).

p. UniqueWaters - Identifies if watercourse has this classification from ADEQ or not.

q. WildScenic - Identifies if the watercourse has been recommended for Wild and Scenic classification or not.

r. Riparian - Identifies if watercourse supports riparian vegetation or not.

s. Preserve - identifies if the watercourse is classified under any one or a combination of the following special status: Nature Conservancy, State Park, and Wildlife Refuge.

t. Source – Sources of the database field information.

u. Notes – Notes or remarks regarding the stream.

v. Ephermeral – This is populated in accordance with the PER field.

The current state of database field population is shown in Table 5.1. Although most of the fields appear 100% populated, confidence on the data is not high because of linkage problems and data issues identified. Queries on Level 1 Evaluation could be performed using the current data and information in the database, however, confidence on the results would be low. The results of the queries built into the database could not be relied upon until data verification is addressed, and steps to improve current data status on some fields are made.

TABLE 5.1
SUMMARY OF DATABASE FIELD POPULATION

Item No.	Database Field Names	Population (%)	REMARKS
(1)	(2)	(3)	(4)
1	HU	100.00	
2	SegNo	100.00	
3	Miles	98.90	
4	StreamName	17.70	
5	County	100.00	Visual check and inspection are necessary to elevate current confidence on the data.
6	PER	100.00	
7	Ephemeral	100.00	
8	With Dam	100.00	Confidence on data is poor due to linkage problems associated with stream names.
9	With Dam (ALRIS)	100.00	
10	With Dam (ASP)	100.00	
11	Dam Impact	0.00	Confidence on data is poor. Population of this must be done in Level 2.
12	Historical Boating	100.00	Confidence on data is poor due to linkage problems associated with stream names.
13	Modern Boating	100.00	Confidence on data is poor due to linkage problems associated with stream names.
14	Fish	100.00	
15	Instream Flow	100.00	
16	Instream Flow (ASP)	100.00	
17	Unique Waters	100.00	
18	WildScenic	100.00	
19	Riparian	100.00	
20	Preserve	100.00	
21	Source	0.00	No data source information are provided.
22	Notes	0.00	No data description are currently provided.

5.5 DATABASE QUERIES AND PROGRAMMING

The following queries of the data fields for the Level 1 Evaluation are defined and described as follows:

5.5.1 River Types Queries (PER)

1. The river types defined in the ANSAC database are classified as ephemeral, perennial, intermittent-interrupted or unclassified. These types were based on the river type classifications used by ALRIS and ASP as follows:

ALRIS	ASP	ANSAC
Perennial	Perennial	*Perennial*
Perennial	Intermittent	*Perennial*
Perennial	Interrupted	*Perennial*
Perennial	Ephemeral	*Perennial*
Perennial	Blank	*Perennial*
Not Perennial	Perennial	*Perennial*
Not Perennial	Intermittent	*Int-Int*
Not Perennial	Interrupted	*Int-Int*
Not Perennial	Ephemeral	*Int-Int*
Not Perennial	Blank	*Int-Int*
Mixed	Perennial	*Perennial*
Mixed	Intermittent	*Int-Int*
Mixed	Interrupted	*Int-Int*
Mixed	Ephemeral	*Int-Int*
Mixed	Blank	*Int-Int*
Blank	Perennial	*Perennial*
Blank	Intermittent	*Int-Int*
Blank	Interrupted	*Int-Int*
Blank	Ephemeral	*Ephemeral*
Blank	Blank	*Insignificant*

1. If a river segment is classified as perennial, it advances to Level 2. It is still queried for the remaining five data tests.

2. If river segments are classified as non-perennial (i.e. ephemeral, intermittent, interrupted, or unclassified), they do not advance to Level 2 evaluation unless they test affirmatively to the other query fields (e.g. WithDam, Historic or Modern Boating, WithFish, and/or Special Status).

5.5.2 Dam Date Queries (WithDam)

1. If a dam is located in a stream segment, that stream segment advances to Level 2. This indicates that natural flow of a stream segment is disturbed.
2. If a blank is encountered in a given record, the river segment is considered to have no dam built in it. This river segment will not be further evaluated for Level 2 Evaluation unless: 1) it is verified that a dam exists upstream of the river segment, or 2) it tests affirmatively to any of the other query fields.
3. A list of dam-impacted segments can only be identified in the Level 2 Evaluation because such river segments can only be verified and checked using more detailed evaluation involving visual analysis and/or inspection. These dam-impacted segments can be resurrected from RL1 dataset for Level 2 Evaluation.

5.5.3 Historical Boating Queries (HistoricalBoating)

1. A blank record indicates that no record is available to support evidence of historical boating in the river. Since a blank record is equivalent to no historical boating in the river, this assumption is considered to be true until reliable and verifiable facts are presented to the contrary.
2. All river segments that have historical boating accounts will be forwarded for Level 2 Evaluation.

5.5.4 Modern Boating Information Queries (ModernBoating)

1. A blank record indicates that no record is available to support evidence of modern boating in the river.
2. Since a blank record is equivalent to no modern boating in the river, this assumption is considered to be true until reliable and verifiable facts are presented to the contrary.
3. All river segments that have modern boating accounts will be forwarded for Level 2 Evaluation.

5.5.5 With Fish Queries (Fish)

1. All river segments that are known to have records of fish are forwarded for Level 2 Evaluation.
2. A blank field in the record is interpreted as having no fish.

3. Since a blank record indicates no fish, such assumption is considered to be true and correct until reliable and verifiable facts are presented to the contrary.

5.5.6 Special Status Queries

1. The fields that are used to describe the Special Status designations of river segments in the database include:

    - Instream Flow
    - Unique Waters
    - Wild and Scenic
    - Riparian
    - Preserve Area

2. River segments that are classified under at least one of the fields listed above are forwarded for the Level 2 Evaluation.

5.6 DATABASE TESTING AND RESULTS

Twenty-eight sample watercourses taken from all over the state were used to test the queries for Level 1 Evaluation as described in Section 5.5. The sample test identified those data that are non-diagnostic, and therefore, were dropped from the data tests comprising Level 1 Evaluation. Originally, water rights and groundwater data were included in the data tests to be part of Level 1 Evaluation. From the preliminary analysis that was performed on the initial set of data, virtually every watercourse - perennial or not - have water rights claims filed. Also, the groundwater data were not considered in Level 1 Evaluation due to the complicated approach of processing existing data to come up with information required. Such complications include determination of distance from pumping locations to watercourses or the determination of critical pumping discharges based on evaluated distance to establish if watercourses are impacted by groundwater withdrawal activities or not. These data would require a time-consuming effort in order to populate the fields in the database.

The Level 1 Evaluation for the 28 test cases resulted in two sets of data. The RL1 data set failed every one of the test queries provided in Section 5.5. The NRL1 data set, however, are those that test affirmatively to one or more of the data queries and thus require further analysis at Level 2.

The results of the Level 1 Evaluation are provided in Appendix C-1. The forms provided include the:

- Main - Form shows stream characteristics of each watercourse in the database

- Summary Form - lists the statistics of the records in the database.
- RL1 Data Set Form - lists the watercourses that have tested negatively to every data query.
- NRL1 Data Set Form - shows those watercourses that advance to Level 2.

6.0 Recommended Work Plan

The work products for this project include the technical and historical criteria, the multi-level evaluation system, the database catalog, and the summary report. The application of the evaluation system to each of the small and minor watercourses cataloged in the database is not part of this project scope. It is anticipated that all the cataloged watercourses will subsequently be assessed utilizing the criteria, the evaluation system, and the watercourse catalog developed under this contract. That work will be performed in a priority to be established in the future by ANSAC and under a separate contract.

ANSAC is required to complete its legislatively mandated tasks by July 1, 2002 as described herein. The following work plan is recommended to meet this objective:

PHASE I

- Current Contract No. A7-0109-001

PHASE II

- Verify and Fully Populate Watercourse Database Fields
- Perform Level 1 Screening
- Determine Datasets RL1 and NRL1

PHASE III

- Perform Level 2 Evaluation
- Determine Datasets RL2 and NRL2

PHASE IV

- Perform Level 3 Analysis
- Determine Datasets RL3 and NRL3

DETAILED STUDIES

- Perform Detailed Technical and Historical Evaluations
- Determine Datasets RDS and ADS

Appendix A-1

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Appendix B-1

Bibliography of Works Relating to Historic Boating in Arizona

APPENDIX B-1
BIBLIOGRAPHY OF WORKS
RELATING TO HISTORIC BOATING IN ARIZONA

The most useful works on the history of small boats are: Percy Blandford's Illustrated History of Small Boats; Edgar Bloomster's Sailing and Small Craft Down the Ages; Frank Donovan's Riverboats of America; Paul Johnstone's Seacraft of Prehistory; James Hornell's Water Transport Origins and Early Evolution; James Moriarity's Pre-Spanish Marine Transport and Boat Building Techniques on the Upper and Lower California Coast and The Boat and The Classic Boat by Time-Life Books.

The major general works on boating in Arizona are Lingenfelter's, Steamboats on the Colorado and Lavendar's River Runners of the Grand Canyon. Very useful information about early boating on the Colorado River and its tributaries is found in various documents relating to the "Utah Riverbed Case" USA v. Utah, 1931. A full issue of Utah Historical Quarterly (1969 V 2) was devoted to various articles about boating on the Colorado. The Great Ferry War of 1905 by McCroskey contains information on the use of ferries and other boats on the Gila River and Salt River.

The following list contains general books about the history of boating, books dealing with specific kinds of boating in Arizona or boating in specific locations, articles about boating and boaters, government documents about government surveys where river crossings or other boating were involved, legal documents with emphasis on the "Utah Riverbed Case" in which small boats are discussed at length, newspaper accounts of matters relating to boating, and various manuscripts, collections and other documents relating in some way to boating in Arizona, and previous navigability studies done for the Arizona State Land Department.

There are many guidebooks written for river runners that give information about boatability and boats, of which Whitewater Rafting and Introductory Guide by Cecil Kuhne and Ann Shafer's Canoeing Western Waterways are especially helpful for the purpose of this study.

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Appendix B-2

Pictures of Historic Boating

Appendix B-2

Pictures of Historic Boating

The following is a list of photos and drawings related to historic boating in Arizona. The photos are organized by boat type and within each boat type by river. The location of the photo is given, the year (or often approximate year) of printing, and a brief description of the contents. This listing does not include most of the wealth of photos in Lingenfelter's Steamboats on the Colorado River or Lavendar's River Runners of the Grand Canyon. Complete references for the books cited are in the bibliography.

Drawings, Diagrams and Ads
Many diagrams and drawings for construction of a multitude of small boats, including duck boats, row boats, canoes, etc. From Picard's manual of 1888.

Ads from the Sears and Wards catalogs show canoes, steel rowboats, duckboats, and paddles available in the early 1900s.

A drawing from the Glenbow Museum in Calgary, Alberta shows a typical bullboat.

Rafts
Lower Colorado River
Drawing shows Mohave tule raft in 1854 somewhere near Needles. Original by Baldiun Mollhausen at the Oklahoma Historical Society.

Painting shows the first inflatable boat (pontoon style with wagon bed) crossing the river somewhere near Needles in 1854. Original by Baldiun Mollhausen at the Oklahoma Historical Society.

Photos show an Indian poling a log raft near Yuma in the 1880s. Originals at the Arizona Historical Society and Huntington Library.

Photo of Indian poling a tule raft on the Colorado River near Yuma. Original at Yuma Historical Society.

Sea of Cortez
Drawings in McGee's book on the Seri depict typical Seri rafts.

Canoes
Canals
Photo depicts people riding in a canoe on the Arizona Canal near Phoenix in 1920. Original in the Southwest Collection, Arizona State University Library

Photo depicts people exploring Black Canyon Dam Site with motor boat and canoe in 1924. Original at the Mohave County Historical Society

Lower Colorado River
Photo shows a man in a canoe running the Grapevine Wash rapids between Pierce Ferry and Needles in the mid 1920s, surveying the LaRue Dam site. Original in the Mohave County Historical Society.

Salt River

Photo shows a man in a canoe somewhere on the Salt River in the 1890s. Original in the Southwest Collection, Arizona State University Library.

Rowboats, Canvas Boats, Skiffs, and other Small Boats
Clear Creek
Photo depicts people in a rowboat shown from above in a deep canyon in Clear Creek (near Winslow, Arizona) in the 1890s. Original at the Sharlot Hall Museum

Colorado River, Grand Canyon
Numerous photos and drawings depict the Powell expeditions of the 1870s in Dellenbaugh's Romance of the Colorado River and Powell's report of the expedition.

Photo shows a man rowing a canvas boat near Lee's Ferry in 1923. From Lavendar's book, no photo credit given.

Photos show people rowing and portaging rowboats in the Grand Canyon in 1923. From Westwood's Rough Water Man.

Photos show a man in rowboat in the Grand Canyon in 1896. From Flavell's Log of the Panthon.

Photos in Freeman's Down the Grand Canyon show people boating the Grand Canyon on a USGS survey expedition in 1909.

Photos in Julius Stone's Canyon Country show boating through the Grand Canyon in 1909.

Photos in Birdseye's Boat Voyage Through the Grand Canyon show people traveling in Galloway-Stone type boats in the Grand Canyon in 1911.

Photos show boaters duplicating Powell's voyage through the Grand Canyon. Some show boats damaged after going through rapids. From National Geographic 1914.

Numerous photos in Eddy's Down the World's Most Dangerous River show boating through the Grand Canyon in 1928.

Colorado River, Lower

Photo shows a rowboat in the canal at Andrade (in the Imperial Valley region) sometime in the late 1800s. Original at the Huntington Library.

Photo depicts a small foot-propelled sternwheeler in the 1890s. Original at the Huntington Library.

Photos show the Wheeler expedition at various points along the Colorado River, including Black Canyon - sail-rigged rowboats and plain rowboats. Good copies at Special Collections Library, University of Arizona.

Photo in Desert Magazine depicts a boat transporting men and goods "into the heart of the desertland" in 1898.

Photo depicts a group of men in a rowboat somewhere in the Needles area about 1900. Original at the Mohave County Historical Society.

Photo shows a rowboat with two men in a canyon in the early 1900s. Original at the Water Resources Center Archives, University of California, Berkeley, Lippincott Collection.

Photo depicts a rowboat at Ft. Mohave in 1904. Original at the Arizona Historical Society.

Photo depicts a rowboat on the Colorado River near Giers in 1906. Original at the Huntington Library.

Photo shows a rowboat with four men rowing on Yuma's main street during the 1916 flood. Original at the Yuma Historical Society.

Colorado River, Upper
Photo shows Utah Gov. Dorn with other dignitaries on shore with boats at Lee's Ferry in 1926. Original in the Southwest Collection, Arizona State University.

Gila River
Photo depicts men in a rowboat somewhere on the lower Gila River near Yuma in the 1890s. Original at the Yuma County Historical Society.

Photo shows a rowboat with cables near Maricopa ferrying people during flood time in the early 1900s, probably 1905. Original at the Arizona Historical Society.

Lakes
Photo shows people boating on a manmade lake at St. George Utah about 1890. Original Lynne Clark Photography, St. George.

Photos depict a boat landing on Roosevelt Lake with rowboat in foreground and people fishing for bass from a rowboat in 1916. Originals at Arizona State University, Southwest Collection.

Salt River
Photo shows two men, two women and a dog in a boat on the Salt River in the 1890s. Original at the Arizona Historical Foundation.

Color postcard depicts people in a rowboat somewhere on the Salt River (not in town) in 1918. Original in the Southwest Collection, Arizona State University Library.

San Francisco River
Photo shows a group of men in a rowboat near Clifton crossing the river during flood time in 1884. Original at the Arizona State Research Library.

Unknown Location
Photo depicts the Luhrs family in a rowboat at an unknown location in Arizona in 1910. From the Luhrs family album at Arizona State University, Southwest Collection

Photo shows Mrs. Carl Hayden and other women sitting on a boat dock with several styles of rowboat at an unknown location (abroad) in 1920. Original in the Southwest Collection, Arizona State University Library

Flatboats, Scows, and Barges
Colorado River, Lower
Photo shows a crude homemade flat boat with a sail in the late 1800s. Original at the Arizona Historical Society.

Photo shows the Silas J. Lewis barge at Needles in the 1890s. Original at the Huntington Library.

Photo shows a temporary skiff ferry in use in the late 1890s while the regular ferry is upended to dry out at Ehrenburg. Original at the Huntington Library.

Photo shows a flatboat about to be unloaded from a wagon at Needles in the late 1800s. Original at the Huntington Library.

Photo shows the St. Valier barge loaded with stack wood at Needles in 1899. Original at the Huntington Library.

Photo shows a flatboat loaded with photographer's supplies in the late 1800s. Original at the Huntington Library.

Photo shows a scow holding a diamond drill north of Peach Springs before 1920. Original at the Mohave County Historical Society.

Photo shows a man on a flatboat on the Colorado River near Needles in 1923. Original at the Mohave County Historical Society

Ferry boats

Colorado River, Lower
Photo shows a sternwheel ferry and rowboat somewhere on the Lower Colorado River in the 1880s. Original at the Huntington Library.

Photo shows a cable crossing on the Alamo River near Brawley, California in the 1880s. Original at the Huntington Library.

Photos of various ferries along the Lower Colorado River from the 1880s-1900s. Originals at the Special Collections Library, University of Arizona.

Photo shows the aerial ferry at Ehrenburg in the 1890s. Original at the Huntington Library.

Photos of the Calizona Ferry showing various vehicles aboard. Originals at the University of Arizona Special Collections Library, Huntington Library and Yuma Historical Society.

Photo of a ferry with a loaded barge in tow at Needles from the late 1800s. Original at the Huntington Library.

Photo of the Old Yuma Ferry about 1890. Original at the Huntington Library.

Photo shows Bonelli's ferry crossing the Colorado River at Rioville (mouth of the Virgin River) in the 1890s. Original at the Utah State Historical Society.

Photo shows a car on board the ferry at Ehrenburg about 1900. Original at the Yuma County Historical Society.

Photo shows a horse and buggy on a ferry at Yuma in 1904. Original at the Yuma County Historical Society.

Photo shows a flatboat with a car on board used as a ferry at Sweeny's Landing in 1916. Original at Mohave County Historical Society.

Photos show the Searchlight Ferry in 1919 and in 1930. Originals at the Mohave County Historical Society.

Photo shows a car on a ferry at Parker in 1920. Original at the Yuma County Historical Society.

Photo depicts the "Miss Marjorie of Chloride" at Willow Beach between 1922 and 1926, transporting drillers to the Hoover Dam site. Original at the Mohave County Historical Society.

Two photos show Grigg's Ferry in 1923. Originals at the Mohave County Historical Society. Photos show the Blythe-Ehrenburg Ferry in 1926. Originals at the Mohave County Historical Society.

Photo shows Senator Keller on the ferry at Parker. Original at the Mohave County Historical Society.

Photo shows Murl Emery's Ferry near the Hoover Dam Site in 1930 and again in 1942. Originals at the Mohave County Historical Society.

Photo shows the Arivada Ferry used in building Hoover Dam in the 1930s. It could carry four cars. Original at the Mohave County Historical Society.

Photo depicts the aerial ferry at Needles in 1934. Original at the Mohave County Historical Society.

Colorado River, Upper

Photo shows emigrant wagon being boated across the river at Lee's Ferry in the 1880s. From Desert Magazine.

Numerous photos of Lee's Ferry are shown in Measeles' book Crossing on the Colorado.

Photo depicts the Rust and Wooley Cable Tram in the Grand Canyon in 1913. Original at the Arizona Historical Society.

Photo shows an aerial ferry at Bright Angel Creek in the Grand Canyon. National Geographic 1914.

Gila River

Surveyor's map from 1874 indicates the way to the Redondo Ferry on the Redondo Ranch upstream from Yuma. Original at the Yuma County Historical Society.

Photos show a car on board the ferry at Dome in the early 1900s. Original at the Yuma County Historical Society.

Photos show Gov. Hunt on a ferry going to and from the Florence prison. Originals at Arizona State University, Arizona Collection.

Salt River

Photo depicts the Hayden Ferry in Tempe around 1895. Original in the Southwest Collection, Arizona State University.

Photo shows a barge-ferry used to cross Roosevelt Lake to connect the south side with the road from Young in about 1915.

Little Colorado River
Photo shows an aerial ferry over the Little Colorado River, probably at Sunset Crossing in the 1880s, with three men and two women aboard. Original at the Huntington Library.

Sailboats

Colorado River, Lower
Photo shows people rigging a sail on a boat at Cottonwood Island in 1923. From Rough Water Man

Photo shows a sailboat in open water somewhere on the river in the early 1900s. Original at the Water Resources Center Archives, University of California, Berkeley, Lippincott Collection.

Lakes
Several photos of sailboats on Walnut Grove Reservoir near Wickenburg (Hassayampa River) in the late 1880s before the dam broke. Originals at Sharlott Hall Museum and Arizona Historical Society.

Photo depicts a sailboat on Rogers Lake near Flagstaff in 1911. From an ad for tourism in Arizona the State Magazine.

Photo depicts a sailboat on Lake Mary near Flagstaff in 1914. From Arizona the State Magazine.

Photos depict a sailboats on Roosevelt Lake in 1912-14. Originals in the National Archives and Arizona Historical Society.

Photos show recreational boating at Granite Dells Lake near Prescott about 1907. Original at Sharlott Hall Museum.

Salton Sea
Photos show Godfrey Sykes' sailboat on the Salton Sea and in a nearby canal in 1907. Original at the Arizona Historical Society.

Motorboats, Tunnel-Stern Boats

Colorado River, Lower
Photos show Murl Emery's tunnel-stern boat hauling drilling crews to work on barges anchored in Boulder Canyon. Original at the Mohave County Historical Society.

Photos show Jagerson's tunnel-stern boats transporting Congressmen to Hoover Dam site and launching the boat at Willow Beach in 1922 and by the Chloride garage in 1929.

Photos depict loading a wagon and equipment at Willow Beach and Congressmen on boat visiting

Hoover Dam site in 1923-24. Originals at the Mohave County Historical Society.

Steamboats

Colorado River

Drawing by Balduin Mollhausen of Ives's Explorer on the river in the 1850s. From Ives' Report on the Expedition.

Photo and clipping about Ives' explorer which had been excavated years after its demise. Original at the Huntington Library.

Tourboats

Photo shows people in a tourist boat on Roosevelt Lake in 1925. Original at the Arizona Historical Foundation.

Photos depict a group on a tourboat on Roosevelt Lake with rowboats in the foreground and the boat landing with rowboats in the foreground around 1915. Originals at Arizona Historical Society.

Photo shows a tourist boat landing for a trip on Lake Mead in the 1930s. Original in Special Collections Library, University of Arizona.

Mixture of Boats

Numerous photos show the Yuma waterfront from the 1890s to about 1905 with the prison or railroad bridge in the background and several steamboats, rowboats and rafts. Originals at the Yuma Historical Society, Arizona Historical Society and the Huntington Library.

Photo shows people surveying sites for Laguna Dam in a rowboat and a flatboat in 1907. From Crowe's Early Yuma.

Photo shows the drydock in the Colorado River Delta, with several boats in the late 1800s. Original at Special Collections in the University of Arizona Library.

Photos of various kinds of boats, barges and drilling rigs involved in the survey and construction of Hoover Dam in the 1920s and 1930s. In The Story of Hoover Dam and Building Hoover Dam. Also photos in USGS archives and Bureau of Reclamation archives.

Appendix B-3

Boating Glossary

APPENDIX B-3
BOATING GLOSSARY

The following definitions are those accepted today. Vernacular use of these same terms before 1913 may have been different.

Aerial Ferry - a ferry which is suspended from some type of cable. Ropes are pulled either from shore or by people on the ferry to make the ferry move.

Barge - any of a variety of pleasure, naval and commercial craft, commonly a rectangular flat-bottomed craft with high sides, used to transport heavy nonperishable cargo.

Bateau - Generic term (literally, French for "boat") applied to any of various local or regional craft developed in the U.S. and Canada. The characteristic shape is long, narrow and flat-bottomed.

Beam - the width of a vessel.

Boatability - The capacity of a watercourse to support some type of boating at least part of the year.

Bow - the front (fore) of the boat.

Bullboat - a boat made of hides stretched around a frame of willows or similar materials.

Canoe - a light, open, shallow-draft double-ended boat, ranging from about 12' to 34' (average 15-17') and usually propelled by one or more paddlers. Originally made of hollowed-out trees or birch bark in the eastern U.S., a wooden canoe was invented in 1879. In the 1880s canvas covered canoes appeared. The molded plywood canoe was invented in the early 1900s and the aluminum canoe in the late 1940s. Fiberglass was first used for canoes in the 1950s.

Catamaran - Developed in the Asian Pacific, the catamaran was first built in the U.S. in the 1870s. U.S. interest in catamarans languished until the late 1940s.

Catboat - A sailboat rigged with one mast and one sail set abaft it, usually shallow draft and are often used for working purposes.

Clinker-built - Having the external planks or plates of a boat put in so that the edge of each overlaps the edge of the plank or plate next to it like clapboards on a house.

Cutter - A single-masted sailboat with a mainsail and at least two headsails. Traditionally the cutter was a distinct hull type -narrow, deep, plumb stemmed with the mast stepped about 2/5 of the waterline. This type now practically extinct.

Dinghy - any of various small, open boats designed for propulsion by oars and used for a number of purposes, or adapted to rigging to sail and used in racing or day sailing. Typically a dinghy has a pointed bow, a transom stern and a round bottom, and is made of wood, plywood, or plastic, though aluminum, steel and composite construction are also seen. They range from under 6' to about 14' long with about 8-10' the most popular. The smaller models carry 1-2 adults and are very lightweight.

Dory - a type of rowboat, usually with bow and stern upswept and curved bottom, originally used for fishing, but adapted for whitewater travel.

Draft - the depth of a boat below the waterline, measured vertically to her lowest point. Also the depth of water she requires in order to float freely - a slight fraction more than her own draft.

Draw - To require a specific depth of water in order to float.
Duckboat - Any of various small,open,commonly flat-bottomed boats used by hunters, and designed to carry them as quietly and unobtrusively as possible through marshy shallows and other areas where wild fowl gather. Models range from 8-15' long and are light.

Ferry - a boat used to transport people and goods from one shore to another, either across a river or on the open sea.
Flatboat - A boat with a flat bottom and flat bow and stern, such as a scow, used for transporting freight on inland waterways, a barge.

Folding boat - generic term for any small lightweight boat designed to be partly or wholly folded, collapsed or disassembled after use. The Mayflower carried a pinnace to be assembled after arrival. Canvas folding boats were used in the Civil War. Folding boats for recreational purposes were developed around 1900 by Bavarian sportsmen. Foldboats appeared in the U.S. in the 1930s. They have been used for rafting the Grand Canyon.

Galloway-Stone boat - a type of rowboat suitable for running rapids developed in the 1890s by Galloway and later developed by Galloway and Stone.

Hole - an area in a stream where the current reverses, flowing backward in a circular motion, usually because of a boulder in the stream, considered quite dangerous for boaters. Also called "reversal" or "spinner."

Houseboat - a waterborne,largely self-contained living unit offering most of the basic facilities of a house ashore, mounted atop a hull or combination of hull forms. It was developed early in U.S. history and played an important role in opening up the frontier.

Hydrofoil - Any vessel that makes use of hydrofoils - wing-like parts, commonly of metal, that operate in water and support the vessel above a certain speed. It was first invented in Italy in 1898. In 1911 Alexander Graham Bell built one, but the effort was abandoned and the hydrofoil was not in general use until World War II.

Inboard boat - any vessel smaller than a ship and powered principally by an inboard or inboard-outboard engine. It developed from the steam boat, with its main development as a pleasure craft starting in the 1890s. Usually the boat is at least 15' long.

India Rubber - Natural rubber usually processed by vulcanization.

Inflatable boat - any boat designed to be blown up with air before use and, normally, deflated afterward for convenience in carrying and storage, generally 12' or less and weighing 60 pounds. or less. First developed in the 1850s, the inflatable was not reliable until the invention of artificial rubber in the 1940s.

Kayak - any of various narrow, lightweight boats, originally developed and named by Inuit, decked except for a cockpit, amidships and usually designed for a single occupant. Modern kayaks use the same basic design with modern materials.

Ketch - A fore-and-aft-rigged sailboat with two masts, the taller forward and the shorter mizzenmast stepped a little forward of the after end of the waterline.

Lifeboat - an auxiliary boat used on a larger boat for emergencies. Lifeboats may either be hard-hulled or inflatable.

Lugger - a vessel rigged with lugsails (quadrilateral sail with specific shape, bent to a yard that hangs from the mast obliquely and is raised and lowered with the sail). The lugger is traditionally a small boat used for fishing or coastal trade.

Mackinaw boat - a flat-bottomed boat used especially on the upper Great Lakes and their tributaries.

Motorboat - any boat propelled by an engine, usually some kind of gas.

Neoprene - a form of artificial rubber used for inflatable rafts.
Oakum - Loose hemp or jute fiber, sometimes treated with tar, creosote, or asphalt used for caulking seams in wooden ships.

Oar - an implement for propelling or steering a boat, particularly a dinghy or other rowing boat. It consists of a long shaft (usually of wood, sometime aluminum or plastic) with a handle at one end and a flat or somewhat concave blade at the other. It is fastened to boat with an oarlock, rather than held free.

Outboard boat - any vessel powered principally by an outboard motor (internal combustion engine with propeller attached, designed to be secured to the stern of a boat and usually burning gasoline or diesel fuel). Originally the motors had low power and were used on small rowboats or skiffs. Motors were improved in the 1920s and 1930s and can now be used on craft up to about 25' long.

Paddle - an implement with a relatively long shaft and a broad, flat (or somewhat concave) blade, used to propel and steer small craft, most commonly canoes. The paddler holds the paddle free with both hands.

Paddle wheel - a form of propeller on the end of a rotating horizontal shaft that lies across a vessel's centerline, so that the wheel revolves longitudinally to propel the boat. They are relatively inefficient and are best suited to shallow water and recreational boats.

Personal watercraft - a one-person powered boat used for recreation on lakes.

Pirogue - a canoe, usually hollowed from a single log up to about 18' long, used for fishing in sheltered waters of the Gulf Coast. Typically it has a flat bottom, round sides, and a sharp bow and is propelled by oars or paddles.

Portage - the transport of boats and gear overland between two navigable bodies of water, also the land so traversed.

Powerboat - a boat propelled by a motor which, in most cases, burns either gasoline or diesel fuel. Also called motorboat.

Pram, Pram Dinghy - a small open boat characterized by a square bow and stern, gently curved sides, and a flat or vee bottom with a slight rocker. Most models are about 8' long, with a beam of about 4'.

Rapids - an area in a stream where the slope increases and the water flows faster, usually over a rocky bottom. Rapids are classified according to the difficulty of running them.

Raft - a simple structure of buoyant elements - logs, empty barrels, supporting planks, etc. - fastened together and used as a water vehicle or float. Normally propelled by a pole, paddle, or sail. Some prehistoric rafts along the Colorado River and all along the western coast of the Americas were made of reed bundles lashed together.

Rowboat - any of various small, open craft designed primarily for propulsion by oars., though more recently also powered by sail or motor, ranging in size from about 10-16' and made of wood, plywood, plastic, or aluminum. Rowboats originated thousands of years B.C. and have been used in many parts of the world.

Rubber duckie - slang term for a one-person inflatable boat.

Sail - A piece of fabric or other material of such size and shape that, when spread to the wind, it will drive or help drive a vessel through the water. Sails come in many sizes and shapes.

Sailboat - a boat smaller than a ship designed to utilize the force of the wind for propulsion. If it also carries a motor for use when the wind falls, or for maneuvering in small quarters, it is called an auxiliary sailboat.
Schooner - Any fore-and-aft-rigged sailboat, with two or more masts, the foremast being no taller than the mainmast. The schooner originated in New England in the early 1700s.

Scull - a single long oar sometimes used to propel a small boat. Also, a small, light open boat of narrow beam and very small draft, designed to be propelled by sculls, usually in racing.

Scow - a large flat bottomed boat with square ends, used primarily for transporting goods.

Sidewheeler - a type of steamboat, with a paddlewheel at the side of the boat.

Skiff - any of various pleasure and work boats. Originally it defined a small open craft with a flat bottom and shallow draft, pointed bowsquare stern. Typically it was used by fishermen and rowed or sailed.

Sloop - a single-masted sailboat with at least two sails. The traditional U.S. sloop was a beamy, shoal draft centerboard hull.

Steamboat - a large boat or ship powered by a steam engine, typically fueled by wood in the 19th century.

Stern - the back (aft) of the boat.

Sternwheeler -a type of steamboat, with a paddlewheel at the stern of the boat.

Tender - a dinghy or other small boat used for transporting persons or supplies to or from a larger one.

Tourboat - an open slow-moving boat, usually gas powered, used to show people the scenery.

Tubing - use of inner tubes to float down a river.

Tugboat - a boat used to maneuver a ship into and out of harbor.

Tunnel-stern boat - a motor boat designed with a tunnel affixed underneath to filter out sand so the motor doesn't get clogged up.

Whitewater - Fast flowing water with rapids.

Yacht - a pleasure boat, ordinarily powered by sails, with auxiliary motors, legally classified as a ship.

Yawl- a fore-and-aft-rigged sailboat with two masts, usually more than 28' long.

Appendix B-4

Selected Historic Quotes about Boating in Arizona

APPENDIX B-4
SELECTED HISTORIC QUOTES ABOUT BOATING IN ARIZONA

The following are quotes chosen from a much larger group that illustrate various historic modes of travel. They are organized by type of boat and chronologically (date of event) within each boat type. For numerous quotes on steamboats on the Colorado, see Lingenfelter's Steamboats on the Colorado. For numerous quotes and descriptions of Grand Canyon boats, see Lavendar's River Runners of the Grand Canyon. Complete references can be found in the Bibliography.

Rafts

Basket Boats on the Lower Colorado River

"Diaz was determined to cross the [Colorado] river, hoping that the country might become more attractive. The passage was accomplished, with considerable danger, by means of certain large wicker baskets, which the natives coated with a sort of bitumen, so that the water could not leak through. Five or six Indians caught hold of each of these and swam across, guiding it and transporting the Spaniards with their baggage, and being supported in turn by the raft."
(Winship, George Parker, 1896, page 407, describing events of about 1540)

Reed Rafts on the Lower Colorado River

"Jedediah [Smith] loaded a part of his goods on rafts of cane grass and moved out on the broad river."
(Morgan, Dale 1953, page 240, describing the Lower Colorado in the 1820s)

Indian Rafts on the Lower Colorado River

"... almost all North and South travel and most light freighting, both by Indians and river-side white folk, was carried on by water. ... Indian family parties were what pleased my wife most. They were often drifting downstream on balsa rafts; men, women, children, dogs, and sometimes chickens. A balsa raft is made of long bundles of tules lashed together into the form of a raft and sometimes stiffened transversely with a few willow poles. One squats with other passengers as nearly over the center of flotation as may be unless one happens to be the steersman with the long pole who endeavors to keep the craft clear of bars and shallows. Getting aground in the muddy Colorado water generally involves unloading, dismantling the entire structure, carrying the tules ashore, spreading them out in the sunshine to dry, shaking the sand out of them and then laying the several keels afresh. A somewhat similar craft was used by the Ceri [Seris] round and about Tiburon Island, in the Gulf of California, but these did not require such frequent dry-docking and dismantling in the clear gulf water.

"Other features of the Indian river navigation above Yuma as we observed it, were the rafts of peeled and dried willow poles, cut to standard lengths, which were floated down, usually under the control of a single navigator equipped with a long steering and fending pole. Yuma was still largely built of willow poles chinked with mud, and the contents of these rafts were sold and used for constructive purposes. They were delivered and piled at the top of the river bank by the draftsman. Then, too there were the floaters of watermelons. This industry was followed in the Summer and Autumn ... The equipment was a triangle of three willow poles, tied together at the angles, a bent pole tied across near to one angle, and the freightage of melons, perhaps a score or more. The triangle was placed in the river with the bent cross-member sagging into the water and the melons were carefully lifted in until the triangular space was about filled. The pilot then tied his clothes, matches and tobacco, and other effects into a compact little bundle which he fastened securely upon the top of his head, took his seat in the water upon the submerged boat pole, said good bye to relatives and friends, kicked off from shallow water into the current and the voyage began. ..."

(Sykes, Godfrey 1945, pages 247-248, describing events of the early 1900s)

Indian Rafts on the Upper Colorado River near Lee's Ferry

"Brother Pierce found an old raft made of two poles lashed together with bulrushes thought to have been used by the Utes. The idea of repairing the raft to ferry their luggage over was abandoned until, as Jacob suggested, a try was made at attempting to ford the river on horseback. Before Thales and Brother Shelton had their mules saddled up and the packs removed in preparation to start across, the Indians had left. He and Brother Shelton stripped off everything but their garments, shirt and hats, plunged their horses into the cold water expecting a long swim. To their surprise they were able to cross without swimming.
Corbett, P.H., 1952, pages 154-155, 173-174 and 200, describing events of the 1850s)

Wooden Rafts on the Gila River

"... proceeded with the construction of our Rafts. Our new Associate, the Husband of the Missouri Woman, was most zealous and active, and proved the most skillful man among us in fashioning the Boats. The Dutchmen's Wagon and the side-boards of a number of other Wagons were utilized for the double purpose of constructing the Boats and lightening the loads. We stripped our own Wagon of one board from the bottom and two from the sides, shortening the coupling, and discarding about three hundred pounds of Provisions (including what we put on the Rafts) and several articles of convenience that had theretofore appeared to be indispensable, which made us about nine hundred pounds lighter than at the commencement of our Journey.

"In five days the Rafts were ready, provided with oars, ropes and stone anchors. ... The Crew told us afterwards that they found the [Gila] River shallow and full of Bars, and the Current very rapid; they frequently found themselves aground and had much difficulty in getting off. No event happened except that on the third day out the Woman was taken with Labor Pains. ... In the evening they helped the Husband carry his Wife and Baby on the Boat; the next morning they went on ... They arrived in Yuma six days before us." [describing events of 1849]
(Hannum, Anna ed. 1930, pages 250-251)

Wooden Rafts on the Lower Colorado River

"West Bank of the Rio Colorado, Tuesday 28th Nov. [1849]. Crossed the river yesterday 27th. After all the ingenuity of some five hundred souls, together with the pretended labor thereof had been in full play since 22nd and without an accident, that is, a serious one. Master workmen, shipmakers, carpenters, coopers, blacksmiths, majors and quartermasters, wagon masters, forage masters and boatmen, and generally artificers and mechanics of all and every description (saying nothing of soldier folks and teamsters) all, all had a finger in the pie, or Raft. Everyone found a small place in the monster, of "Felix Grundy #2" to slip in an idea of his own. She was launched on night of 25th and the welkin made to ring with the shouts of the multitude (?) assembled to witness the exhibition or baptism, and as she glided into the turbid waters of El Colorado was christened "Felix Grundy No. 2" after Evan's horse that departed this life at the Pima Village on 31st ult. ...

"But the F.G.#2 she was not more than christened, before six or eight men jumped aboard of her and under she went. ... The wood is too heavy, dead cottonwood, although 20 kegs are under her, and she sinks with about ten men. Another was constructed on 26th of same wood, but kegs left out, much larger than the "#2" called the "Pawnee Dash" ... The Dash drew as much water as she well could without sinking; but with stretched ropes, pulleys, &c, or, on the whole by the assistance of all trades and professions, ... We could send over nearly one wagon at a time. So near it that in a couple of days we had all over, making about six trips per hour, a wagon with a very light load could go but otherwise her freight had to be landed for another trip. ... In crossing yesterday on the Raft, with Givens; baggage wagon and some ten men, the Raft sunk as soon as it hit the channel, one corner of it going down and the one diagonally opposite tilting up. ..."
(Couts, Cave J., 1961, pages 79-80, describing events in 1849)

Wooden Raft on the Gila River

"Killed four [cattle] and made a raft of cottonwood poles and started down the river." [Gila River near Gila Bend.]
(Hattie Anderson, 1858, page 76)

Wooden Raft on the Lower Colorado River

"After traveling about 10 miles we struck the Colorado river, at a large sand bar, and here there was nothing for our animals but some cottonwood bark; we had to feed some corn as we were about to start across a great desert of eighty miles and we had to get across the river in quick time which we did. We got 4 cotton wood logs, dried and cut them about 8 feet long, put a wagon bed on them, caulked as well as we could, lashed all together tightly, making a very serviceable ferry boat. We were very fortunate in securing the services of 4 Indians who pushed the ferry boat over, one swimming at each corner."
(Etter, Patricia, ed. 1986, quoting from Robert Brownlee's journal of the 1849).

Wooden Rafts on the Colorado River near the Mouth of the Virgin River

"They constructed a raft from the dry driftwood which had been washed up on the bank during flood time. They remembered the boat and supplies they had cached about four months before on their first journey. They found the boat in good condition, but the supplies were ruined. ... This crossing was later named 'Pierce's Ferry.'"
(Corbett, P.H., 1952, pages 154-155, 173-174 and 200, describing events of the 1850s)

Bullboats and Canoes

Bullboats on the Colorado River Near Present Day Lake Mead

"We slept here at night and started at dawn for the Colorado. It was entirely barren of wood, save for a few scant osiers of green willow. But there was the river and to cross it there was not a bit of standing or drift timber wherewith to build a raft. By a long search we found willow enough to make an osier frame for our skin canoe sufficiently strong for our purpose. We killed two horses, made a canoe of their hides and landed safely over. ...

[On the return trip] "Again we killed two of our few horses to make a canoe and we crossed well."
(Adams, Winona, ed.. 1930, pages 11 and 16, journal of woman describing events of 1841, trappers crossing the Colorado River twice somewhere near the mouth of the Virgin River.)

Canoes on the Rio Grande River

"Here we had to cross the [Rio Grande] river [Joyeta, NM]. We sounded and found that the Channel was over six feet deep. The nearest timber was three miles away over an almost impossible road; so we decided to raise the bodies of our Wagons to the top of the standards and pull them over with ropes. We purchased a lot of brushwood which the People had gathered for fuel, and nailed it across the standards to support the Wagon bodies. This was no small labor, as it involved the unloading and reloading of the Wagons as well as that of raising the bodies upon the cross pieces. This done, we dug down the banks to make a road, then carried the line over in a Canoe, and hitching a few yoke to the rope, pulled the Wagons over separately, wetting nothing but the running gear. ...

"Two ladies with white veils and painted faces arrived on the opposite side of the River, riding in an Ox Cart. They were recognized by two Young Mexicans on our side, who instantly stripped themselves naked, swam across the River, and embraced the Ladies, both Parties appearing to be rejoiced at the meeting. After a short chat they returned, procured a Boat, and ferried the ladies over.

"On Saturday night we passed over the River in Canoes and spent Sunday on the other side."

(Hannum, Anna, 1930 pages 223-225, describing events of 1849)

Canoe on the Lower Colorado River

"We notice also an Indian pirogue [dug-out canoe] which is moored to the California shore. ... Large trees must be very scarce, for since Yuma we have seen only two pirogues. ... We are again taking wood on the Arizona side. We see many Indians, men and women, some ponies and some pirogues. ..."
(Berton, Thomas, 1953 pages 68-73, describing a voyage up the lower Colorado in 1878).

Canoe on the Salt River and Grand Canal

"Mr. North Wilcox and Dr. Anderson inform us that they came in from Fort McDowell, day before yesterday by canoe, coming down Salt River to the head of the Grand canal and down the canal to town. They camped one night on the way down and traveled about a day and a half."
Phoenix Herald 2-15-1883

Common Rowboats and Skiffs

Rowboat covered made of India Rubber on the Lower Colorado River

"Our company are making two boats to cross their goods in. Their frames are made of willow poles, in shape of a ship's boat, and covered with India rubber blankets. ... The company having completed a boat, made two trips with her this afternoon. She is 18 feet long and shaped like a whaleboat. The others are about the same size. In crossing, the current carries the boat downstream, and in returning a little more distance is added in spite of the most active rowing."
(Clarke, A. B. 1988 page 84, describing crossing the lower Colorado in June 1849)

Rowboats and Rafts in the Grand Canyon

" ... with four boats constructed upon the ground, the largest of which was twenty-two feet in length. The limited time I had to construct these, the quality of the lumber, the capacity of the mill for sawing, and the rapid falling of the water in the river, prevented me building the boats in every respect as I could have desired.
In consequence of the reduction of our force, and sickness, I was compelled to take charge of my boat alone; this was swamped twice by running under a fallen tree, and by being dashed against the rocks below the upper end of Cave Canyon ... The river here was fifty feet in breadth; the depth twenty-two feet. ... My boat was so much injured by the late accidents that I was compelled to abandon it one mile from the mouth. ... Such was the rocky character of the river, that the lower edges of the sides of my boat were so much worn that I was compelled to cut these down twice since starting. The water falling rapidly, made it more difficult to run over the rocks. ... Our first boat was lost at the mouth of Rocky Canyon; the second one mile from the moth of Cave Canyon; the third one mile from the head of Grand Canyon; and the fourth one mile below this. ... Built a cedar raft, five by sixteen feet, and upon this we took passage ran down the river thirty miles, ... In this our raft again struck, where we lost all our salt, all our cooking utensils, except one frying pan, and most of our flour and bacon. There was less elasticity to this than the Tulie rafts upon which I passed through the canyons of the Lower Colorado, and in striking with much force against the rocks the material of the cedar raft would part.... Built another raft, and descended forty miles further, when again, in turning an angle in the river, she struck a rock, and all our provisions, except five days rations of flour and bacon were lost. [8]
(Adams, Samuel, 1869, pages 6-8)

Skiff on the Salt and Gila Rivers

"Messrs. Cotton and Bingham will leave tomorrow for Yuma by way of the Salt and Gila Rivers. They have constructed for the trip an 18-foot skiff, flat bottom, which will draw very little water, while at the same time it has the appearance of being very strong and durable, and able to stand pretty severe buffeting."

(Phoenix Gazette 2-17-1881)

Rowboat on the Salt and Gila Rivers

"The Yuma or Bust party which left Phoenix recently for the purpose of exploring the Salt and Gila rivers were seen yesterday, only twelve miles from here, all wading in mud and water up to their knees, pulling the boat, and apparently as happy(?) as mud turtles."
(Phoenix Gazette 11-30-1881)

Rowboat on the Gila River

"Two men arrived here last week who had accomplished the dangerous feat of navigating the Gila River from source to mouth. ... About six months ago they sold their horses and wagon and started down the Gila in a boat of their own making. Their starting point was in the Black Range New Mexico, where the Gila has its source. ... They met with no special incident until the high water of the February floods began to come down. Their boat was upset and lost, but they built another and started on. ... The men hunted and trapped on the way but met with only moderate success. They claim to be the first who ever made the whole length of the river.
(St. Johns Herald, 7-7-1891, quoting the Yuma Times)

Rowboats on the San Juan River

"I am a carpenter and between 1893 and 1895 lived in Bluff and made 5 or 6 boats for miners who took the boats down the San Juan River with their supplies. There were other men in Bluff who made boats for miners during that 2-year period and some of the miners made their own boats. They were a crude sort of row boat, 22' long, 3 ½ or 4' wide and with a draft of about 1' loaded."
(William J. Nix, describing events of 1893 to 1895, witness in the Utah Riverbed Case)

Canvas Covered Rowboat on the Salt and Gila Rivers

"... We would build a boat and just drift down! [Salt-Gila rivers from Phoenix to Yuma] We set about building a boat in a corral ... It was a good boat, with a light wooden frame, canvas covered. We gave the canvas a good coat of white lead and oil, sold our burros and were ready to start. ... fortunately the boat was of light construction, which we found later was what saved the situation. For after eating our breakfast, loading the duffel into what might well have been christened "The Pride of the Salt River: and shoving off, the river went dry on us. ... There wasn't enough water to float the boat with us in it, but by walking along each side and helping the craft over the shallower places, we managed to make some progress. ... This kind of thing kept up for some days, until at last we reached the Gila, and from then on we had a little better going. There was not what could be called too much water, ever here, but most of the time one of us could stay in the boat. ... After this we had as much desert but more water in the river bed, so we made pretty good time to Yuma. I don't recall just how long it took us to make the trip. Three weeks or maybe a month would be my guess now."
(Coconino Sun, Sept. 5, 1945 and Arizona Wildlife and Sportsman, Aug. 1945. Stanley Sykes recalling a trip he made "about 52 years ago" in the winter at low-water time.)

Rowboats and a small steamboat on the Lower Colorado River

"It was past midday, the 21st of Dec. 1901, when our party of nine, in 3 rowboats (a black canvas boat, a red boat and a green boat) pushed off from the muddy bank of the Colorado at the town of Needles, and began our journay of 300 miles to the southward. The smoky little railroad town was soon left behind ... The current was swift with many shoals and sandbars, but with a little practice we soon learned to keep the channel. ...

"At Friant's ranch, on the AZ side, 3 miles above Williams Fork, was the first attempt at agriculture we

had seen. Here Mr. Friant has a few acres of alluvial soil, above high water, to which he pumps water with an engine and windmill ... He owns a little steamboat and carries most of his produce to Needles, a distance of 55 miles. ..."
(Three Hundred Miles on the Colorado, 1901)

Rowboats on Granite Dells Lake

"Grand Opening of Granite Dells Resort. ... Dancing, boating, bathing, log riding, swings for young and old, a shooting gallery, and a ball game between the Diamond Jos and a team from Jerome will be among the attractions to be found at this summer resort, so popular with Prescott people. ..."
(Prescott Journal-Miner, 5-5-1907)

Rowboat on the Salt River and Canals

"WATER ROUTE TO ROOSEVELT - Accomplishment of Two Mesa Voyagers
VIA CANALS IN ROWBOAT
Another Story of Two Men Not Including the Dog.
The Route is Not Yet Recommended for General Travel.

"The first trip ever made from Roosevelt to Mesa by way of boat was that of yesterday when Roy Thorpe and James Crawford arrived in Mesa by way of the Mesa canal, having made the entire journey from the dam site by means of an ordinary row boat.

"The original idea of the voyagers in making the trip was to enjoy the sensations of going over a route that is seldom frequented and also attempting a feat which has never yet been accomplished. It is understood that at least two parties have made the trip by boat from Roosevelt to Granite Reef, but the making of the entire trip by water from Roosevelt to Mesa is a record.

"The row boat that was used was in a very dilapidated condition at the end of the trip. Before the start was made three bottoms had been placed in the craft and one of these had been worn through by the constant friction with the boulders and sands found in shallow waters. Many times the men were compelled to lift their craft from the water and carry it over obstacles and at other times had to haul it along the stands. ....

"One incident of the trip was that just prior to leaving Roosevelt one of the men exchanged a faithful dog to which he had become attached for a puppy. The idea being that the older dog would be entirely too heavy for the craft. The dog, which was left at Roosevelt, in some manner chewed the rope in two with which he was tied, and followed the master the entire distance, arriving at Granite Reef but a few hours after the boatmen had left. Those who understand the Salt river will recognize that the feat performed by the dog is even greater than that by the men. Coming through the Box Canyon necessitated the animal swimming for a considerable distance while the falls this side of Mormon Flat would offer many obstacles. The men are well pleased with their adventure, but have no serious intention of attempting to go into competition with the stage company, nor did they attempt to break any speed regulations."
(The Arizona Republican. 6-28-1910).

Rowboat on the San Juan River

"Armed with the boat design from Billy's Alaska forays, Norman began construction of his first boat in January, 1934. An old horse trough and a privy provided the lumber. Huge knot-holes were patched with tin, and old undershirts stuffed into the cracks made it watertight. The boat had a six inch "kick" or upsweep from the bottom to the top of the bow, and stood sixteen feet long by five feet wide. To keep out waves, a six inch splashboard was tacked onto the twenty inch sides. Two feet wide at each end, the boat looked "something like a cracker box." This description was a distinct improvement over the recent honeymoon expedition in the Grand Canyon, that of Glen and Bessie Hyde. The Hydes disappeared in 1928, leaving behind few clues and a boat described as resembling a coffin. Pumprods from a well served for Nevills' oar shafts, and "borrowed" Utah State Highway signs made serviceable oar blades.

On a test run in February, a rock tore open the bottom of the boat. The next day Norman cut some sheet iron into three inch strips and covered the bottom and sides of the boat. On future boats, oak stripping replaced the sheet iron."
(Nelson, N., 1991, page 3, describing travel on the San Juan River) .

Rowboats on the Upper Colorado River to Lee's Ferry

"The party descended the canyon by using two 16-foot flat-bottomed rowboats, which were built in Los Angeles, Calif., shipped to Green River, Utah and hauled 170 miles with a quad truck to a point on the river 4 miles below Bluff, Utah. The boats were launched and the canyon voyage began ...

"Numerous oil and gold prospectors have descended in rowboats and on rafts parts of the San Juan between Bluff and Zahn's Camp. ... Some of the prospectors ascended the canyon with their boats, but they had to tow the boats upstream, because the current is too swift for upstream rowing.

"In 1894 Water E Mendenhall, a gold prospector, of Lake City, Colo., made the trip alone in a crude hand-made boat from Mendenhall Cabin to Lees Ferry."
(Miser, H. D., 1924, pages 2-3)

Rowboat on the Upper Colorado River

"My brother and I went in a 16-foot rowboat with a 5-foot beam, drawing only 4 inches of water loaded."

(John Galloway describing a trip in 1926, witness in the Utah Riverbed Case)

Scows, Flatboats, and Miscellaneous

Wagons Used as Boats on the Gila River

"Thurs. Dec. 31st. ... Here the Colonel ordered two wagons to be unloaded, their boxes put into the Gila River [downstream of Gila Bend, 9 days march from the Colorado River] and loaded with corn, bacon, and flour, and set down the river with men to man them, with instructions to haul in every afternoon and camp with the command. This move of the Colonel's we did not like and we had forebodings it would not be a success.

"Sun. Jan. 3rd ... Our boat have not come up since they left on the first and the Colonel has sent up the river to know what is the matter and this evening a report came in that the boats had run aground and it was doubtful about their coming any further. ...

"Wed. 6th This evening the boats arrived minus the provisions. Part of it had been put ashore and part left on a sandbar in the middle of the river. ..."
(Bigler 1932 p. 52, speaking of events in 1847.)

Scow on the Lower Colorado River

"Major Lawrence P. Graham, in 1848, commanding a troop of US soldiers destined for California, had abandoned here about twenty wagons. Selecting the most seaworthy body to be found among those wagons, with nails extracted and lumber supplied from others, we constructed a scow, caulked it with strips of torn-up shirts, for want of pitch using tallow supplied from the bladders bought from the Mexicans for use as lard. This tallow answered astonishingly well, the cool water keeping it hard and unmelted even under a blazing heat. Oarlocks were attached and, lo!, she floated the water - thing of life - though mayhap not of beauty."
(Harris, B. B., 1960, p. 85, quoting travelers crossing the Colorado in 1848)

Flatboats on the Gila River

"The Gila Copper Mines. These mines were discovered in the early part of 1856 by Richard Halstead, well known in the Gadsden purchase ... They are situated about twenty-four miles from the junction of the

Gila, with the Colorado, on the left bank, southern side of the Gila, and two miles from the river.

"... The great advantage in the location of this mine must make it immensely valuable - the ore or smelted copper can be transported on flatboats down the Gila to the junction of the Colorado and Gila, whence it can be carried by steamboats now running on the river, and delivered on board vessels at the head of the gulf at eighty dollars a ton, a rate which would defy competition from any distant part of the Gadsden purchase. ..."
(Mining Magazine, May 1857, page 483. There is no record of such transport actually occurring.)

Flatboat on the Salt River and Canals

"Salt River is navigable for small craft, as last week L. Vandermoerk and Wm. Kilgore brought five tons of wheat in a flat boat from Hayden Ferry, down the river to the mouth of Swilling canal and thence down the canal to Hellings & Co.'s mill."
(Weekly Arizona Miner Prescott, 5-3-1873)

Hand-Propelled Boat on the Gila River

"A new model of Gila craft was launched at the Florence pier Thursday, but did not meet the expectations of the inventor, Alex Gay. The new craft was provided with hand driven side propellers, but when the trial trip was undertaken it was discovered that the Gila current was mightier than human muscle and the boat drifted with the stream for a mile or more before a return to the launching shore could be effected. Nothing short of a ten horse power engine could drive a paddle wheel successfully in the Gila."
(Florence Blade-Tribune, 3-18-1905)

Houseboat (?) on the Salt and Gila Rivers

"The Phoenix Shipyard. Its First Boat, a Suspicious Looking Vessel, Launched Yesterday.

"The People that live along the lower Gila are pretty well accustomed by this time to seeing all manner of strange things drifting down on the breast of that ever surprising stream. Such odd collections as railroad bridges, ferry boats, farm houses, chicken coops, lumber yards, etc., no longer create surprise. But there was launched here yesterday something that may make their eyes bug out for it was ostensibly a houseboat, though it may be a torpedo boat in disguise or some new manner of war vessel that has been constructed here on the quiet for the Russians with a plan of attacking Tojo's nest in the rear while he is busy heading off Rodejvehsky's battle squadron as it enters Chinese waters. It will the same time be a matter of news to Phoenix people to know that this city has a real shipyard that the product of it is already in evidence.

"The master mind of this shipbuilding enterprise is Mr. Jacob Shively that came here not long ago from Ashland, Oregon. While Phoenix was standing around in open mouthed wonder, not imagining before that there was so much water in the world, Mr Shively was engaged in plans to make some use of it. He came from a country where they had had water before and a little surplus does not bewilder them. Mr. Shively says he's 76 years old and therefore of sufficient mature experience to conduct his own business without taking the whole world into his confidence or asking the advice of the whole town as the average man does before he starts something.

"He secured space for a drydock at the Chamberlain Lumber Co. and proceeded with the construction of the keel and first deck. A second deck was contemplated at first and the fact that the plans were changed leads to the suspicion that Mr. Shively had a warship in mind and received a change of orders from his prospective purchaser or employer. In the event the plans had been previously perfected. Anyhow it is surmised that a one decker could creep about more stealthily than a formidable appearing boat. In lieu of a second deck or a cabin therefore he equipped the vessel with bows for a wagon against which will turn Arizona hailstones, the only thing one needs armor for in these waters. When stripped for motion or action the wagon wheel may be removed.

"The boat was finished yesterday morning and the dry dock being some distance from the harbor a two horse wagon was pressed into service to assist in the launching which was accomplished without the slightest trouble. The launching went on in the presence of a vast crowd of two or three men and there was no champagne wasted or ceremony of a public character. The builder announced his intention of accompanying the crew as far at least as Yuma, but he was silent concerning the later plans. There are fears in some quarters that the boat may prove to be a submarine before it leaves American waters."

An article two weeks later reported that the boat had nearly reached Gila Bend with many trials and tribulations before capsizing. Capt. Shiveley opined that "no one has any business on that river with a boat les than 6 feet wide 14 feet long 3 feet hie an 2 good men." [sic]
(Arizona Republican, 3-24-1905 and 4-3-1905)

Flat-bottom Boat on the Verde River

"Word has been received at Clarkdale that Fred Fogal and Earl Gireaux who left Clarkdale about three weeks ago on a small flat-bottom boat, to brave the dangers of navigating the Verde river as far as Granite Reef dam, have successfully traveled approximately seventy miles.

"The two adventurers are at present trapping in the Bloody Basin country and report bagging coyote, civet cat and many other fur-bearing varmints. They also state that the river becomes easier to navigate the farther south they go and that they are thoroughly enjoying the trip."
(Jerome Copper News, 2-6-1931)

Sailboats

Sailboat on the Colorado River Delta and Lower Colorado River

"I had purposely designed and was building my craft of ample size and equipping it for both river and sea use in order to carry my reconnaissance down into the Gulf. She was turning out to be a clinker-built Mackinaw-type boat, about twenty-two feet in length by six feet beam, rather heavily framed and fitted with a large iron center-board. She was schooner-rigged, and intended to balance under either her full spread of canvas (two pound boat sails and a jib), her mainsail and jib, or her foresail alone
... a small load of lumber in accordance with my specifications, were dumped on the river-bank and I set to work on the boat."
(Sykes, Godfrey, 1945, pages 210 and 227, describing the early 1900s).

Sailboat on the Salton Sea

"I shortly thereafter found myself camped alone on the shore of the still filling "Salton Sea," building a large and commodious sailing boat for botanical and eremographic investigation. ... I had designed and was building the craft sufficiently commodious to provide ample space not only for an unknown number of co-explorers, but also for the usual load of specimens, botanical and otherwise, which I had already learned would be collected upon a trip of the kind we were to make. I rigged her with a single large sail, a sprit-sail, and equipped her with a lee-board in order that she might be worked to windward if the occasion arose. She was of coarse flat-bottomed for making mud landings ..."
(Sykes, Godfrey, 1945, pages 269-270, describing the early 1900s).

Ocean-going yacht on the Sea of Cortez

"Went to Tiburon Island
Arizona Charley Meadows ... and party returned Saturday [to Florence] from their trip to the gulf. On account of the floods and high tides the hunting grounds about the mouth of the Colorado river, usually so prolific of exciting sport for the hunter, were mostly submerged and the party had little enjoyment in this direction, but in another way their expedition was interesting. Two or three days were spent in trimming up and preparing Charley Meadow's yacht for a voyage and the party then set sail for Tiburon Island about 500

miles distant. The wind and weather were favorable and they had a fine trip. Reaching the island they sailed all around it, landing in at least twenty different places. ..."
(Florence Blade Tribune 5-6-1905)

Ferries

Wooden Ferry on the Colorado River at Yuma

"July 1850 Foster wrote in the SF Herald that 2 other ferry companies were being organized to take over the lucrative job of transporting emigrants from the east to the west banks of the river. Rumors had it that one of these was got up under the auspices of Col. Jack Hayes Whilom of Texas, and now sheriff of San Francisco. Both of these parties numbering 20 men each had arrived at San Diego one of them it was said, with $20,000 worth of goods to trade with the Indians. In addition, an application for a license to keep a ferry at this point had been made by a brother of Major Fitzgerald.

"To make up the complement a couple of Yankees were actually on their way with goods to this point and would be up in a few days. This being the state of affairs, it was at once concluded to be indispensable that we should proceed forthwith from our then camping ground, and take possession at this point, as this has been heretofore the place where the ferries have been established, and it is also unquestionably the point where the military was to be stationed when it arrives. Accordingly the next night we yoked up our teams, and pushed ahead, and without meeting any obstacle worth relating, found ourselves at the point which my letter is dated. This you must know is on a high bluff at the angle formed by the Colorado, immediately before and after its junction with the Gila .. The spot we occupy has always been called Concepcion on the Mexican maps. Etc. ...

"Dug a well, then went into the slough, cut down cottonwood trees that gave us butts two and half to three feet through and 10 to 15 feet long. Sawed them into sized lumber necessary for flat boats. Between doing guard duty daytime, and picket nights, sawing out lumber, building boats and cattle guard duty we were busy."
(Sweeny, Lt. Thomas W. , Woodward, E. ed. 1956, in a journal from 1848)

Wooden Ferry on the Colorado River south of Yuma

"Paddock's Old Ferry which was about 23 miles below Ft. Yuma, where there were ruins of an adobe house. 3 miles lower down was Gonzales Ferry which was a place where the Mexicans crossed the river (this was an old and established place of crossing). Cooke's Old Ferry was about 6 miles below Algodones which at that time belonged to L.J.F. Jaeger. He also operated the ferry about 1 mile below the fort. In 1848 Couts built a raft, allegedly the first ferry to cross the Colorado. Many were simply made by covering wagon boxes with waterproof sheets or tarpaulins, some of willow boughs covered with rubberized cloth, but these were in the main cranky, unstable and decidedly unsatisfactory craft. ... In 1849 Couts was once again at the ferry and helped immigrants across."
(Couts, 1960)

Ferry on the Gila River East of Gila Bend

"Boating in Arizona

"It does one so much good to read of boating in Arizona that we produce the following account of a wreck on the Gila from the Arizonian:

"On the 9th inst, the large ferry boat which had been used for years on the Salt River at the Maricopa crossing was floated down the river with the purpose of taking her to the Gila Bend crossing. Five men were manning her and everything was going on smooth until they reached a point about forty miles below Phoenix, when the boat came into contact with a willow snag just in the middle of the river. The current of the river being about at the rate of fifteen miles per hour the five men lost control of her and she struck the snag. She

was cut in two parts as if she had come across a buzz saw. She is a total loss. Her owners, Messrs. Vol Gentry and W. Cox, valued her at about $1,000."
(Tombstone Prospector, 1-24-1885)

Ferry Boat on the Salt River at Phoenix
"The new ferry boat for the Gila is delayed for want of oakum for caulking purposes."
(The Phoenix Herald 4-8-1894)

Aerial Ferry at Kelvin
"The Gila river is still up and dangerous to ford. At Kelvin a wire rope is stretched across the river on which runs a cage for carrying passengers and freight. On Thursday a cart was carried over and an attempt was made to lead a horse across. The man in the cage foolishly tied the halter rope around his body, the other end attached to the horse. As the cage started towards the middle of the river the horse bogged down in the quicksand, the rope became taut and jerked the man out of the cage and it was by the skin of the teeth that he was rescued alive. That historical animal, Thompson's colt, has many prototypes."
(The Florence Blade-Tribune, 2-16-1901

Ferries on the Gila River at Florence and Kelvin at Flood Time
"Eight hundred feet of the Maricopa railroad bridge across the Gila went out Saturday and the break has not been repaired, hence the S.P. passengers booked for Phoenix are now coming from Casa Grande to Florence by stage. They ferry the raging Gila here and go on to the capital by the P. & E."
(Florence Blade Tribune 02-18-1905)

"The Gila Queen, a finely constructed boat recently purchased by the Florence Commercial company, was busy all day Sunday transferring freight for that company. Over 8,000 pounds, together with several passengers and trunks were hauled during the day. ...
"The Kelvin Navigation company launched their new flat boat Sunday afternoon. The boat is attached to a wire cable, extending across the Gila from a point opposite the Ray mill, by means of two travelers and ropes. The trial trip was an exciting one. When it struck the swift water it began to buck and plunge like a true Arizona bronco. ... Jack was on the other side of the river watching the antics of that awful monster. ... "
(Florence Blade-Tribune 02-25-1905)

"The Mayflower and the Rey del Gila have gone into active competition at the Florence port and both now issue tickets to passengers. The competition was particularly keen Thursday and the cost of a voyage across the raging Gila fell to 20 cents."
(Florence Blade Tribune 03-18-1905)

Aerial Ferry on the Gila River at Kelvin
"The Florence Commercial Co. and Troy-Manhattan are at present putting a cable at Kelvin which, when completed, will solve the problem of safely crossing the Gila."
(Florence Blade-Tribune 3-25-1905)

Aerial Ferry on the Gila River at Kelvin
"E. O. Devine, the Kelvin merchant, was a visitor at Florence Monday and Tuesday. He says there are now two cables in operation at Kelvin, across the raging Gila. The car on one of the lines is operated by gravity and will carry 2,000 pounds of freight. These cable ferries are putting the marine fleet out of business."
(Florence Blade Tribune 04-08 -1905)

Ferryboat on the Gila River at Maricopa

"Building Boat to Cross the Gila. Maricopa and Phoenix Expects to Transfer Passengers Tomorrow.

"Carpenters are busy today building a boat that will be used to cross the Gila River until such time as the Maricopa and Phoenix road can make repairs to the bridge, 400 feet of which has been swept away by the high water of the past few days.

"H.W. Riley, who has the contract for building the boat, is working extra men on it this afternoon in order to have it completed in time to be take to the Gila river some time tomorrow and given its first trial.

"... The boat will be eighteen feet long, five feet wide and three and a half deep. It will be fixed for several pairs of oars. ...

"Transfers have been made in the past at the Gila River when the bridge was out, but never before has the boat used been as large as the Maricopa & Phoenix is now having made. It will carry about three times the amount of the ordinary row boat. ..."

(Arizona Enterprise, 1-6-1905. The location described must have been near the town of Maricopa, between Gila Bend and Phoenix.)

Ferryboat on the Gila River at Maricopa

"At the Gila Bridge. M & P. Railroad Cooperates with Gila River Navigation Co."

"Passengers who find it imperative to travel can get across now, though the transfer is a disagreeable and provoking one, and it will be several days probably before the mails will begin coming regularly from that direction.

"The ferry is across the south channel of the river, and the train from this side cannot get within a quarter mile of it. That is because the bridge over the north channel is too badly washed out to run an engine over. Passengers have to walk down this paralyzed structure to the south channel and then descend to the muddy bank and embark in boats. ...

"Another incident was the overturning of one of the ferryboats or canoes. Beside the boatman there were two men in it, members of a party of eastern visitors who were enroute here on for a mining enterprise. ... Both of them testify that the water was very wet, notwithstanding it was chocolate-like in both color and consistency."

(Arizona Republican, 1-16-1905)

Ferries on the Gila River at Florence

"Jack Hanson had a good thing and did not know it. He thought the cage on the cable was too slow so, he got the Gila Blunder back up the river attached her to the cable and loaded down with whiskey and beer he started across the river. In mid stream the cable parted and down the river they both went. Jack jumped overboard followed by Dave, making for shore. The Dutchman who was with them was sighted bobbing up in the water amidst the floating barrels, The Gila Queen crew started out and was able to rescue the crew of blunderers. They then started down stream for the barrels of beer, which they were after to rescue at the peril of their lives.

"The old Gila is doing business in the good old way this week. It has been impossible to cross it without the use of boats and at present the water is higher than at any time this season."

(Florence Blade-Tribune, 8-1-1908)

Motorboats

Gas-Powered Boat on the Salt River and Canals

"Round Trip Voyage of the River Fleet

"La Primera" with two small boats in tow sails to Consolidated Heading and returns.

La Primera, with Capt. Le Baron in charge, C.C. Jacobs at the helm, loaded with passengers and having in tow two smaller boats carrying passengers left the dock at the division gates Tuesday evening for a trip to Consolidated Heading and return. ...

"To all of those on board the experience was a novel one. Here were 18 people, none of whom, with two or three exceptions, had ever made a voyage on a gasoline power boat in Arizona. Few had ever ridden on any boat and a large part of the passengers had resided in Arizona when the water supply for the Consolidated Canal would hardly have damped a 6' X 9' dooryard. Only a few years ago and the idea of a boat ride in what was then called a desert would have been ridiculed. ... A beaver at work, unmindful of the reward offered by the government for its scalp, paused in its labors to gaze on the unexpected sight and an occasional coon, night hawk and owl sought to make themselves invisible. ...

"On the return trip the two small boats were cut loose and came down with the current assisted by oars in the hands of Messrs. Pomeroy and Lewis. ... Messrs. Le Baron and Jacobs were the hosts at the first voyage but they have purchased the boats as a business proposition and will, it is understood, place them at the disposal of the public for picnic and business trips - for a consideration. Their plans have not yet been fully given out."

Arizona Republic 8-22-1912

Outboard Motorboats on the Lower Colorado River

"My boat turned out to be a rectangular box, four feet wide and about eighteen feet long. One end, supposed to be the bow, was sloped up in order to offer less resistance to the water. The oarlocks were holes between pieces of boards nailed to the sides. The oars were lengths of inch board nailed to willow saplings. The was a foot of difference in their lengths, and the shorter of them had been broken and repaired with a couple of rusty nails and a shoestring. The craft was not exactly an Argosy (or at least it does not appear to me such at this day), but still it had a capacity for considerable freight in the way of Golden Hopes; also, which was of more practical importance, for several score of heads and hides. Boat room was not going to be a matter of serious worry.

"The boats we were to take had been constructed by the Southern California Edison Company for the use of their engineers who had made surveys in Glen Canyon the previous summer. Very solidly built in the first place, the rough bangings against rocks had left the heavy planks of their bottoms considerably shattered. Water poured through in streams on launching and the worst of them required brisk bailing to be kept afloat in pulling upstream to our camp. Twenty-four hours of soaking stopped the worst of the leaks and careful caulking most of the rest. A certain amount of seepage through some of the crushed planks persisted, however, and it was evident that it was going to take a deal of nursing to keep the aspiring flood of the Colorado on the under side of those boulder-battered bottoms until the end of the trip.

"The outboard motors were assembled and tried out during the afternoon of the sixteenth. True to form, my little Elto, clamped to the rail of the Ferry-boat started and ran like a top at the first turn. No less satisfactory was its trial run on the stern of my still leaking boat. Tiny as it looked in comparison with the other motors, there was still power and to spare in its diminutive cylinders to drive the big skiff at good speed against the four-mile current. I had used an Elto down three thousand miles of the Missouri and Mississippi the previous summer, unclamping it finally in New Orleans in practically as good shape as when I shipped it at Bismarck. But this was running with the current on a light boat, and in rivers with bottoms of sand and mud and offering nothing to bump against harder than snags. Pushing a thousand-pound load in a six-hundred pound boat against the current of a river flowing in a continuously rock-walled canyon was quite another matter. Also to be reckoned with was the fact that the abrasive action of the grit-charged waters of the Colorado was incomparably more severe than even that of the muddy Missouri. ... Tome, who had made some use of outboard motors in freighting for another government party in upper Glen Canyon the summer before, was determined to take full advantage of the experienced gained on that occasion in preparing our own motors for the stiff grind ahead. Against the inevitable and continuous bumping of rocks to be expected, he hinged the section of the stern to which the motor clamped, so that the effect of striking an obstruction would be to tilt rather to break it. Having found that no plunger pump would stand the scouring of the Colorado water for more than a few hours, he dispensed with pumps entirely, replacing them with five gallon gasoline cans, set on boxes in the stern, from which water to cool the cylinders cold be circulated through rubber tubes. To minimize the scouring of the submerged gears, these were to be opened and greased twice a day...

"We went on a USGS survey in a 16' Evinrude motor boat, in which we had two rolls of bedding, supplies for a week, at least 25 gallons of gasoline and our camera and surveying instruments."
(Carroll Dobbin, a witness in the Utah Riverbed Case, describing events of 1926 on the Lower Colorado River and Hardy River)

Motorboat on the Upper Colorado River to Glen Canyon

"The boat was 27 feet long, 5 feet wide, and drew 10" of water with ordinary load; it had a 6-cylinder automobile engine. Another boat was 20' long, 4' wide, with a draft of 6-8" of water and was powered with a Ford motor. Another boat was 18' long, 3 1/3' wide, and drew 10" of water."
(Virgin Baldwin describing events of 1925-30, witness in the Utah Riverbed Case)

Tunnel-stern motorboat

Tunnel-stern Motorboat on the Colorado River near the Hoover Dam Site

"I was running the ferry at about 14 years old. So I developed the ability of navigating on the Colorado River. No rapids, just muddy water. It was awfully hard to find clear water to run the boat in. I became the expert at it as time went along. I had to know what I was doing, because I could get the ferry to Arizona and back to Nevada.

"Another highlight of my life was when the beaver trappers came down the river. What they would do - about Christmas time each year they would wind up in St. Thomas Nevada. They would come in there, make a deal with somebody to load up their gear, and go by wagon down the Virgin River to Rioville. Part of their load, outside of the necessary bacon and beans, their lard and whatnot - the load consisted of two-by-fours, one-by-twelves, a bucket of tar, and a handful of nails. They'd just built themselves a little flat-bottom boat and make a pair of oars. And that's what they used coming down the river.

"So we built this little boat - 30 feet long, 6 feet wide. The only thing we had to go by was the old rule of thumb that a boat on the Colorado River must be six times as long as it is wide. That was the most ridiculous thing that ever come up. But that was it. That was how you'd do it. It was made out of one-by-twelves and two-by-fours, just like the trappers'. Thirty feet long, 5 feet wide, tunnel stern. Up to the building of the dam, all our boats were tunnel stern. That was a tunnel-like arrangement at the stern of the boat, usually a third as long as the boat. A propeller was run into this opening so you could navigate. We hauled it down to Cottonwood, down below the ferry line.

"I left there and went on up and got up to Boulder Canyon. I got over the roaring rapids, pushed my way over that. We got over Rainbow Rapids. I got over the reverse rapids. I had to get out and pull a little, push and pull a little to get over it. So we got up there. The boats were operated were homemade, flat-bottomed boats with a tunnel built in the bottom contoured to curve the water [as it went through], which would keep the propellers and the rudder above the bottom of the boat so they didn't hit rocks and things to damage them. These boats were powered by automobile engines. The one I operated had two Studebaker engines in it. In navigating the river you only navigated by what you could see on the surface, because you could not see through the water at all. And you operated only by the currents to guide your boat back and forth. [quoting Murl Emergy and Ray Cutright]
(Dunar, Andrew J and McBride, Dennis, 1993, pages 7 and 18, describing events in the 1920s and 1930s)

Rowboats Adapted for Whitewater

Rowboats on the Colorado River from northern Utah through the Grand Canyon

"The boats for this trip were modeled on those used on the former descent, with such changes and improvements as experience had suggested. They were honestly and thoroughly constructed by a builder named Bagley, who had a yard where he turned out small craft at the north end of the old Clark Street bridge [Chicago], and we often felt a sense of gratitude to him for doing his work so well. They were three in number, of well-seasoned, clear-gained, half-inch oak, smooth built, double-ribbed fore and aft, square-sterned, and all practically the same, the former trip having shown the needlessness of taking any smaller or frailer boat for piloting purposes. These were each 22 feet long over all, and about 20 on the keel. They were rather narrow for their length, but quite deep for boats of their size, drawing, if I remember correctly, when fully laden, some 14 or 16 inches of water. This depth made it possible to carry a heavy load, which was necessary, and at the same time which acted as a ballast to keep them right side up amidst the counter-currents and tumbling waters. A rudder being entirely out of place in the kind of navigation found in the canyons, a heavy rowlock was placed at the stern to hold a strong, 18 foot steering oar. The boats were entirely decked over on a level with the gunwales, excepting two open spaces left for the rowers. These open spaces, or standing rooms, were separated from the decked portions by bulkheads, thus forming under the decks three water-tight compartments or cabins, that would not only protect the cargoes and prevent loss in event of capsize, but would also serve to keep the boats afloat then loaded and full of water in the open parts. The rowlocks were of iron, of the pattern that comes close together at the top, so that an oar must either be slipped through from the handle end or drawn up toward the thin part above the blade to get out. By attaching near the handle a rim of hard leather, there was no way for the oar to come out accidentally, and so well did this arrangement work that in a capsize the oars remained in the rowlock. To anyone wishing to try the descent of the Colorado, I commend these boats as being perhaps as well adapted to the work as any that can be devised; though perhaps a pointed stern would be an improvement. Iron construction is not advisable, as it is difficult to repair.

"An arm chair obtained from the field was arranged so that it could be strapped on the deck of the middle cabin of our boat, as a seat for Powell, to enable him to be comfortable and at the same time see well ahead. This had a tendency to make the Dean slightly top-heavy, but only once did serious consequences apparently result from it, and I am not sure that the absence of the high load would have made any difference. (Dellenbaugh, Frederick, 1926, pages 236-240, 349, 359, describing Powell's second voyage. In 1871)

Cedar Rowboats on the Colorado River through the Grand Canyon

"After purchasing a boat, an ordinary flat-bottomed dory, fifteen feet in length, made of pine and ribbed with oak, ... I went to the railroad yard and opened the box car to see our boats. As soon as I looked upon them my heart sank within me, not on account of their size, their build or manner of fitting, but on account of the material - thin, light, red cedar - with which they were planked. The handling they had received in transportation had split two of them almost from end to end. ... They were five in number, fifteen feet long, forty inches wide, and about eighteen inches deep, sharp at both ends, clinker built, and planked with thin red cedar. ... had had them strengthened with extra ribs and braces, decked over at both ends and long the sides, thus giving them extra stiffness, and perfect strength for the material of which they were built, and they were provided with large air-tight compartments in both ends. Their one defect was the material - thin, red cedar - with which they were planked and the way it was put on, clinker built," which made them more difficult to repair. These boats were well fitted in form for the water, even the rough waters of the Colorado, but the delicate cedar of their sides and bottoms could not stand the bumping on the rocks of the River, and not be split at every contact.

"Profiting by the experience of the summer before, our new outfit was vastly different from the first. I had built, at Waukegan, Illinois., three boats, twenty-two feet long, four and a half feet beam, and twenty-two inches deep. These were made of oak, from plans of my own, with ribs of one and a half by three-quarters of an inch, placed four inches apart, and planked with one-half-inch oak, all riveted together with copper rivets. Each boat had ten separate air-tight compartments, two large ones in the ends and four along each side. (Two water-tight lockers were built in the ends, for meats and other things, which, if possible, we did not wish to unpack when making a portage.) Two cross seats were built into the sides, which with the bulkhead division in the center (without deck) completely braced and stiffened the sides. A fifty-foot line in the bow, and two hundred and fifty feet of three-quarter-inch line at the stern, a life line rigged all around the whole boat, and a plentiful supply of selected eight-foot oars for rowing, and twelve-foot oars for steering, constituted the equipment of the boats.

The best cork life preservers, made expressly for us from my own pattern, were provided for all the men, and during the expedition, everyone was compelled to wear them, whenever on the water."

(Stanton, Robert, 1987, pages 36-37 and 95, describing events of 1889)

Rowboats on the Upper Colorado

"We started with 6 boats, (15' boats with a 3' beam and a depth of 2' and keel bottom) which were so heavily loaded that the water came within 3-4" of the gunnel. Thereafter we pulled ashore and made a raft, which the 6th boat towed with part of our cargo on it. We lost 2 boats in Cataract Canyon and broke up a 3rd boat in order to get nails to make repairs on the other 3 boats. Below Cataract Canyon we encountered the Tickaboo Rapid, where one boat was damaged and repaired and we had more trouble at Trachyte Rapid, where we stopped and repaired leaks."

On another 1889 trip - "We shipped 3 22' boats, with a 3 ½ ' beam and a depth of 22",having a draft of from 15-18" loaded."

(Frederick A Nims describing the 1889 Stanton expedition, witness in the Utah Riverbed Case)

Galloway Style Rowboat on the Colorado River Through the Grand Canyon

"In 1896 Nathan Galloway, a Utah trapper, with one companion, made the complete voyage through the canyons from Wyoming to Needles. Galloway designed the type of boat which has since been used almost exclusively in the canyons of the Colorado, and later parties have profited much by his careful study of the features and conditions of the river. Our little navy consisted of four wooden boats of the Galloway type, 18 feet long by 4 feet beam, decked over fore and aft and fitted with water-tight hatches and airtight compartments. The oarsmen sat in an open cockpit in the center, running the rapids stern first, so as to have as much chance as possible to avoid the rocks and rough waves. A strong, light canvas boat was provided to aid in the work of the rodman.

(Birdseye, C. H., 1911, page 179-181)

Galloway Style Rowboat on the Colorado River Through the Grand Canyon

"A simpler, less pretentious boat than Mr. Galloway's could not be conceived, yet experience has demonstrated that it is the safest yet constructed for running the rapids of the Colorado River and going over its dangerous places. Mr. Galloway is his own architect and builder. A few three-quarter inch planks; a little heavier timber for braces; oars with holes in them, through which iron rods, fastened to the sides of the boat, serve always to keep the oars in the same place and are more secure than ordinary oarlocks; with canvas outriggers and cover to keep her form being filled with water and swamped when running the rapids; a bow at both ends, and a flat bottom with the merest pretense of a keel, and the boat is ready. For our trip the outriggers were taken off, as we had no dangerous rapids to encounter."

{James, G.W., 1903, page 231)

Galloway-Stone Type Boats on the Colorado River Through the Grand Canyon

"Three boats had been built for this expedition and paid for by the Southern California Edison.

Two of them were of the Galloway type and were on the same lines as the Edith, but larger, because ten men in all had to be transported down the [Colorado] river, and no supplies were available after leaving the town of Green River until the Cataract Canyon survey was completed. These two boats were named the L.A. and the Edison. The third boat had different lines from the others, being short and broad with deep sloping sides and a flat deck, and was equipped with an outboard motor.

"Later it was christened the "Static." All boats were of wood, flat bottomed, with a ten-inch rocker both bow and stern. Emery Kolb's Edith was the fourth boat. We had two sixteen-foot skiffs, about sixteen inches deep, with probably a four foot beam. The boats would be used mainly for transportation of supplies and equipment, but occasionally both men and equipment had to be transported. On these occasions the boats sat very low in the water.

That spring H.E. built a twenty-foot boat equipped with a fourteen-horsepower engine, naming it the Ida B. for his wife. He made several trips on the river with the Ida B. before deciding to build another boat, one with less draft. The second boat was longer and narrower and used the engine from the Ida B. He called it the Utah. ... On the trip to Moab the Utah carried 2,000 pounds of freight besides the passengers. ...

Three boats for the expedition had been built in Wilmington, California and shipped by rail to Green River, Wyoming. Two of them were of the Galloway type, eighteen feet long and about four and a half feet of beam. The other one was sixteen feet long with a hull like a common flat-bottomed rowboat. The boats were similar to those used by the Kolb brothers in 1911 and the Chenoweth party in Cataract Canyon the year before. ...

These boats were far different from those used the year before on the San Juan. They were decked over at each end with an open cockpit in the center for the oarsman. The end compartments were equipped with hatch covers fastened with wing nuts, and these covers had been made watertight by lining the contact edges with rubber. The frames of the boats were oak, and the two larger ones had shiplap sides. The bottoms were flat and protected by oak strips running lengthwise.

"When the boatmen looked over the two longer boats before unloading them, they seemed too large for one man to handle. For a while they considered having them cut down. But the plan was soon abandoned because when the boats were in the water they did not seem nearly as large and unwieldy.

"The new boat was eighteen feet long, made of oak, and weighed 800 pounds. It had a four-inch rake (the amount of overhang or incline from perpendicular at the bow) its bottom was protected with two-and-a-half-inch slats spaced two inches apart, and it had thin sheet copper at the chines (the intersection of bottom and sides).

"Each of these boats was equipped with a three-quarter inch lifeline that led all around the gunwale (the upper edge of the boat's side) through iron eyes. The rope was stopped by turksheads (turban-shaped knots worked on the rope with a piece of small line) at both sides of each ring. The oars were copper-covered at the tips. A metal handle or portage bar was fitted at the sterns, and all the boats had air tanks for safety and buoyancy. All were without keels.

"The fifth boat was a fourteen-footer made of canvas. It had tire inner tubes on each gunwale for bumpers and oil cans fitted inside for buoyancy. Life preservers for everyone were of cork with a kapok collar. Of the four wooden boats, the new one handled the most easily."
(Westwood, Dick, 1992, pages 6, 10, 51-53, 74-75, and 130-131, describing events of the early 1900s)

Galloway-Stone Type Boats on the Colorado River Through the Grand Canyon

"The four boats to be used on the expedition, while differing slightly in size and details, were all of the flat-bottomed, decked-over, one-man type that is appropriately called the Galloway-Stone. The somewhat crude original was designed and built by Nathan Galloway, a Mormon hunter, for use on his lonehand trapping expeditions to stretches of the upper Colorado canyons not reachable except by boats. One the very sound theory that it is better to avoid a rock in a light boat than to hit it with a heavy one, Galloway sacrificed strength for handiness, but built a boat which he repeatedly ran single-handed through rapids in which the large, heavy boats of Powell and Stanton had encountered much trouble.

"When Julius F. Stone, an Ohio manufacturer, scientist and sportsman, decided to make a voyage to photograph and study the geology of the Colorado River canyons in 1909, he had Galloway come to his home in Columbus, where the two men put their heads together to build an ideal boat along the lines of that already used with such success by the Utah trapper. The present type of the Grand Canyon boat was the result. It was entirely decked over except for a cockpit for a single oarsman, and weighed less than 250 pounds. Its length was sixteen feet, four inches, it beam forty-six inches and its depth sixteen inches. The material was Michigan white pine, five-eighths of an inch thick. The four boats of this type built to Mr. Stone's order were used with signal success on his voyage through the canyons. The run from Green River, Wyoming, to Needles, California, was made in one week over two months. Both Stone and Galloway brought their boats through all the ways without an upset and with but a single light collision each while under control of the oars. These are by long odds the best records ever made in the Colorado Canyons, both for time and for skillful boatsmanship. [describing a voyage in 1909]
(Freeman, Lewis R., 1924, page 311)

Steel Rowboats on the Colorado Rive Through the Grand Canyon

"In 1907 three miners, Charles Russell, E.R. Monett, and Albert Loper, with three steel boats, each 16 feet long, left Green River, Utah, September 20 to make the descent. Lopez and one damaged boat were left at Hite, near the mouth of Fremont River, while Russell and Monett proceeded. In the beginning of the Grand Canyon they lost a boat, but with the remaining one, after various disasters, finally made their exit from the Grand Canyon January 31, 1908. Their boats of steel were unsuited to the river work".
(LaRue, E.C., 1916)

Galloway-Stone Type Boats on the Colorado River Through the Grand Canyon

"They were beauties - - these boats of ours - - graceful, yet strong in line, floating easily, well up in the water, in spite of their five hundred pounds' weight. They were flat-bottomed, with a ten-inch rake or raise at either end; built of white cedar, with unusually high sides; with arched decks in bow and stern, for the safe storing of supplies. Sealed air chambers were placed in each end, large enough to keep the boats afloat even if filled with water. The compartment at the bow was lined with tin, carefully soldered, so that even a leak in the bottom would not admit water to our precious cargoes. We had placed no limit on their cost, only insisting that they should be strictly in accordance with our specifications. In every respect but one they pleased us. Imagine our consternation when we discovered that the hatch covers were anything but water-tight, though we had insisted more upon this, perhaps, than upon any other detail. Loose boards with cross-pieces, fastened with little thumbscrews - - there they were, ready to admit the water the very first upset. ... Certainly the boats acted so beautifully in the water that we could almost overlook the defective hatches.

"Directly underneath and beyond the roots of the tree were large rounded boulders, covered with slippery mud. Past this barrier the full force of the water raced, to hurl itself and divide its current against another rock. If was useless to try to take a boat around the end of the rock. The boat's sides, three-eighths of an inch thick would be crushed like a cardboard box. If lifted into the V-shaped groove, the weight of the boats would wedge them and crush their sides. Fortunately, an upright log was found tightly wedged between these boulders. A strong limb, with one end resting on a rock opposite, was nailed to this log; a triangle of stout sticks, with the point down, was placed opposite this first limb, on the same level, and was fastened to the upright log with still another piece; and another difficulty was overcome. With a short rope fastened to the iron bar or handhold on the stern, this end was lifted on to the cross-piece, the bow sticking into the water at a sharp angle. The short rope was tied to the stump, so we would not lose what we had gained. The longer rope from the bow was thrown over the roots of the tree above, then we both pulled on the rope, until finally the bow was on a level with the stern. She was pulled forward, the ropes were loosened and the boat rested on the cross-pieces. I foolishly insisted on making another trial at it with the Edith, for I felt sure I could make it if I only had another chance, and the fact the Emery had the empty boat at the end of the rapid and could rescue me if an upset occurred greatly lessened the danger. The idea of making a portage, with the loss of nearly a day, did not appeal to me.

"It is difficult to describe the rapids with the foot-rule standard, and give an idea of their power. One unfamiliar with "white water"usually associates a twelve-foot descent or a ten-foot wave with a similar wave on the ocean. There is no comparison. The waters of the ocean rise and fall, the waves travel, the water itself, except in breakers, is comparatively still. In bad rapids the water is whirled through at the rate of ten or twelve miles an hour, in some cases much swifter; the surface is broken steams shooting up from every submerged rock; the weight of the river is behind it, and the waves instead of tumbling forward, quite as often break upstream. Such waves less than six feet high, are often dangers to be shunned. After being overturned in them we learned their tremendous power, a power we would never have associated with any water, before such an experience, short of a waterfall.

(E.L. Kolb., 1989. pages 7-8, 186-188 and 240-241, describing events of 1909)

Galloway-Stone Type Boats on the Colorado River Through the Grand Canyon

"The current is swift and the water, loaded with sand and silt, has tremendous power. Except where the rocks actually extend above the surface of the muddy water, it is impossible to know precisely where they are and falls cannot be avoided when the men wade out into the stream to work the boats along. If the boats are kept too near the shore they must be lifted over the rocks and if they are run too far out there is constant danger of their being capsized in the river or jammed against rocks and held there by the force of their current."

(Eddy, Clyde, 1919.)

Galloway-Stone Type Boats on the Colorado River Through the Grand Canyon

"We obtained 3 boats of the Galloway type and used them down the Green River and through Cataract Canyon. When we brought the boats down the Green and made our survey through Cataract Canyon we had an Evinrude motor in one boat. It was 16' long, 4' beam, and drew about 10" when loaded with about 1000 pounds. The other boats were 16' boats with rounded sides. ... just above the confluence we hit a sand bar and broke the propeller shaft of our motor. ... I don't think we could have brought the same loads they had up the river with that motor."

(Leigh Hunt, describing a trip in 1921, witness in the Utah Riverbed Case)

Galloway-Stone Type Boats on the Colorado River Through the Grand Canyon

"Nathan T. Galloway and S.S. Dubendorf come in from Vernal, Utah. All set about unloading the boats, which are apparently in good condition, except that the canvas decking over the front and rear cockpits is not water proof, as it should have been, and the method provided for fastening it down is not as arranged for. The iron standards at each corner of the cockpit which should have been provided to hold the canvas sides and ends have been omitted entirely. Neither are the small bow and stern compartments provided with airtight covers according to contract.

"Here we find signs of a party consisting of two men and a half-grown boy just ahead of us. ... They have but one flat-bottomed -and that not a very large one. The bottom is not protected with sheet metal and already carries some patches. ... [4 days later] Just below the head of this rapid we find a wrecked boat, evidently belonging to the party just ahead, and on a rock nearby a blue serge coat spread out as though to be dried in the sun. Near the coat is a crude oar and a push pole. ... The boat is irrevocably lost. ... We find no further trace of them.

"We are up at daybreak and begin patching my boat by nailing a strip of tin with a double strip of cotton cloth covered with white lead, underneath it, all the way around the lower seam, then clinching the nails on the inside of the boat. ..."

(Stone, Julius, 1932, pages 45, 71, and 73, describing events of 1909)

Rowboats on the Colorado River Through the Grand Canyon

"The boats were designed after those used by Powell and Stanton. His 2 large boats were 22' long, 5' beam, built of ½" Mexican mahogany, on very heavy oak ribs and keels, having 3 water-tight compartments, forward, amidships, and aft, and intended to be unsinkable. The small boat was 16' long, built of 5/8" cedar, on same heavy oak ribs and keels, decked over for 4' at each end, and had a splash board, but no water-tight compartment. The draft was 14-18" loaded."

(Parley Galloway describing a trip made in 1927, witness in the Utah Riverbed Case)

Canoe Construction

Our canoes, or boats, as they were usually called, were made of one-half inch marine plywood. They were shaped like sadirons and were 16 feet long, 6 feet wide and about 18 inches deep. They had been "cockpitted" for the baling bucket, an extra oar and ropes for both bow and stern. Behind the boatmen was the bow deck, which had a small hatch and a place for storing some of the lighter material. ...

The stern deck was wide -- extending on out to the squared-off end of the boat. And here was where the passengers mostly rode. If there were too many, the smallest would be put behind the oarsman n the bow, usually on the bow deck with his feet hanging over into the cockpit. It was customary to keep the minimum weight on the bow to allow for quick maneuvering.

The boats were flat-bottomed, but rocker shaped from bow to stern. And with oars remaining almost in the same spot, it was possible to spin the boat rapidly enough to give the passengers a bad time. If the oarsman reversed quickly, they needed to be aware, or they might be dumped into the water. They were a little sluggish at the beginning of a roll, but they could spin rapidly, which was essential in the rapids.

Wayne McConkie 1940

Appendix C-1

Watercourse Database Catalog

ARIZONA NAVIGABLE STREAMS ADJUDICATION COMMISSION

FINAL REPORT

SMALL AND MINOR WATERCOURSES PILOT STUDY

CONTRACT No. A7-0109-001

Stantec Consulting Inc.
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Phoenix, Arizona 85044

in association with:

JE Fuller/Hydrology & Geomorphology, Inc.
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September 1999

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1.0 Introduction

1.1 GENERAL

The State of Arizona is currently adjudicating in regard to its ownership interest in streambeds throughout Arizona. Claims of streambed ownership turn on whether or not the streams were navigable or susceptible to navigation at the time of statehood in 1912. The reader is referred to the Project Background section of the previously submitted report *Criteria for Assessing Characteristics of Navigability for Small Watercourses in Arizona* (Stantec, 1998) for a complete discussion of the history of the navigability issue in Arizona.

The Arizona Navigable Stream Adjudication Commission (ANSAC) is legislatively mandated to establish administrative procedures, hold public hearings, and make recommendations to the Arizona Legislature as to which watercourses were navigable or non-navigable at statehood. The watercourses that have been adjudicated according to this procedure include a total of 14 major river systems throughout the state.

ANSAC is required to complete the legislatively mandated tasks described above by July 1, 2002. There are over 13,000 documented watercourses in Arizona, the vast majority of which are minor or small watercourses. In consideration of these two factors, ANSAC determined that the small watercourses should be considered separately from the major rivers in order to expedite the evaluation process to meet the target date for completion in the year 2002. ANSAC contracted with Stantec in 1997 to establish minimum technical and historical criteria for small watercourses in accordance with the legislative definition of navigability, susceptibility and non-navigability; develop an evaluation system to assess watercourses utilizing the criteria; catalog in a database all documented watercourses in the state. That work was completed in 1998 and the results are summarized in *Criteria for Assessing Characteristics of Navigability for Small Watercourses in Arizona* (Stantec, 1998).

Subsequently in May 1999, ANSAC authorized the Stantec project team to proceed with a Pilot Study to further test the evaluation system and apply the small watercourse criteria to a limited sample of small watercourses in selected locations. This report presents the scope of work, project approach, analysis, and findings for the Pilot Study. The project team is currently under contract the Arizona State Land Department to continue this work by applying the evaluation system to all remaining watercourses throughout the state that were not addressed in the Pilot Study. That work is scheduled for completion in August 2001.

The Small and Minor Watercourses Pilot Study fully utilized the ANSAC watercourse database, the minimum technical and historical criteria, and the multi-level watercourse evaluation system as described in *Criteria for Assessing Characteristics of Navigability for Small Watercourses in Arizona* (Stantec, 1998).

1.2 SCOPE OF WORK

The work plan for the Small and Minor Watercourses Pilot Study (hereinafter referred to as the Pilot Study) was comprised of the following main work tasks and activities.

Task 1 – *Fully populate and verify the master watercourse database*

All fields containing data considered diagnostic in the evaluation of watercourse navigability or susceptibility to navigation were fully populated and quality checked. Additionally, other data fields were incorporated into the watercourse satellite databases for information only; including a stream naming convention and township/ range/ section (TRS) information, among others. Further information regarding the master and satellite databases, source data, and data issues is presented in Section 2 of this report.

The analytical utility of the ANSAC master watercourse database previously developed using Microsoft Access software was enhanced by the use of ArcView GIS (Version 3.1), a Geographic Information System (GIS) mapping software product. ArcView provides mapping capabilities and facilitates geographic analysis to evaluate and interpret spatial data. ArcView allows the user to assign unique attributes to each record providing a useful sorting mechanism for analysis and evaluation. In addition, the project team was successful in obtaining valuable GIS hydrologic assessment data developed by various state and federal agencies. These additional data were incorporated into the watercourse database for completeness.

Task 2 – *Perform Level 1 analysis of the entire watercourse dataset statewide*

Level 1 analysis was conducted on all small and minor watercourses statewide. This first level in the watercourse evaluation process consisted of application of six criteria to each watercourse as described in Criteria for Assessing Characteristics of Navigability for Small Watercourses in Arizona (Stantec, 1998). These criteria include: perennial flow regime, dam impacts, historical and/or modern boating accounts, presence of fish, and special status designation(s). The data fields relating to these diagnostic criteria were fully populated in Task 1.

A database query – a digital expression of the Level 1 screening procedure – was applied to the GIS watercourse database to sort and divide the watercourses into two resultant datasets. Watercourses testing negatively to all of the six criterion were determined most likely to be non-susceptible to navigation. These watercourses were rejected for further evaluation and analysis under the multi-level watercourse evaluation system and comprise the Rejected Level 1 (RL1) dataset. Watercourses that tested affirmatively to at least one of the criterion proceed to qualitative analysis at Level 2 and comprise the Not-Rejected Level 1 (NRL1) dataset. Section 3.1 of this report presents more detailed information regarding the methodology utilized in Level 1 evaluation.

Task 3 – *Perform Level 2 analysis for the Yuma, La Paz, and Mohave Counties*

All watercourses in the NRL1 dataset located in Yuma, La Paz, and Mohave Counties were further analyzed and investigated in the second level of the evaluation system by employing a qualitative approach as described in Section 3.2. The initial Level 2 qualitative analysis resulted in categorization of the watercourses in the three counties into three groups as follows:

- Category A – Potentially Susceptible to Navigation;
- Category B – Not Likely Susceptible to Navigation; and
- Category C – Not Susceptible to Navigation.

A second, more refined, evaluation of the Category B watercourses was performed to determine which watercourses were to potentially susceptible to navigation and, thus, were included in Category A. Watercourses determined to be not susceptible to navigation were included in the Category C dataset. Only those watercourses included in Category A comprised the Not Rejected Level 2 (NRL2) dataset that will advance to more intensive Level 3 evaluation. Category C watercourses comprise the Rejected Level 2 dataset (RL2) and are not further evaluated.

Level 2 analysis will be applied to all NRL1 watercourses in the remaining 12 counties as part of a follow-on contract with the Arizona State Land Department commencing in October 1999.

Task 4 – *Perform Level 3 analysis for three selected watercourses*

The project team selected three NRL2 watercourses from the statewide database for Level 3 analysis. These watercourses were selected based upon geographic representation of the diverse physiographic provinces in Arizona, and to ensure the Level 3 analytical approach developed for the classification analysis is tested under a broad spectrum of stream characteristics. Results of Level 3 analysis will identify watercourses Not Rejected Level 3 (NRL3) which are forwarded to Detailed Study (Level 4) to verify susceptibility to navigation and/or evaluate any evidence of actual or historical navigation. Watercourses which are classified as Rejected Level 3 (RL3) lack sufficient justification for further study. Section 3.3 presents more information regarding Level 3 methodologies.

Results from the Level 2 analysis performed as part of the Pilot Study indicate no watercourses in Yuma and La Paz Counties require Level 3 analysis, while three watercourse in Mohave County will be evaluated at Level 3. One of those watercourses, Kanab Creek, was included as one of the selected watercourses analyzed at Level 3 for the Pilot Study. The other two watercourses analyzed at Level 3 are Aravaipa Creek and Pinal Creek. More detailed information relative to the Level 3 analysis performed for the Pilot Study is presented in Section 4.3.

The remaining NRL2 watercourses for Mohave County and the those located in all other 12 counties in Arizona will be investigated in a separate project under contract to the Arizona State Land Department, excluding the three sample watercourses analyzed as part of the Pilot Study.

Task 5 – *Prepare a final report and work product presentation*

The work products of the Pilot Study include the watercourse database and the final report summarizing the project approach, analysis results, and conclusions of the Pilot Study. Both are delivered in hardcopy and digital formats.

Task 6 – *Meetings and Coordination*

The project team coordinated all project activities with the staff and the Commission. Project briefings were presented to the Commission at the monthly public hearings. In addition, two coordination meetings were held with the Technical Review Committee for the project comprised of technical personnel from five State of Arizona agencies, including: Department of Water Resources, State Land Department, Game and Fish Department, State Parks Department, and Department of Environmental Quality. These meetings were attended by Commission staff and counsel and a representative from the Arizona Attorney General's Office.

The Scope Of Work for this Pilot Study consists of the limited application of the multi-level evaluation system described in detail in Criteria for Assessing Characteristics of Navigability for Small Watercourses in Arizona (Stantec, 1998) to small and minor watercourses in Arizona for the purpose of testing and refining that system. The results of the Pilot Study are presented in Section 4 of this report, as well as various figures illustrating both the three-level evaluation process and the findings of the analysis. Tabular data summarizing project results are included in the appendices. The CD submitted to the ANSAC contains the entire watercourse database developed for this project in digital form.

2.0 Data Requirements

2.1 BASELINE DATA

The watercourse database operates in a Geographic Information System (GIS) environment. This allows the user to analyze the spatial characteristics of the studied watercourses in a graphical or tabular format. The project team selected Arc View, a GIS analysis and thematic map software, for its ease of use and its operational capabilities. In addition, ArcView supports many of the hydrologic assessment activities that have been conducted by state, federal and local agencies. The viability of this data must meet the following criteria to be considered applicable to this project:

- Data is in, or can be readily converted to, a GIS format
- Data is readily accessible and is technically and historically sound
- Data is sorted, or can be easily sorted, by category criteria.

The primary data source in the development of the master database was obtained from the Arizona Land Resource Information System (ALRIS). The surface water data sets were originally derived from baseline Digital Line Graph (DLG) maps compiled by the US Geological Survey (USGS), which were further enhanced by the US Environmental Protection Agency (EPA) in several versions called the River Reach Files. The latest version, commonly called RF3, is a federal standard for identifying and cataloging water bodies. The RF3 file was converted to a GIS ARC format by ALRIS and has been distributed and used by various public and private agencies working on water management issues.

The base GIS layer used in the master watercourse database is an ALRIS-converted RF3 data set called STREAMS. It is a line coverage of hydrography (streams) within Arizona and contains 87,735 separate watercourse segments. The STREAMS file includes several fields that were relevant in the development of the master watercourse database. They include the Hydrologic Unit Code (HUC), segment number, mileage, watercourse type, and watercourse name. A binary (yes/no) field for each criterion and a county field were added to aid in the Level 1 sorting process. All manmade water features (canals, aqueducts, flumes, etc.) were removed from the master watercourse database. The major rivers previously assessed by the ASLD for characteristics of navigability or susceptibility to navigation and subsequently adjudicated by the ANSAC were also removed. The resulting master watercourse database contains 76,166 records.

Additional ALRIS datasets were used in conjunction with the STREAMS layer to allow for detailed resolution of the physical location of each watercourse. They include:

Name of Dataset	Data Type / Format	Description
AZSPRINGS	Vector; Point ArcInfo	This coverage consists of spring locations in Arizona. Incorporates information extracted from both the USGS Geonames database and the USGS Digital Line Graphs (DLG).
AZTRS	Vector; Polygon Format: ArcInfo	This statewide coverage consists of the Township, Range and Section grid lines.
County	Vector; Polygon Format: ArcInfo	This polygonal dataset consists of individual county and an appended statewide coverage.
Lakes	Vector; Polygon Format: ArcInfo	This polygon cover consists of all the lakes in Arizona.
HUCS	Vector; Polygon Format: ArcInfo	This data set consists of Hydrologic Unit Code areas (drainage basins) in Arizona.

2.2 DATA CONVERSIONS

The processing of data during query and search operations was slow due to the large file size of the data sets being used. To allow for ease of data storage and manipulation, a method of reducing the file size was undertaken with the goal of minimizing the impact to the outcome of the investigation and analysis.

The largest challenge was identifying a method to combine multiple stream segments into a single watercourse. Approximately 73% (55,387 segments) of the records in the original STREAMS dataset are without names. In addition, there are a large number of watercourses with repeated names; e.g., Sycamore Wash. To resolve this, the project team assigned a unique nomenclature to all unnamed and same-named watercourses. For unnamed watercourses, nomenclature was assigned by combining the HUC ID with the Segment number. For example, H34-2300. Same-named watercourses were assigned new nomenclature by combining the name with the county within which the majority of the watercourse was located. If there were more than one same-named watercourse within a county, an additional numerical ID was added to the name; e.g., Sycamore Creek, Yavapai 1. This naming convention enabled reliable query and display, and reduced the watercourse records to 39,039.

The project team assigned township/ range/ section (TRS) geographic location attributes to the mouth of each watercourse. The project team was not successful in linking the watercourse database to latitude/ longitude GIS coverages, but this is not essential as the database is linked to the TRS system for location referencing.

2.3 DEVELOPMENT OF SATELLITE DATABASES

Six satellite databases were developed for each of the criterion comprising the Level 1 evaluation screening process. These satellite databases were populated with both diagnostic data fields used for the binary queries in the ANSAC master watercourse database, and also informational fields to provide additional information relative to the Level 1 criteria where readily available. The watercourses that tested affirmatively were converted to new satellite databases (themes) based on the criterion queried and are linked to the master database by a unique watercourse name. Each satellite database can be layered graphically in any selected combination to facilitate watercourse evaluation and to create meaningful reports. Listed below are the six satellite databases (themes) that were created along with the source documentation associated with each database.

Perennial - Only watercourses that have been classified by both the Arizona State Parks (1995) and ALRIS (1988) as perennial are so identified in the database. The approach used in identifying these watercourses in case of classification conflict was presented and described in detail in an earlier ANSAC report by Stantec (1998). Since the original stream database (comprised of 76,166 stream segments) was recently converted into a watercourse database (comprised of 39,039 records), assignment of perennial stream type to watercourses was made for those washes and streams with at least one perennial segment.

Conflicts in the classification of watercourses beyond the two sources named above are addressed in the Level 2 analysis which employs a qualitative approach in the evaluation procedure. The project team acquired a GIS coverage developed by the Arizona Game and Fish Department entitled Perennial Waters of Arizona (AG&F, 1995,1997). The perennial streams originally compiled and mapped by Brown et al (1977, 1978, and 1981) are the foundation of the GIS coverage of perennial streams developed by

Arizona Game and Fish Department (1995, 1997). Those data are used extensively by recognized organizations and agencies – both federal and state – and were used by the project team to supplement the original perennial streams classified by Arizona State Parks (1995) and ALRIS (1988). Brown's perennial streams data were not integrated into the Level 1 analysis, but were used for the qualitative assessment in Level 2 for NRL1 watercourses located in Yuma, La Paz, and Mohave Counties.

Dams - The Arizona Department of Water Resources (ADWR) developed the GIS coverage in point features indicating the location of all the jurisdictional dams in Arizona. The coverage contains data fields describing essential attributes of those dams important to the agency in matters of dam safety, management, and ownership. However, essential data important to the pilot study are not completely populated such as township, range, and section, county, date constructed, dam types, and wash location. The missing information plus the resolution of the dam coverage make the task of identifying dam-impacted streams very difficult. The resolution problem associated with the dam GIS coverage is largely due to inconsistent development standards of different state agencies. Most of the GIS coverages used in the project were developed by ALRIS, while the dam coverage was developed by ADWR.

Aside from ADWR, there are other sources of data for dam structures built in the state of Arizona. The US Geological Survey (USGS) and the Federal Emergency Management Agency (FEMA) maintain a listing of dams for the entire United States. Inconsistency in the use of names for the dams and data attributes between these various sources resulted in the sole utilization of ADWR dam database for the Pilot Study. Originally, the dam coverage from ADWR was comprised of 397 records. After the deletion of dams that are used for tailings and those that are located off-stream (a total of 26 records), the final record count was reduced to 371 dams.

Fish - A report published by the USDA Forest Service titled *Run Wild* (Silvey et al, 1984) was used to identify the occurrence of fish species and their habitat in Arizona. Several documented sources validate the findings as listed in the *Run Wild* document. A total of 292 watercourses were documented to have fish. Efforts to acquire existing fish GIS database information from Arizona State University were not successful. Instead, fish information gathered from a number of reliable federal and state agency sources was used for the Pilot Study. These sources are listed in the references.

Historical And Modern Boating – Published accounts of modern boating were obtained from the Greenlee County Historical Society, Coconino Historical Society, Mormon Archives, Apache County Historical Society, Arizona State Parks, Central Arizona Paddlers Club, Arizona Game and Fish Department, and professional river rafting companies. One watercourse has a documented account of historical boating while 10 others have modern boating accounts.

Special Status – The Special Status category includes water-related characteristics that make a watercourse of particular interest or concern to various organizations and/or governmental agencies. Watercourses identified as having the following designations were included in the Special Status database: In-stream Flow Application and/or Permit, Unique Waters, Wild and Scenic, Riparian or Preserve area. Agencies issuing the Special Status designation were contacted to identify watercourses meeting the criterion.

3.0 Methodology

A three-level evaluation system shown in Figure 1 was developed for by the project team under the previous phase of this project (Stantec, 1998) and adopted for use in this Pilot Study. The approach involves a multi-level screening process of increasing refinement designed to identify watercourses least likely to meet the statutory and legal definitions of navigability as early in the process as possible. The evaluation process consists of three levels as follows:

3.1 LEVEL 1 ANALYSIS

The goal of Level 1 of the watercourse evaluation procedure is to perform a first-cut screening of the catalog of small and minor watercourses. The purpose is to eliminate the watercourses most likely to be non-susceptible to navigation and which exhibit no evidence of actual navigation in fact.

The Level 1 analysis is a binary, quantitative sorting process utilizing the data queries programmed into the database catalog. Those queries are the digital expression of the technical and historical criteria considered diagnostic for evaluating watercourses for susceptibility to navigation and for navigation in fact, respectively. Those minimum criteria include stream type, dam information, historical and modern boating accounts, the existence of fish, and any special watercourse status designation as shown in Figure 2.

The Level 1 screening process is applied to all small watercourses in the database catalog using available information from existing databases compiled by various agencies. Only those watercourses that test negatively to all six criteria are rejected at Level 1 as most likely non-susceptible to navigation. All watercourses, which test affirmatively to one or more of the criteria comprising the data queries, require further evaluation at Level 2.

Figure 1
THREE-LEVEL WATERCOURSE
EVALUATION PROCEDURE

Three-Level Watercourse Evaluation Procedure

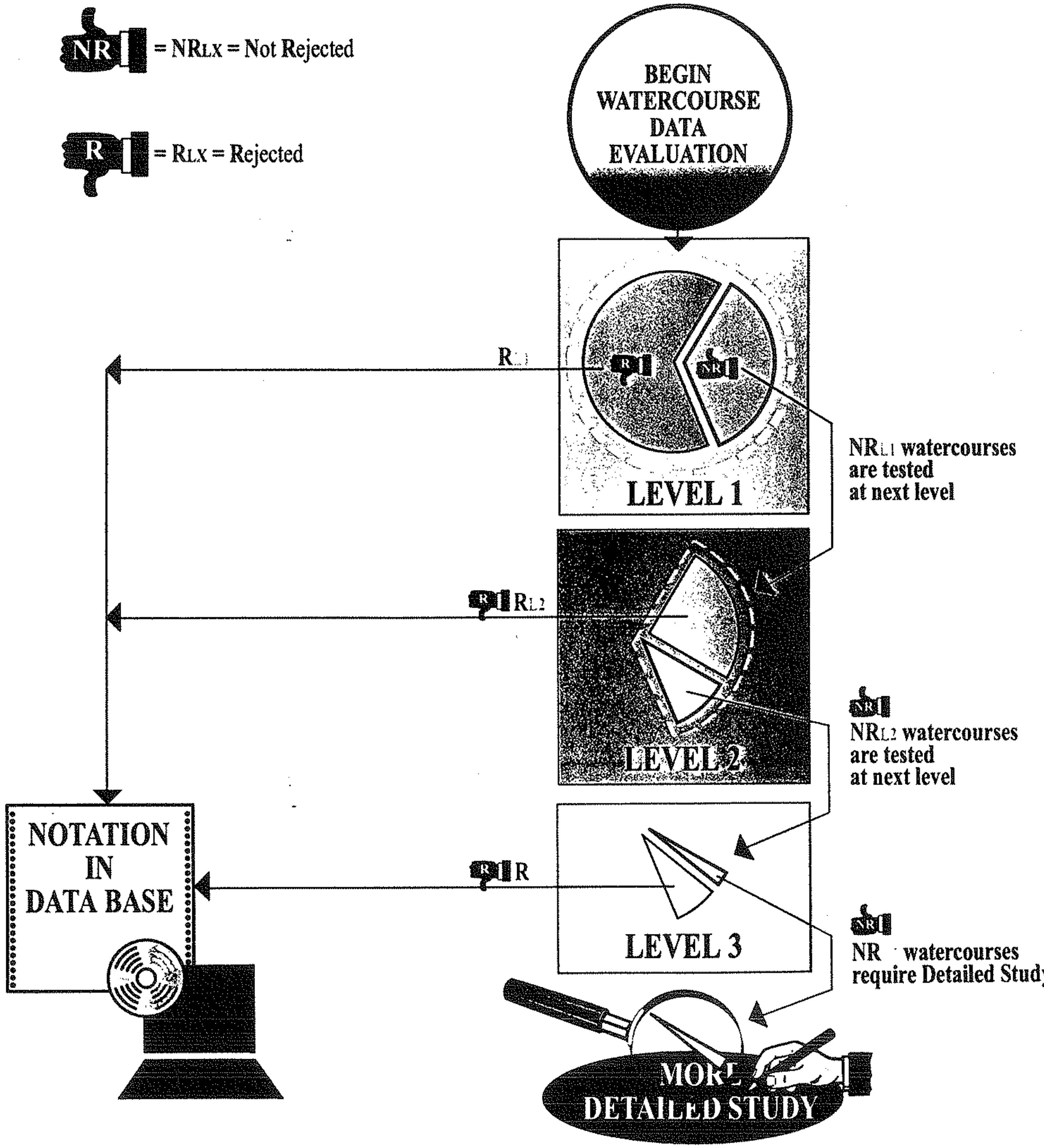
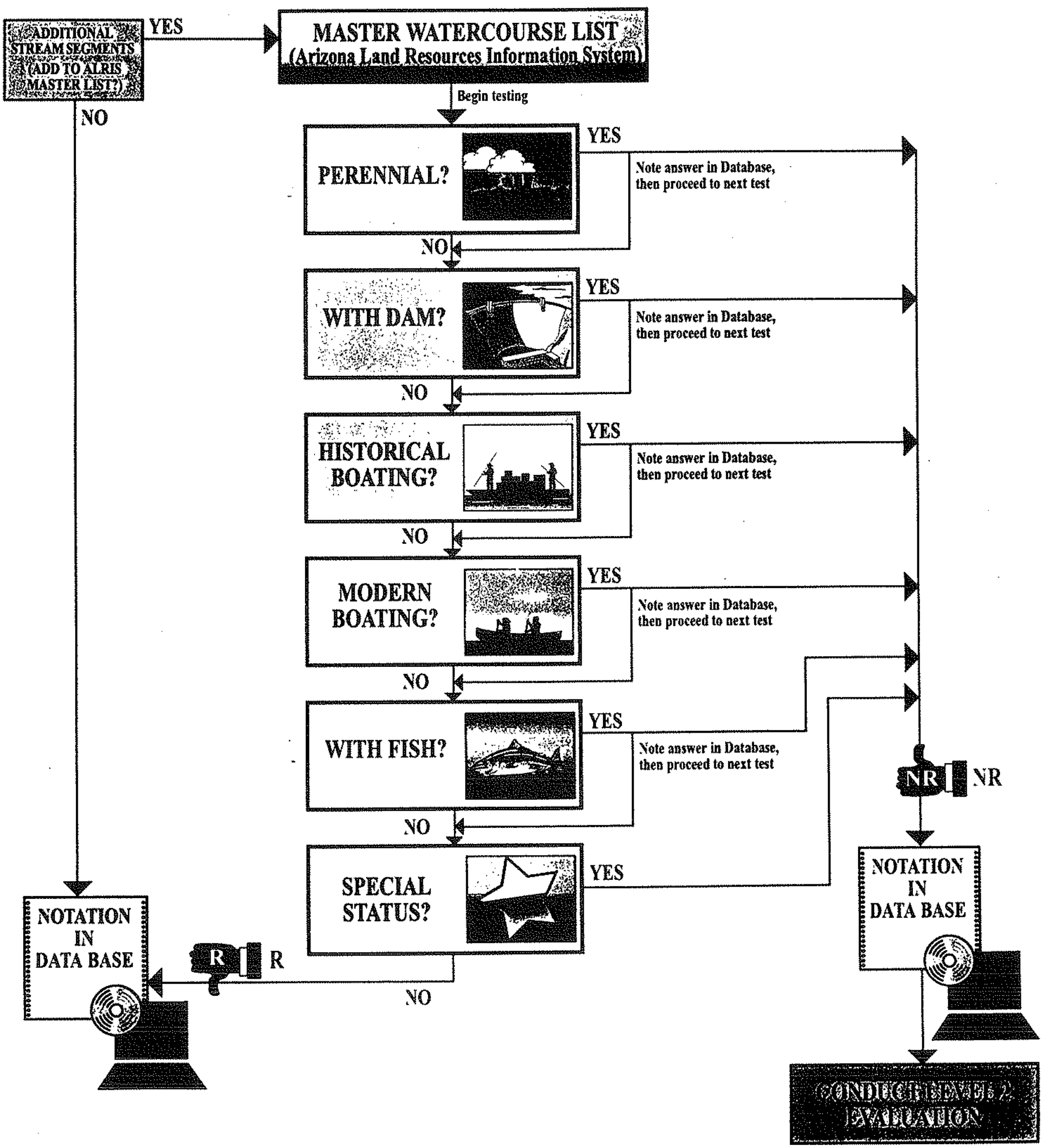


Figure 2
LEVEL 1 SCREENING PROCEDURE

Level 1 Screening Procedure



3.2 LEVEL 2 ANALYSIS

The goal of the Level 2 watercourse evaluation procedure is to perform a refined screening to eliminate the watercourses unlikely to be susceptible to navigation. Contiguous watercourse segments were combined to form study reaches to be evaluated in Level 2.

The Level 2 method of approach is more qualitative than the binary data queries employed at Level 1. Level 2 assessment involves the qualitative review of watercourse location, typical watershed characteristics, typical watercourse characteristics, among other features, for verification and interpretation of the reason(s), which caused them to advance from Level 1. In concept, the recommended Level 2 methodology involves the further assessment of those watercourse characteristics that tested positively at Level 1 in two parts as shown in Figure 3 and briefly described below:

1. The first-cut filter individually analyzes each criterion that caused a particular watercourse to advance to Level 2 – referred to herein as positive "hits" – for information salient to the navigability question as shown in Figure 4. Those watercourses are categorized into three groups as follows:

   Category A – Potentially Susceptible to Navigation;

   Category B – Not Likely Susceptible to Navigation; and

   Category C – Not Susceptible to Navigation.

2. The second-cut filter analyzes Category B watercourses with multiple positive hits on multiple segments for diagnostic hit combinations that are evidence of navigation in fact or are indicative of susceptibility to navigation, as shown in Figure 5. Watercourses will be categorized into two groups based on their likelihood of being susceptible to navigation. All watercourses with documented boating accounts, historical and/or modern, will automatically advance to Category A comprised of watercourses potentially susceptible to navigation. Watercourses with multiple hits indicative of susceptibility on contiguous segments will also advance to Category A. Watercourses which are determined upon visual and/or manual inspection to exhibit physical characteristics incompatible with successful navigation, such as high elevations, steep slopes, etc., will advance to Category C and are rejected from further consideration at Level 2.

The Level 2 qualitative review is applied only to those watercourses that advance from the Level 1 binary sorting process (NRL1 dataset). The Category C watercourses that are unlikely to be susceptible to navigation are identified and rejected at Level 2. Category A watercourses with multiple hits on contiguous segments merit quantitative engineering analysis are potentially susceptible to navigation and advance to Level 3.

Figure 3
LEVEL 2 SCREENING – CONCEPT

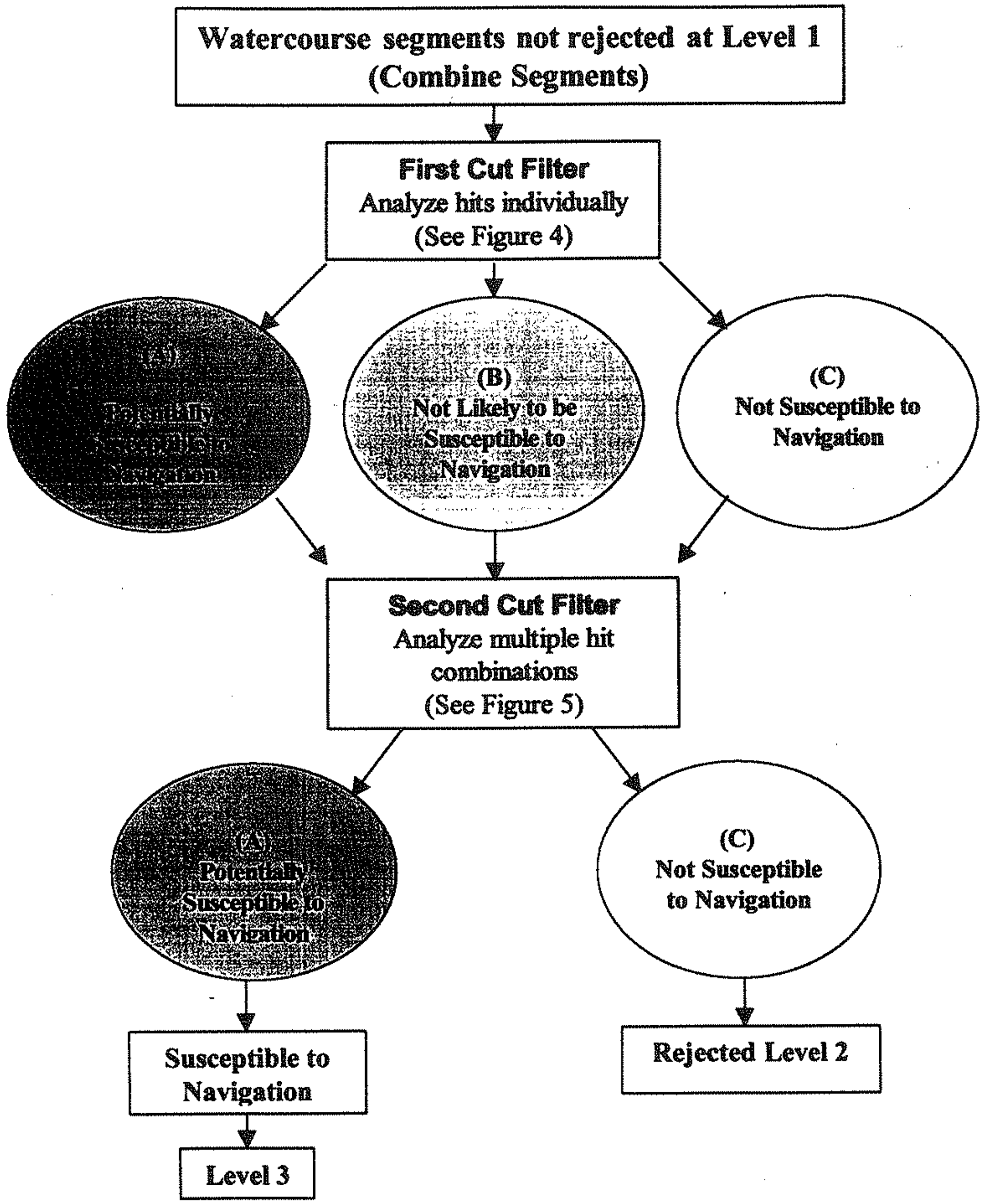


Figure 4
LEVEL 2 WATERCOURSE SCREENING
FIRST CUT FILTER

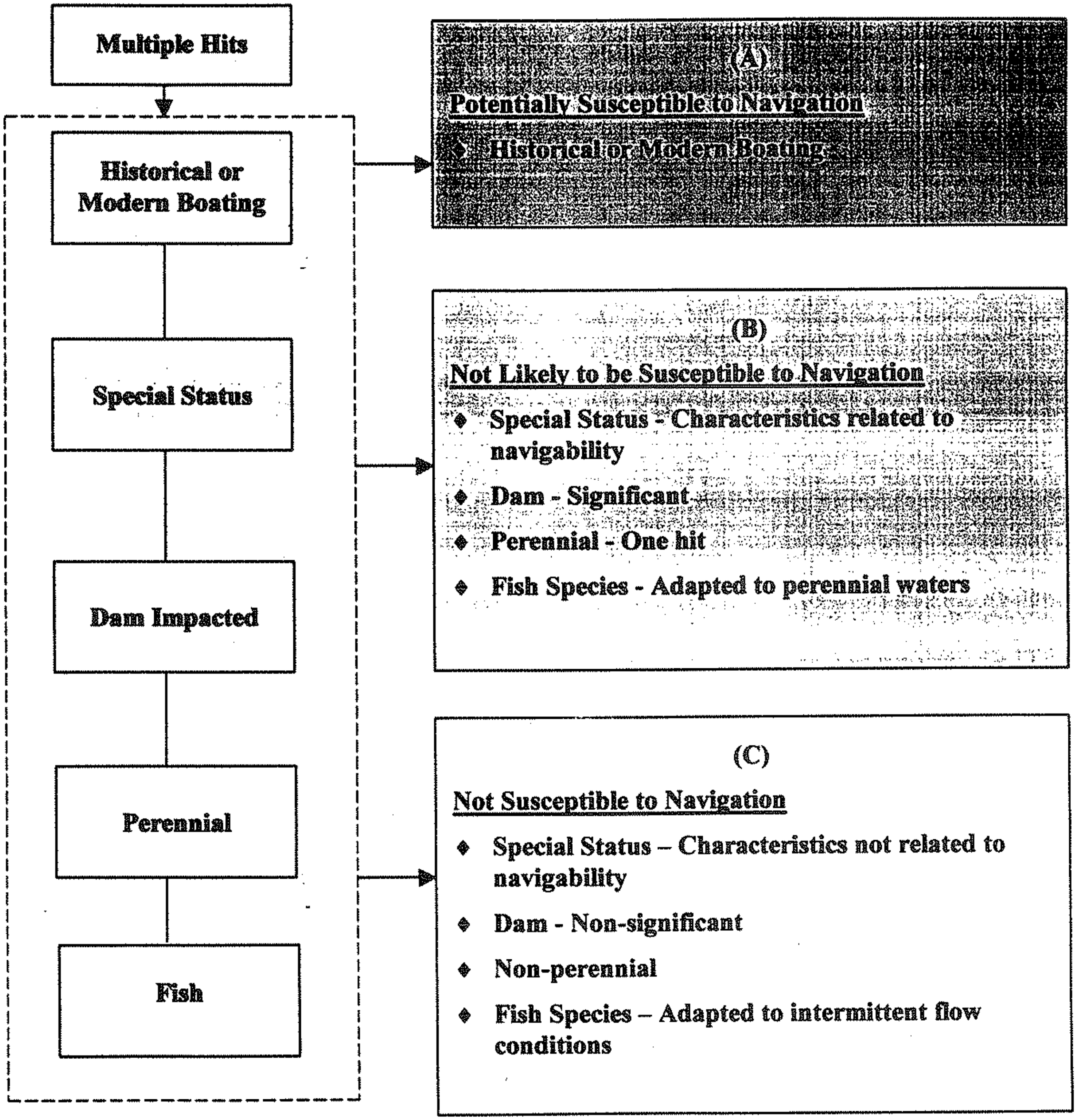
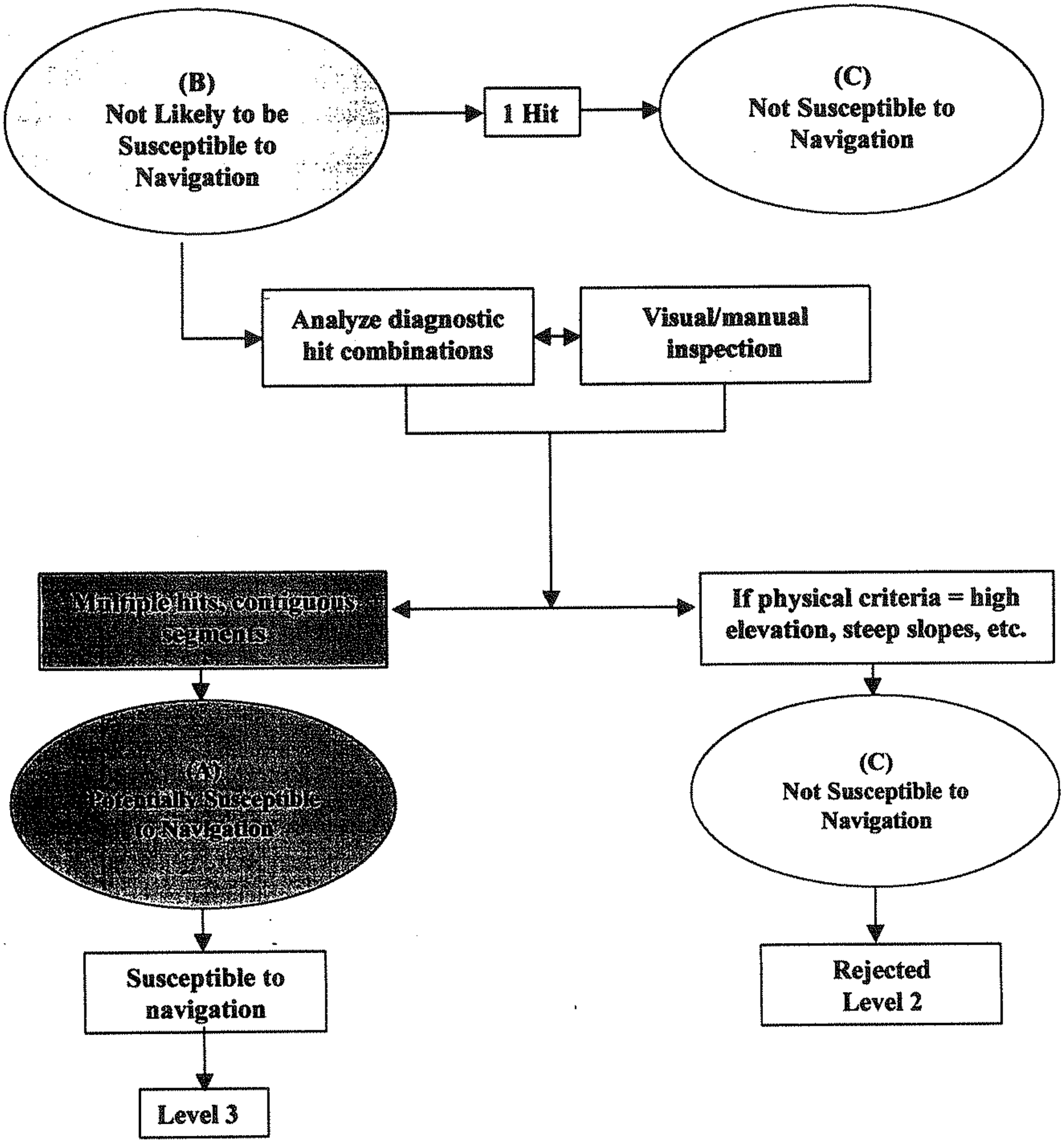


Figure 5

LEVEL 2 WATERCOURSE SCREENING SECOND CUT FILTER



3.3 LEVEL 3 ANALYSIS

The goal of the Level 3 fine sorting process is to eliminate watercourses that are non-susceptible to navigation utilizing quantitative engineering methodologies. The primary objective of the Level 3 engineering methodologies is to provide technically sound data from which typical channel characteristics and flow rates for each watercourse can be estimated and used to determine susceptibility to navigation. Additionally, any physical obstacles to successful navigation along a watercourse will be identified and assessed at Level 3.

The recommended methodologies for the Level 3 screening process involve application of quantitative hydrologic and hydraulic analysis procedures that require a significant level of effort to meet the requirements of the adjudication process. The availability of streamgage data significantly impacts the level of effort required to quantify discharge rate and hydraulic geometry for evaluation of watercourse susceptibility to navigation. The recommended methodologies include:

1. Quantitative analysis of US Geological Survey (USGS) streamflow records, or USGS regression-type methodologies based on streamflow records, or extrapolation of gage data to adjacent watersheds to estimate discharge in the subject watercourse; and

2. Use of USGS rating curves or Manning's ratings to estimate flow characteristics such as depth, width, and velocity in the subject watercourse.

The Level 3 screening process is applied only to those watercourses not rejected at Level 2 (NRL2 dataset). The watercourses with no evidence of actual navigation in fact and determined to be not susceptible to navigation are rejected at Level 3. All remaining watercourses merit Detailed Study (Level 4) comparable to that performed for the major river studies and advance to the final level of the watercourse evaluation system.

4.0 Results

4.1 LEVEL 1 ANALYSIS

The application of the Level 1 sorting procedure to all small and minor watercourses in Arizona resulted into two datasets. The RL1 dataset is comprised of all watercourses that test negatively for each criterion used in the Level 1 database query. This indicates that no characteristics of stream susceptibility to navigation are exhibited based upon know records and information. Level 1 analysis results indicate a significant percentage of the watercourses (99.4% or 38,785 records out of 39,039 total) test negatively to all Level 1 criteria and, therefore, do not justify further evaluation at Level 2.

Conversely, the NLR1 dataset is comprised of those watercourses that exhibit some characteristics of susceptibility to navigation based upon at least one affirmative response (hit) to the six criteria used in the Level 1 evaluation. Results of the analysis indicate that there are 1025 watercourses (approximately 0.6%) in Arizona which justify analysis at Level 2. The Pilot Study addressed Level 2 analysis of only those NRL 1 watercourses in La Paz, Mohave, and Yuma Counties (i.e., about 79 watercourses). NRL1 watercourses in the remaining 12 counties will be assessed at Level 2 under a separate contract.

A summary of listing of the NRL1 dataset for all counties is presented in Table A-1 in the Appendix. By inspection, the majority of the NRL1 watercourses (i.e., 762 records or 74%) are one-hitters and approximately 26% tested affirmatively to more that one of the Level 1 criteria used in the database query.

The shape files associated with the RL1 and NRL1 data sets evaluated from Level 1 sort are shown in Figures 6 and 7, respectively.

FIGURE 6

RL1 Data Set from Statewide Level 1 Analysis

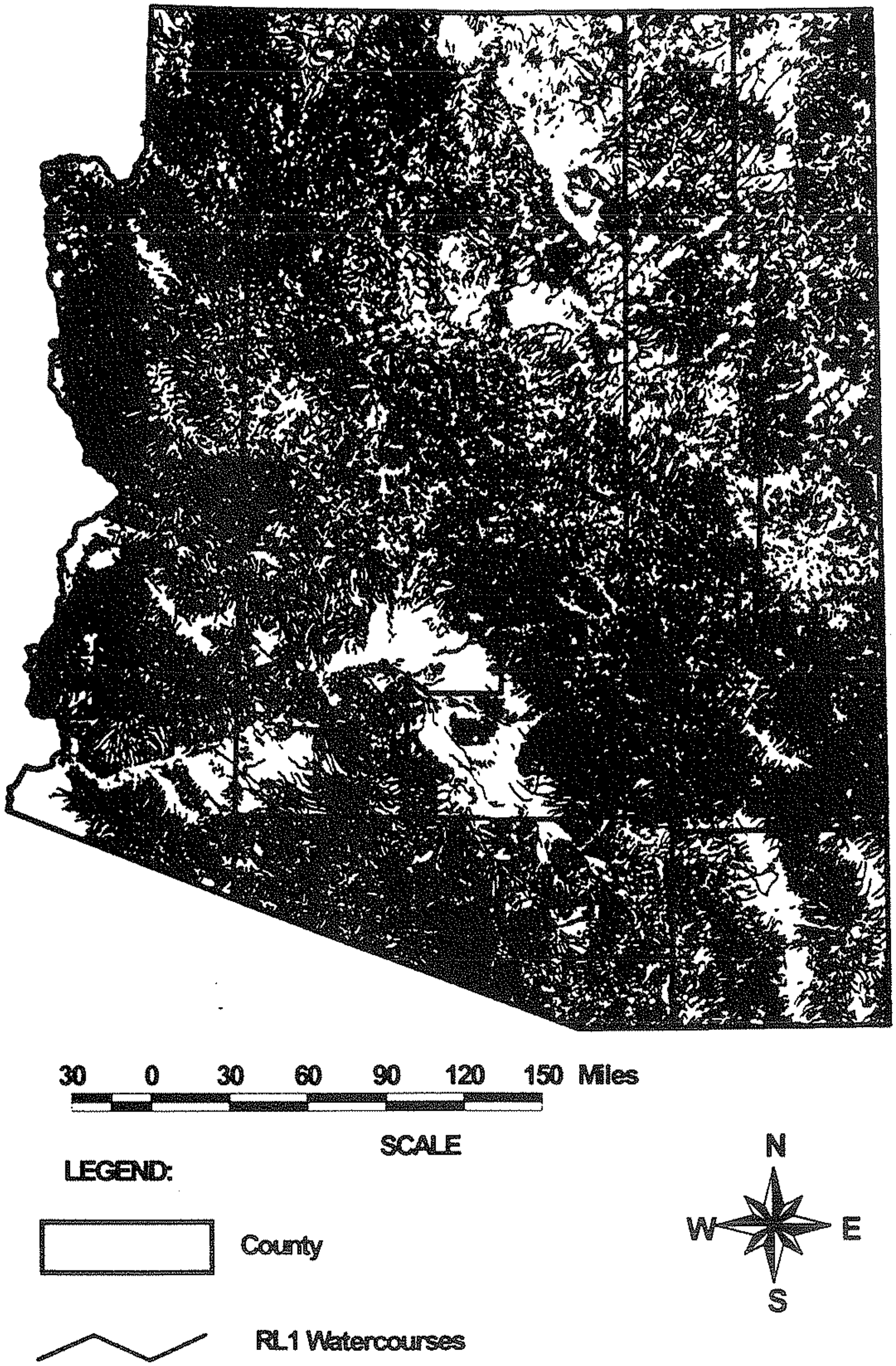
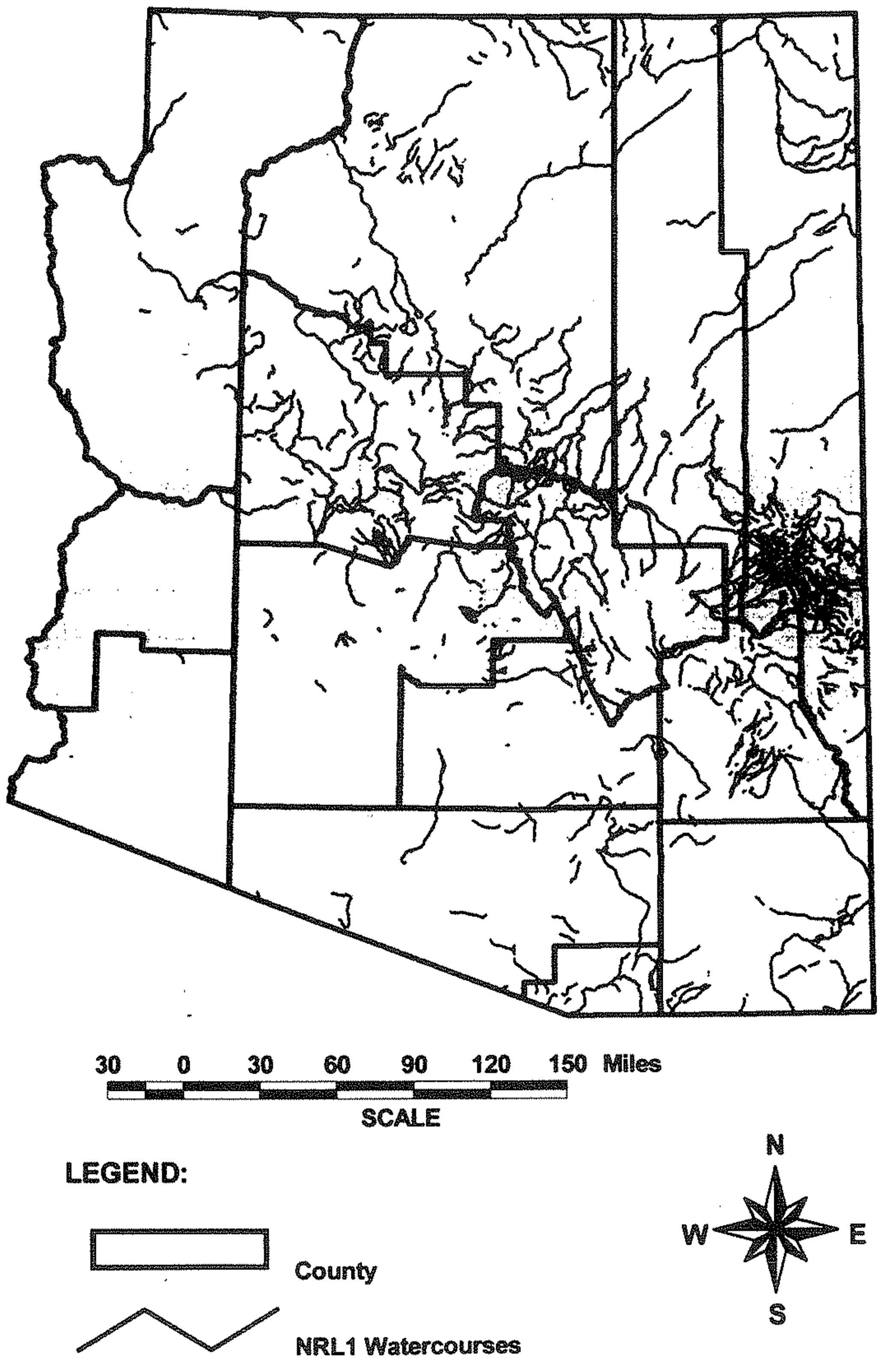


FIGURE 7

NRL1 Data Set from Statewide Level 1 Analysis

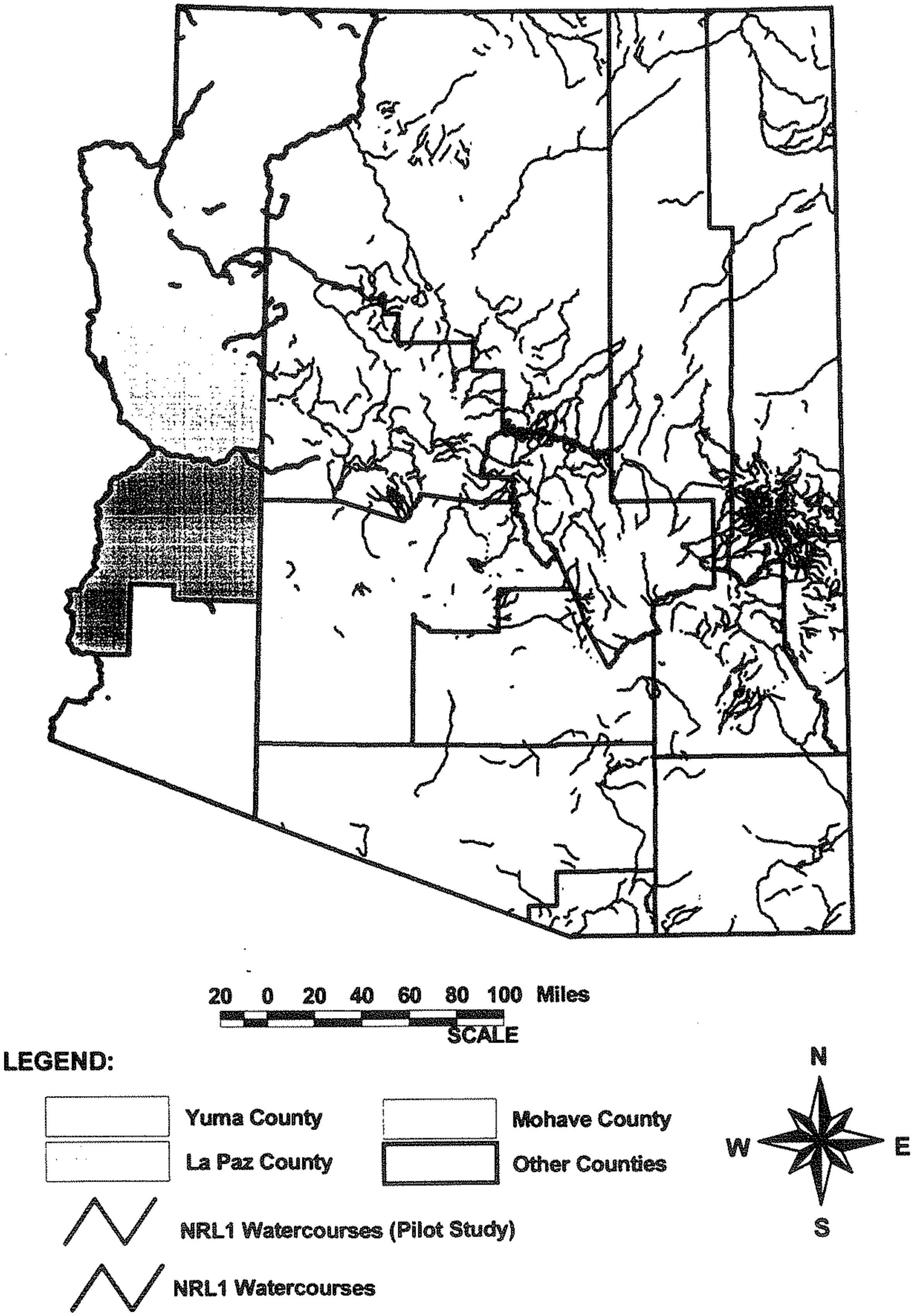


4.2 LEVEL 2 ANALYSIS FOR YUMA, LA PAZ, AND MOHAVE COUNTIES

The NRL1 dataset resulting from statewide Level 1 analysis contains 79 watercourses that are located in Yuma, La Paz, and Mohave Counties. Of those, 26 watercourses are located in La Paz County, 36 in Mohave County, and 17 in Yuma County. Results from the application of the Level 2 approach to the 79 watercourses are presented and discussed in the sections that follow. Figure 8 illustrates the NRL1 dataset for the three counties.

FIGURE 8

Three West Counties with NRL1 Watercourses



La Paz County

There are 26 watercourses in La Paz County forwarded for Level 2 analysis. Table A-2 in the Appendix lists the NRL1 watercourses evaluated for La Paz with the six criteria that serve as key attributes in Level 1 evaluation. By inspection, all the watercourses are one-hitters (see column (13)) except for Date Creek which has two-hits. Furthermore, all the watercourses are classified as perennial (see column (6)) by ALRIS (1988) and Arizona State Parks (1995), but the same watercourses, except for Date Creek, are identified as non-perennial according to Brown's perennial streams map developed by Arizona Game and Fish Department (1995, 1997). Considering the reliability of the Brown's perennial map in comparison to the other data sources, all the watercourses except for Date Creek do not exhibit any characteristics supporting evidence of potential susceptibility to navigation. Thus, these 25 watercourses are classified under stream Category C and are considered not susceptible to navigation.

Date Creek has two affirmative hits including perennial stream classification and fish. The watercourse is 49.3 miles long and is comprised of 54 segments. It runs from Yavapai to La Paz Counties. Date Creek in La Paz County is contains 15 segments along its 16 mile length; while Date Creek in Yavapai County is composed of 39 segments and is about 33.3 miles long. Using the Brown's perennial map and the original stream database by ALRIS (1988), all the 15 segments of Date Creek in La Paz County are non-perennial which reduces this particular watercourse from a two-hitter to a one-hitter. For the fish criterion, Silvey et al (1984) document only one fish species for Date Creek. By virtue of weak evidence, Date Creek is classified under stream Category C.

In summary, all the NRL1 watercourses in La Paz County are classified under stream category C indicating these streams to exhibit no evidence or, at the least, very weak characteristics indicative of susceptibility to navigation.

Mohave County

Based upon the Level 1 evaluation, there are 36 watercourses in Mohave County forwarded for Level 2 analysis. Table A-3 in the Appendix lists the NRL1 watercourses evaluated for Mohave County with the six criteria that serve as key attributes in the Level 1 evaluation. From Table A-3, there are 29 watercourses that are one-hitters (see column (13)), 4 are two-hitters, 1 is a three-hitter, and one is a four-hitter. The list also includes one watercourse identified as Spencer Canyon that was originally included in the RL1 dataset, but later moved to the NRL1 dataset. Spencer Canyon tested negatively to all six of the Level 1 diagnostic criteria; however, Brown's perennial streams map classified Spencer Canyon as a perennial stream. This data inconsistency justified included Spencer Canyon in the NRL1 dataset for further evaluation in Level 2.

Applying Brown's perennial streams information further relative to the initial classification (see column (13)), about 20 watercourses from the list becomes candidates for elimination from further analysis. This is because these watercourses are not perennial streams according to Brown's perennial streams map, which reduces confidence about their initial classification as perennial streams according to the ASP and AG&E data sources. Applying Brown's perennial streams standard to the other watercourses, the initial classification is modified with the following results: 20 watercourses become no hitters, 12 become one-hitters, 2 become two-hitters, with one each for three- and four-hitters. The no-hitters and the one-hitters (i.e., 32 watercourses), based on the evaluation procedure outlined for Level 2, are classified under stream category C, i.e., not susceptible to navigation.

The multiple hitters, on the other hand, including: Beaver Dam Wash, Francis Creek, Kanab Creek, and Trout Creek, are classified under stream category B, i.e., not likely susceptible to navigation. Further evaluation is performed for these four watercourses to refine their classification by examining the various hits involved. Ultimately, these four watercourses, after thorough investigation and qualitative analysis at Level 3, could end up in either Categories A or C. Streams classified under stream Category A are strong candidates for Level 3 analysis, while streams classified under stream Category C are eliminated from further evaluation and analysis.

Beaver Dam Wash

Beaver Dam Wash, which has three affirmative hits that include its perennial stream classification, fish, and special status, is about 9.6 miles long with only one segment. According to Brown's perennial streams map (Arizona Game and Fish Department, 1997), only about 1.5 miles of the watercourse's lower reach is perennial.

Regarding fish, about eight fish species are widely documented by Silvey et al (1984).

Regarding special status, Beaver Dam Wash has both riparian classification and instream flow permit designations. Since instream flow permits are significantly related to characteristics of navigability, the watercourse indicates of susceptibility to navigation. The watercourse could be classified under stream category A indicating potential susceptibility to navigation and justification for forwarding to Level 3.

Francis Creek

Francis Creek, which has two affirmative hits that include having fish and special status, flow from Mohave County into Yavapai County. The stream is about 23.8 miles long comprising of 20 identified segments.

About five fish species are widely documented by Silvey et al (1984). From to the listing provided by Arizona Game and Fish Department (1999), the fish species are both native and non-native fish.

Regarding special status, Francis Creek has a riparian classification according to Nationwide Rivers Inventory by National Park Service (1997). Since the riparian status of the watercourse is not water-related and the classification carries no bearing on navigability question, Francis Creek is classified under stream category C and the watercourse is excluded from any further investigation.

Kanab Creek

Kanab Creek, which has three affirmative hits that include perennial, fish and special status, is about 72.5 miles long with 47 segments. This watercourse flows from Utah to the Colorado River along the Mohave-Coconino County border. The watercourse is classified perennial according to Arizona State Parks (1995), but Brown's perennial streams map indicates the watercourse is interrupted – not fully perennial with intervening non-perennial stream segments. From Brown's perennial stream map, two intervening non-perennial reaches (a total of 51.5 miles) separate three stretches of perennial stream segments (a total length of 21.0 miles). Further, ALRIS (1988) listed Kanab Creek as entirely non-perennial weakening the case for perennial classification for this Pilot Study.

About eight fish species are widely documented by Silvey et al (1984). The fish species identified in Kanab Creek include both native and non-native species based on the information provided by Arizona Game and Fish Department (1999).

For the special status designations, Kanab Creek has a riparian classification and a Wild And Scenic status according to Nationwide Rivers Inventory by National Park Service (1997). From further examination of the facts, these special status classifications are not water-related and are not diagnostic relative to the navigability question. Kanab Creek, by virtue of its twenty-one-mile long perennial segments and by its various fish species, is classified under stream Category A and forwarded for Level 3 evaluation.

Trout Creek

Trout Creek, which has two affirmative hits including having perennial stream classification and fish, is about 54.2 miles long with 43 segments. The watercourse is located in Mohave and Yavapai Counties. All the perennial segments of the watercourse, according to ALRIS (1988) and to the Brown's perennial stream map (1997), are located entirely in Mohave County with a total length of about 24.8 miles.

About seven fish species are widely documented in the literature that includes Silvey et al (1984). The fish species identified in Trout Creek include both native and non-native species based on the information provided by Arizona Game and Fish Department (1999).

Based on the two hits from Level 1 and from thorough investigation of these hits in Level 2, Trout Creek could be classified under stream category A like Beaver Dam Wash and Kanab Creek and ought to be further investigated in Level 3 analysis.

In summary, only Francis Creek is not recommended for Level 3 analysis. The other three watercourses, Kanab Creek, Beaver Dam Wash, and Trout Creek, by virtue of their classification under stream category A, are recommended for further investigation and analysis in Level 3.

Yuma County

There are 17 watercourses in Yuma County forwarded for Level 2 analysis. Table A-4 in the Appendix lists the NRL1 watercourses evaluated for Yuma County with the six criteria that serve as key attributes in Level 1 evaluation. From the list, all the watercourses are one-hitters (see column (13)). Furthermore, all the watercourses are classified as perennial (see column (6)) by ALRIS (1988) and Arizona State Parks (1995) but the same watercourses are declared non-perennial except for Date Creek according to Brown's perennial streams map developed by Arizona Game and Fish Department (1995, 1997). Considering the reliability of the Brown's perennial map, all the watercourses do not exhibit characteristics supporting evidence of susceptibility to navigation. In summary, all the NRL1 watercourses in Yuma County are classified in stream Category C.

4.2 LEVEL 3 ANALYSIS FOR THREE SELECTED WATERCOURSES

Three watercourses, representative of various physiographic provinces in the state of Arizona, were selected for pilot evaluation at Level 3 as described in *Criteria for Assessing Characteristics of Navigability for Small Watercourses in Arizona* (Stantec, 1998). The objective was to test the recommended methodologies on a full spectrum of stream conditions. The selected watercourses are described below and illustrated in Figure 9. Details of the analysis plus a presentation of the Level 3 analysis results for each of the three watercourses follows.

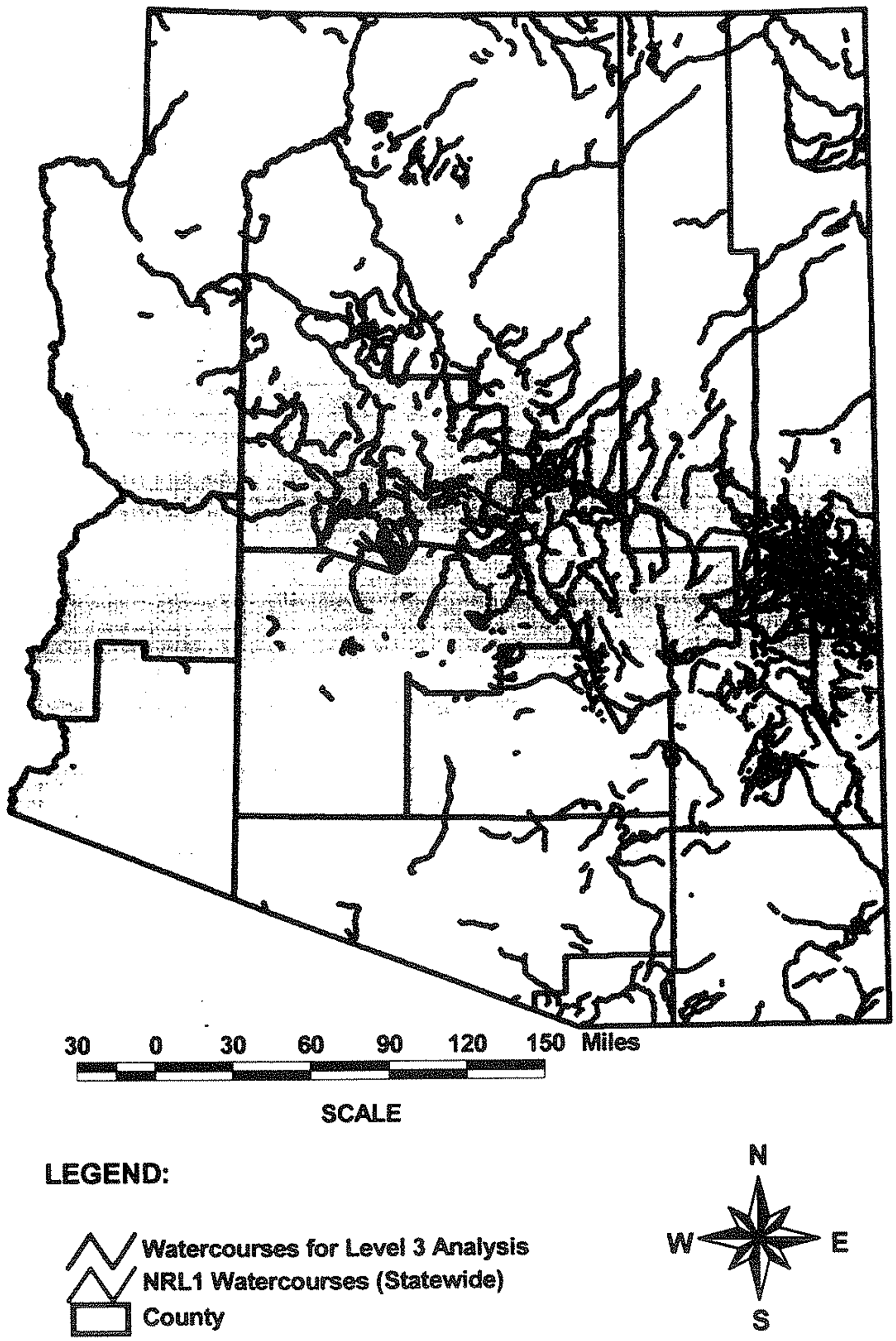
1. **Kanab Creek** in northern Arizona forms the boundary between Mohave and Coconino Counties starting from the Utah border to the north flowing into the Colorado River to the south;

2. **Aravaipa Creek** in southeastern Arizona, which is a tributary to the San Pedro River, is located in Pinal and Graham Counties.

3. **Pinal Creek** located in central Arizona in Gila County, is a tributary to the Upper Salt River.

FIGURE 9

Selected Watercourses for Level 3 Analysis



4.3 KANAB CREEK

Introduction

The following summarizes our preliminary information for the Level 3 analysis of Kanab Creek. The purpose of the Level 3 analysis is to provide basic technical data regarding stream characteristics from which the ANSAC can make a recommendation of navigability or non-navigability.

Stream Geomorphology

Kanab Creek, a tributary to the Colorado River, forms the boundary between Mohave and Coconino Counties from the North Rim of the Grand Canyon to the Utah border. The 2,322 square mile watershed drains the Grand Staircase and Kaibab Plateau regions of the Arizona Strip and Southern Utah. Approximately 625 square miles of the Kanab Creek watershed lies in Utah, with the remainder in Arizona. Elevations in the watershed range from about 9,350 feet near the headwaters of Johnson Wash to about 2,590 feet at the Colorado River confluence.

The Arizona portion of Kanab Creek can be divided into the following two stream reaches:

- Upper Alluvial Reach – Utah border to Confluence of Johnson Wash
- Lower Canyon Reach – Johnson Wash to Colorado River Confluence

The upper reach flows through the alluvial valley located between Kanab, Utah and Fredonia, Arizona. Most of the natural runoff in the upper reach is diverted for municipal and agricultural use. The upper reach is perennial where it enters Arizona until it reaches the town of Fredonia, where it becomes ephemeral. The channel in the upper reach underwent extensive erosion and entrenchment near the turn of the 20th century (Webb, et al, 1991). Since the time of Arizona statehood, the channel in the upper reach has been characterized by a wide braided stream bed inset between steep banks of erodible alluvium. The average channel slope is less than one percent.

The lower reach extends from downstream of Johnson Wash where the Kanab Creek Canyon begins to the Colorado River confluence. Most of the lower reach is non-perennial, according to the Arizona Department of Water Resources, although numerous springs provide a level of base flow to short reaches of the stream or its tributaries. The lower reach consists of flat-bottomed, boulder-strewn channels between vertical bedrock canyon walls. The lower reach has a slope of less than one percent.

Photographs of the two reaches of Kanab Creek are provided in the Appendix.

Hydrology

Hydrologic data are available from the USGS stream gage "Kanab Creek near Fredonia, AZ" (Station #09403780), and "Kanab Creek near Kanab, UT (Station #09403600), both of which are located in the upper Reach of Kanab Creek, as described above. For this analysis, the USGS flow data were used as representative of the upper reach only. Because the lower reach is non-perennial, it is not considered in detail for the level 3 evaluation.

Flow data for Kanab Creek reported by the USGS (Pope et. al, 1999) and the Utah Department of Water Resources (1993) are summarized in Table 1 and Figures 1 and 2. Flow duration data are not available for the Kanab near Kanab, UT station.

Table 1. Flow Data
Kanab Creek @ USGS Stations

Period	Discharge (cfs) Fredonia 09403780	Discharge (cfs) Kanab 09403600
Mean Annual Flow	6.8	6.8
90% Flow Duration	0	-
50% Flow Duration	0	-
10% Flow Duration	11	-
2-Year Flood Peak	875	541

Figure 1. Kanab Creek Flow Duration Data
Kanab Creek Near Fredonia

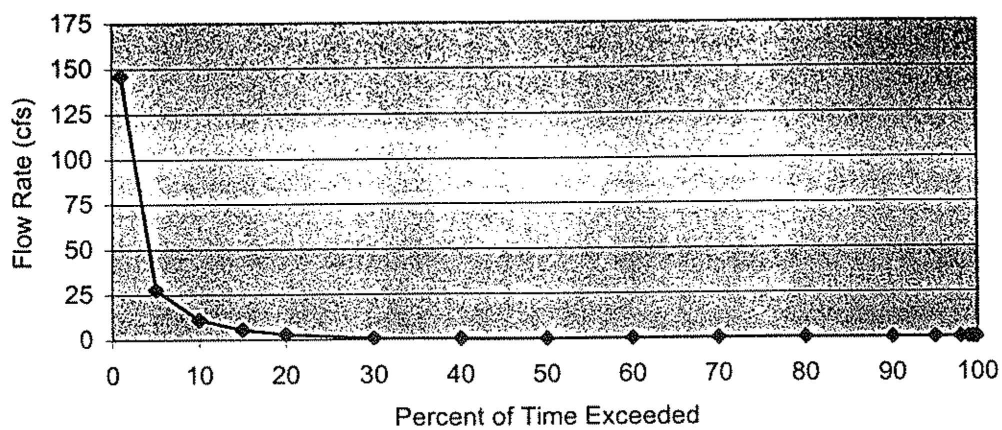
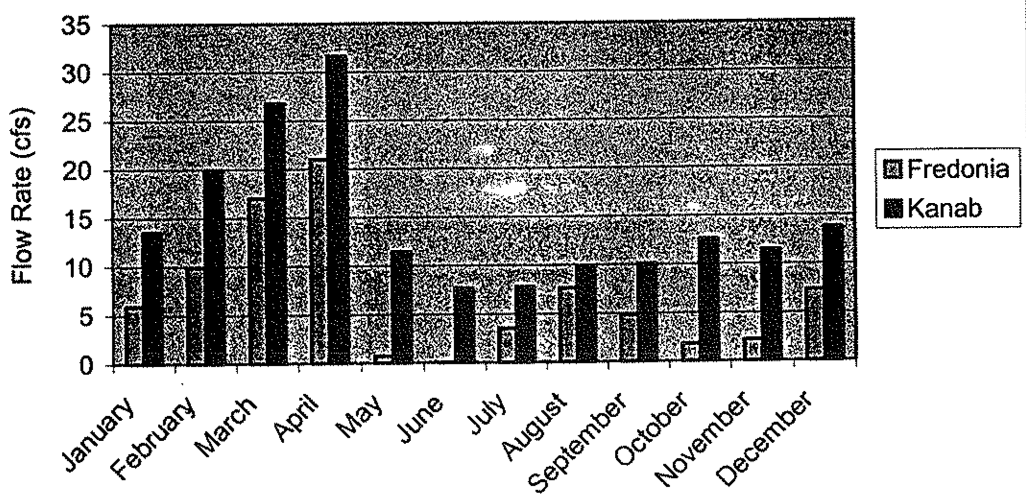


Figure 2. Kanab Creek Monthly Average Flow Rate



The flow data summarized above indicate that the lower reach of Kanab Creek is not perennial at the USGS gage near Fredonia, with zero flow about 50 percent of the time. Upstream near Kanab, monthly average flow rates confirm published descriptions of perennial flow, although no flow duration data were readily available. Diversion and groundwater pumping probably deplete surface runoff supplies from Kanab Creek near Fredonia. Higher periods of flow occur in late winter and early spring during snowmelt, with average flow rates approaching 20 to 30 cfs. Seasonal low flow occurs during the summer months. The average annual flow rate is 6.8 cfs at both USGS gaging stations, and the median flow rate (50% duration) is 0 cfs at the Fredonia gaging station. The flow data reported above generally applies to the portion of the upper reach nearest the town of Fredonia. Near Kanab, marginally higher flow rates and perennial flow is expected, although not documented by the USGS. These data do not apply to the lower canyon reach, which is not perennial and typically has a dry streambed over most of its length.

Hydraulics

USGS rating curves were not available for either of the Kanab Creek gaging stations. Therefore, channel geometry and roughness coefficients were estimated from historic and recent photographs of the stream. Channel slope was estimated from USGS topographic maps. Hydraulic data reported in Tables 2 and 3 were obtained from rating curves developed using Manning's equation.

Table 2. ANSAC Pilot Study Level 3 Analysis
Kanab Creek in Upper Alluvial Reach (See Photograph #1 in Appendix)

	Discharge (cfs)	Depth (ft)	Width (ft)	Velocity (ft)
Mean Annual Flow	6.8	0.3	16	1.4
90% Flow Duration	0	0.0	0.0	0.0
50% Flow Duration	0	0.0	0.0	0.0
10% Flow Duration	11	0.4	16	1.7
2-Year Flood Peak	875	4.1	151	4.0

Table 3. ANSAC Pilot Study Level 3 Analysis
Kanab Creek in Lower Canyon Reach (See Photograph #2 in Appendix)

	Discharge (cfs)	Depth (ft)	Width (ft)	Velocity (ft)
Mean Annual Flow	6.8	0.1	49	1.1
90% Flow Duration	No Info.	-	-	-
50% Flow Duration	No Info.	-	-	-
10% Flow Duration	No Info.	-	-	-
2-Year Flood Peak	875	2.4	49	7.4

Boating Criteria

The boating criteria cited below were reported in previous detailed navigability studies prepared for the Arizona State Land Department, and are based on the following references:

1. Cooperative Instream Flow Service Group, 1978. Methods of Assessing Instream Flows for Recreation. Instream Flow Information Paper: No. 6. FWS/OBS-78/34. June. Report prepared by U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Heritage Conservation and Recreation Service, and Bureau of Reclamation.

2. Jason M. Cortell and Associates, Inc., 1977, Recreation and Instream Flow, Vol. 1: Flow Requirements, Analysis of Benefits, Legal & Institutional Constraints. Report submitted to U.S. Department of the Interior, Bureau of Outdoor Recreation #BOR D6429. July.

3. Walter B. Langbein, 1962. Hydraulics of River Channels as Related to Navigability. U.S. Geological Survey Water-Supply Paper 1539-W.

4. Jim Slingluff, 1987. Deposition of Jim Slingluff for No. C 569870, Maricopa County, et al and Arizona Center for Law in the Public Interest, et al., and Calmat Co. of Arizona, et al, v. State of Arizona, Arizona State Land Department, M. Jean Hassel, and Milo J. Hassel, et al. November 23, 1987.

The following tables summarize navigability criteria information from references 1 to 4. Note that these data reference recreational boating, not necessarily commercial boating.

Table 4. Minimum Required Stream Width and Depth for Recreation Craft[1]

Type of Craft	Depth (ft.)	Width (ft.)
Canoe, Kayak	0.5	4
Raft, Drift Boat, Row Boat	1.0	6
Tube	1.0	4
Power Boat	3.0	6

[1] After reference #1

Table 5. Minimum and Maximum Conditions for Recreational Water Boating[1]						
Type of Boat	Minimum Condition			Maximum Condition		
	Width	Depth	Velocity	Width	Depth	Velocity
Canoe, Kayak	25 ft.	3-6 in.	5 fps	-	-	15 fps
Raft, Drift Boat	50 ft.	1 ft.	5 fps	-	-	15 fps
Low Power Boating	25 ft.	1 ft.	-	-	-	10 fps
Tube	25 ft.	1 ft.	1 fps	-	-	10 fps
[1] After reference 2.						

Table 6. Flow Requirements for Pre-1940 Canoe Boating[1]	
Boat Type	Depth
Flat Bottomed (Wood or Canvas)	4 in.
Round Bottomed (Wood or Canvas)	6 in.
[1] After reference 4.	

Summary

Comparison of the boating criteria and hydraulic data for Kanab Creek shown above indicate that the lower reach generally could not be boated even by low draft canoes or kayaks more than 90 percent of the time, and that boating by larger commercial craft would be even more unlikely. During floods, even low draft recreational boating would be difficult due to overhanging vegetation, fences and other obstructions. No modern or historical accounts of any type of boating in Kanab Creek were obtained during the course of the Small Watercourse Study. A Level 4 study is not recommended for Kanab Creek.

Limitations

This evaluation is based on readily available information that reflects the level of detail and funding authorized for the ANSAC Small Watercourses Navigability Study. The following limitations apply to the results presented above:

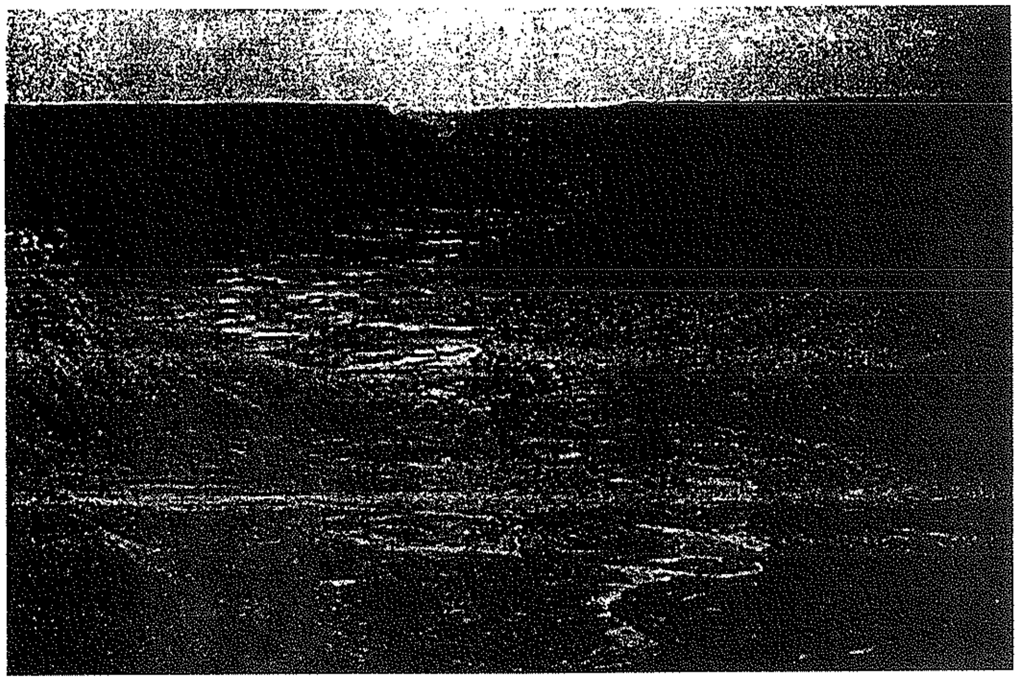
- The hydraulic rating sections may or may not apply to the entire study reach. However, the rating section results probably represent better than order-of-magnitude accuracy for estimates of width, depth, and velocity at any given point within the study reach.
- Hydrologic data for any stream varies with location within a reach, and with time in response to climatic conditions. The hydrologic information provided is best readily available data for the stream.

- Stream conditions were assumed to represent conditions as of the time of Arizona statehood. Unless stated otherwise, no data were identified during the Level 3 analysis that indicated substantive changes in stream morphology with respect to navigability criteria.

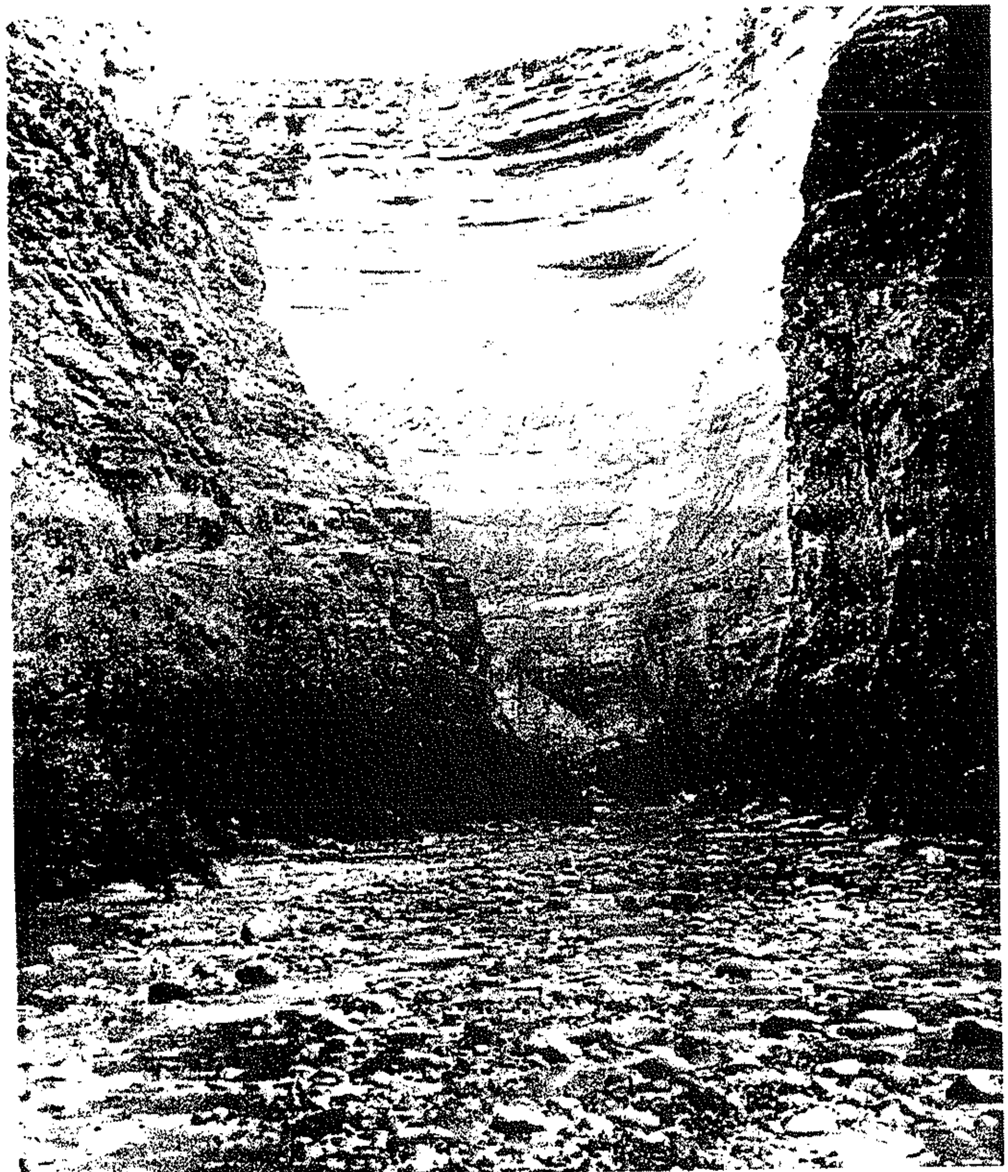
Photographs of Kanab Creek

Photograph #1

View of Kanab Creek near the Vermillion Cliffs. This photo was used to estimate channel geometry for the hydraulic rating curve summarized in Table 2 (Source: Figure 3-4B of Webb, R.H., Smith, S.S., McCord, V.A.S., 1991)

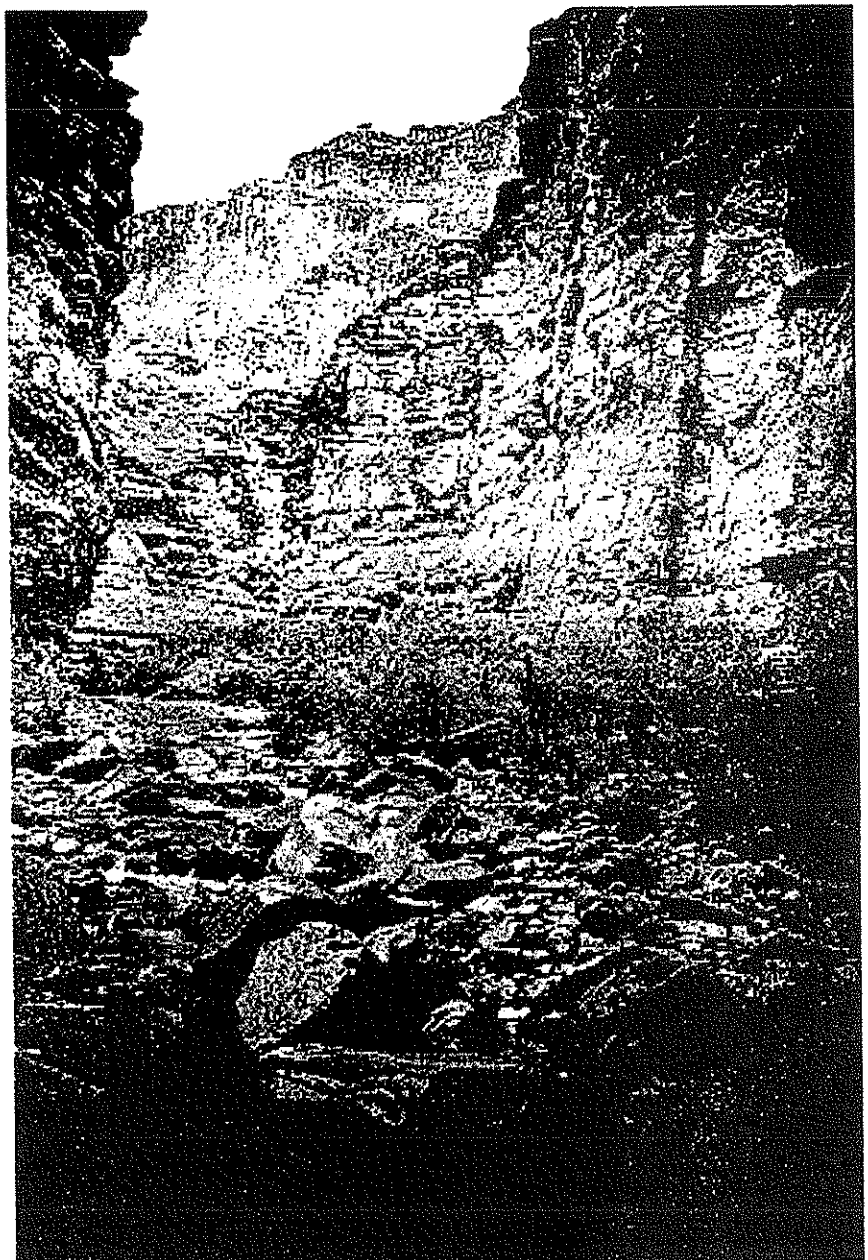


Photograph #2
View of Upper Kanab Creek near Kanab.



Photograph #3

View of Kanab Creek downstream of Showerbath Spring in Lower Canyon Reach. This photo was used to estimate channel geometry for the hydraulic rating curve summarized in Table 3 (Source: Figure 3-12B of Webb, R.H., Smith, S.S., McCord, V.A.S., 1991)



Photograph #4
Modern Photo of Lower Canyon Reach near Colorado River Confluence.

4.4 ARAVAIPA CREEK

Introduction

The following summarizes our preliminary information for the Level 3 analysis of Aravaipa Creek. The purpose of the Level 3 analysis is to provide basic technical data regarding stream characteristics from which the ANSAC can make a recommendation of navigability or non-navigability.

Stream Geomorphology

Aravaipa Creek, a tributary to the San Pedro River, is located in Pinal and Graham Counties in southeastern Arizona. The 541 square mile watershed drains the Galiuro, Pinaleno, and Santa Teresa Mountains, as well as the intervening alluvial fill valleys. Elevations in the watershed range from about 8,400 feet in the Pinaleno Moutains to 2,160 feet at the San Pedro River confluence, although the maximum elevation along Aravaipa Creek itself is only about 4200 feet.

Aravaipa Creek can be divided into the following three stream reaches:

- Upper Reach – Aravaipa Valley above BLM Wilderness Area
- Middle Reach – BLM Wilderness Area & Canyon
- Lower Reach – Downstream of BLM Wilderness Area to San Pedro River

The upper reach flows through the Aravaipa Valley, an agricultural region located mostly upstream of the town of Klondyke. The upper reach is ephemeral or intermittent, and consists of wide, braided channels which are normally dry. The upper reach is about 55 miles long and has a slope of about 0.9 percent. The middle reach extends through the Aravaipa Canyon Wilderness Area managed by the Bureau of Land Management, with portions owned by The Nature Conservancy. The middle reach is perennial, and consists of sand- and gravel-bedded stream segments flowing in the bottom of deep, vertical-walled bedrock canyons. The middle reach is about 11.5 miles long and is slightly steeper than the adjacent reaches with a slope of about 2.5 percent. The lower reach extends from the downstream end of the Aravaipa Canyon Wilderness Area to the San Pedro River confluence. Most of the lower reach is perennial, with the flow becoming less reliable in the downstream direction. The lower reach is approximately 6 miles long, consists of wide, shallow, slightly braided channels, and has an average slope of about 0.9 percent.

Photographs of Aravaipa Creek are provided in the Appendix.

Hydrology

Hydrologic data are available from the USGS stream gage "Aravaipa Creek Near Mammoth, AZ" (Station #09473000), which is located in the Lower Reach of Aravaipa Creek, as described above. Other gaging information is also available from the US Fish & Wildlife Service, the Bureau of Land Management, the Nature Conservancy, and some private parties living along the wash. For this analysis, only the USGS data were considered due to the high quality of USGS sampling and reporting procedures, the length of record at the USGS station (1919-1921, 1931-1941, 1965-1999), and the availability of the USGS data. The USGS gage data are most applicable to the middle and lower reaches of the study area.

Flow data for Aravaipa Creek reported by the USGS (Pope et. al, 1999) are summarized in Table 1 and Figures 1 and 2.

Table 1. Flow Data Aravaipa Creek @ USGS Station 09473000	
Period	**Discharge (cfs)**
Mean Annual Flow	36
90% Flow Duration	6.2
50% Flow Duration	17
10% Flow Duration	48
2-Year Flood Peak	3,980

Figure 1. Aravaipa Creek Flow Duration Data

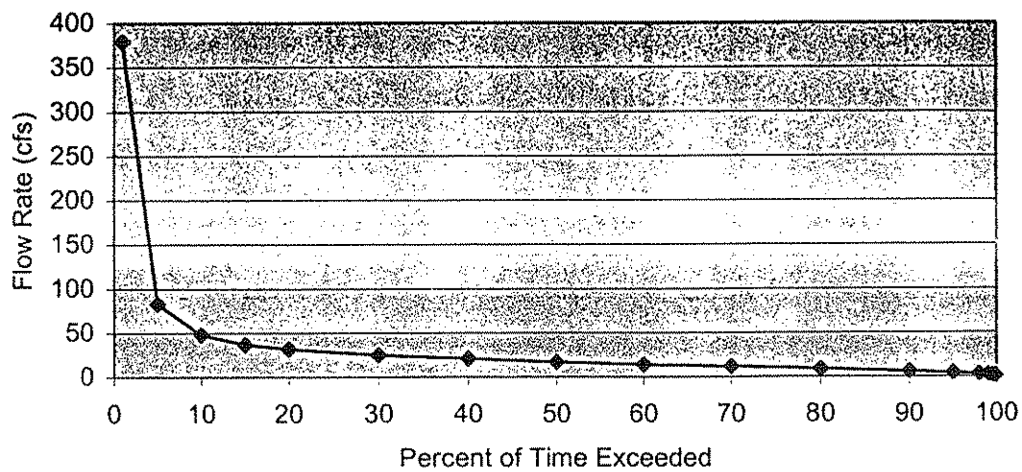
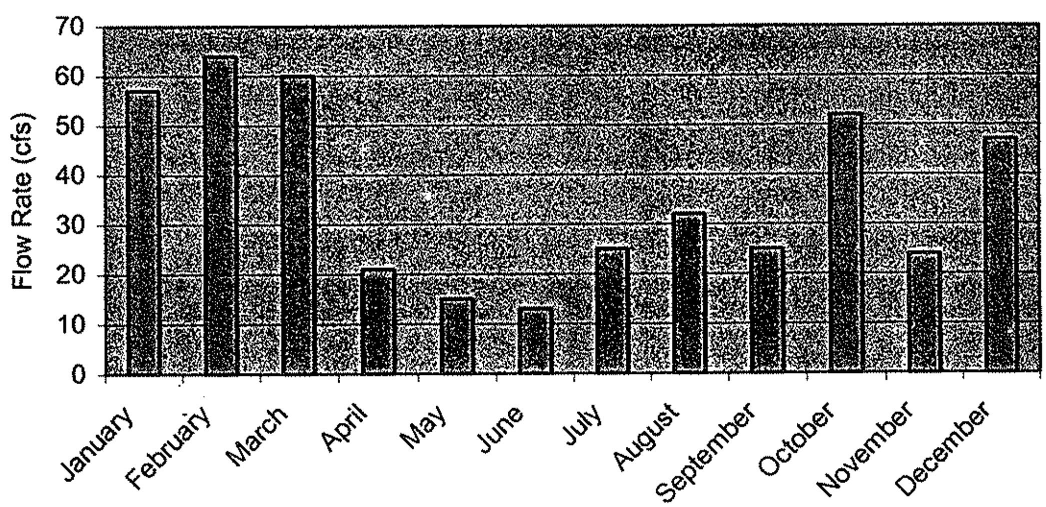


Figure 2. Aravaipa Creek Monthly Flow Data



Stantec

The flow data summarized above confirm that Aravaipa Creek is perennial, and that flow rates average 50-60 cfs between January and March each year. The average annual flow rate is 36 cfs, although the median flow rate (50% duration) is only 17 cfs. The flow data reported above generally applies to the lower and middle reaches of Aravaipa Creek. These data do not apply to the upper reach, which is not perennial and typically has a dry streambed.

Hydraulics

Rating curves were obtained from USGS records and from field-surveyed cross sections. Field sections were hand gaged at discharges ranging from 12 cfs to 17 cfs. Hydraulic data reported for the field sections at the 50 percent flow duration are actual measurements of depth, width and velocity at 17 cfs. Hydraulic data reported for other frequencies were obtained from rating curves developed using Manning's equation. The hydraulic data from the USGS gage are from actual field measurements by USGS staff.

Table 2. ANSAC Pilot Study Level 3 Analysis Aravaipa Creek @ USGS Gage

	Discharge (cfs)	Depth (ft)	Width (ft)	Velocity (ft)
Mean Annual Flow	36	1.6	32	2.2
90% Flow Duration	6.2	1.2	18	0.5
50% Flow Duration	17	1.4	30	1.3
10% Flow Duration	48	1.7	32	2.3
2-Year Flood Peak	3,980	6.1	No info.	No info.

Table 3. ANSAC Pilot Study Level 3 Analysis
Aravaipa Creek in BLM Wilderness (Canyon Reach, Field Surveyed Sections)

	Discharge (cfs)	Depth (ft)		Width (ft)		Velocity (ft)	
		Xn #1	Xn #2	Xn #1	Xn #2	Xn #1	Xn #2
Mean Annual Flow	36	1.6	0.7	12	23	4.0	3.1
90% Flow Duration	6.2	0.8	0.3	5	19	2.9	1.8
50% Flow Duration	17	1.2	0.5	7	21	3.6	2.5
10% Flow Duration	48	1.8	0.8	15	24	4.3	3.2
2-Year Flood Peak	3,980	14.9	8.6	31	40	12.8	13.5

Notes:
1. Section #1 (Xn#1) is located immediately downstream of the Painted Cave Creek confluence.
2. Section #2 (Xn#2) is located immediately upstream of the Turkey Creek confluence.

Boating Criteria

The boating criteria cited below were reported in previous detailed navigability studies prepared for the Arizona State Land Department, and are based on the following references:

1. Cooperative Instream Flow Service Group, 1978. Methods of Assessing Instream Flows for Recreation. Instream Flow Information Paper: No. 6. FWS/OBS-78/34. June. Report prepared by U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Heritage Conservation and Recreation Service, and Bureau of Reclamation.

2. Jason M. Cortell and Associates, Inc., 1977, Recreation and Instream Flow, Vol. 1: Flow Requirements, Analysis of Benefits, Legal & Institutional Constraints. Report submitted to U.S. Department of the Interior, Bureau of Outdoor Recreation #BOR D6429. July.

3. Walter B. Langbein, 1962. Hydraulics of River Channels as Related to Navigability. U.S. Geological Survey Water-Supply Paper 1539-W.

4. Jim Slingluff, 1987. Deposition of Jim Slingluff for No. C 569870, Maricopa County, et al and Arizona Center for Law in the Public Interest, et al., and Calmat Co. of Arizona, et al, v. State of Arizona, Arizona State Land Department, M. Jean Hassel, and Milo J. Hassel, et al. November 23, 1987.

The following tables summarize navigability criteria information from references 1 to 4. Note that these data reference recreational boating, not necessarily commercial boating.

Table 4. Minimum Required Stream Width and Depth for Recreation Craft[1]

Type of Craft	Depth (ft.)	Width (ft.)
Canoe, Kayak	0.5	4
Raft, Drift Boat, Row Boat	1.0	6
Tube	1.0	4
Power Boat	3.0	6

[1] After reference #1

Table 5. Minimum and Maximum Conditions for Recreational Water Boating[1]

Type of Boat	Minimum Condition			Maximum Condition		
	Width	Depth	Velocity	Width	Depth	Velocity
Canoe, Kayak	25 ft.	3-6 in.	5 fps	-	-	15 fps
Raft, Drift Boat	50 ft.	1 ft.	5 fps	-	-	15 fps
Low Power Boating	25 ft.	1 ft.	-	-	-	10 fps
Tube	25 ft.	1 ft.	1 fps	-	-	10 fps

[1] After reference 2.

Table 6. Flow Requirements for Pre-1940 Canoe Boating[1]

Boat Type	Depth
Flat Bottomed (Wood or Canvas)	4 in.
Round Bottomed (Wood or Canvas)	6 in.

[1] After reference 4.

Stantec

Summary

Comparison of the boating criteria and hydraulic data for Aravaipa Creek shown above indicate that the lower and middle reaches could be boated by low draft canoes or kayaks slightly more than half the time, but that boating by larger commercial craft would be unlikely. Expected velocities during the 2-year flood approach the maximum rates for recreational boating, and would seriously hinder upstream travel. Field data collected by the author indicates that such recreational boating would be moderately difficult due to numerous shallow riffles and overhanging vegetation. No modern or historical accounts of any type of boating in Aravaipa Creek were obtained during the course of the Small Watercourse Study. A Level 4 study is not recommended for Aravaipa Creek.

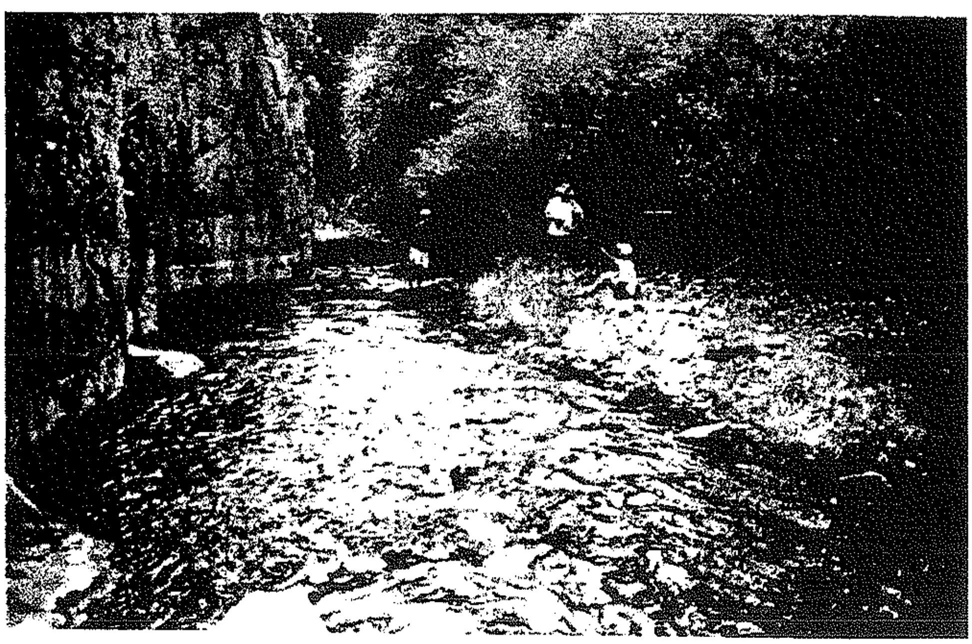
Limitations

This evaluation is based on readily available information that reflects the level of detail and funding authorized for the ANSAC Small Watercourses Navigability Study. The following limitations apply to the results presented above:

- The hydraulic rating sections may or may not apply to the entire study reach. However, the rating section results probably represent better than order-of-magnitude accuracy for estimates of width, depth, and velocity at any given point within the study reach.
- Hydrologic data for any stream varies with location within a reach, and with time in response to climatic conditions. The hydrologic information provided is best readily available data for the stream.
- Stream conditions were assumed to represent conditions as of the time of Arizona statehood. Unless stated otherwise, no data were identified during the Level 3 analysis that indicated substantive changes in stream morphology with respect to navigability criteria.

Photographs of Aravaipa Creek

Photograph #1
Aravaipa Creek above Turkey Creek (Canyon Reach) at approximately 17 cfs on July 2, 1999.



Photograph #2
Aravaipa Creek below Painted Cave Creek (Canyon Reach) at approximately 17 cfs on July 5, 1999.

4.5 PINAL CREEK

Introduction

The following summarizes our preliminary information for the Level 3 analysis of Pinal Creek. The purpose of the Level 3 analysis is to provide basic technical data regarding stream characteristics from which the ANSAC can make a recommendation of navigability or non-navigability.

Stream Geomorphology

Pinal Creek, a tributary to the upper Salt River, is located in Gila County in central Arizona. The 195 square mile watershed drains the Pinal and Salt River Mountains, as well as urbanized and mined areas within the Globe-Miami copper mining district. Elevations in the watershed range from about 7,600 feet at Pinal Peak to about 2,400 feet at the Salt River confluence, although the maximum elevation along Pinal Creek itself is only about 4,400 feet.

Pinal Creek can be divided into the following two stream reaches:

- Upper Reach – Headwaters to Horseshoe Bend Wash
- Lower Reach – Horseshoe Bend Wash to Salt River Confluence

The upper reach flows through the Globe-Miami copper mining district and the small cities of Globe, Miami, and Claypool, as well as portions of unincorporated Gila County downstream of Globe. The upper reach is ephemeral and consists of relatively wide, braided channels which are normally dry except during floods. The average channel slope is about one percent. The lower reach extends from downstream of Horseshoe Bend Wash where perennial flow begins to the Salt River confluence. Most of the lower reach is perennial, with the flow rate highly dependent on the rate of groundwater infiltration, depth to bedrock, and groundwater pumping. The lower reach is approximately 7 miles long, consists of relatively wide, shallow channels with a broad floodplain that transitions to a moderately narrow, deep canyon about 3 miles upstream of the Salt River confluence. The lower reach has a slope of about 0.9 percent.

Photographs of the two reaches of Pinal Creek are provided in the Appendix.

Hydrology

Hydrologic data are available from the USGS stream gage "Pinal Creek at Inspiration Dam, Near Globe, AZ" (Station #09498400), which is located in the

Lower Reach of Pinal Creek, as described above. For this analysis, the USGS flow data were used as representative of the lower reach. Because the upper reach is ephemeral, it is not considered in detail for the level 3 evaluation.

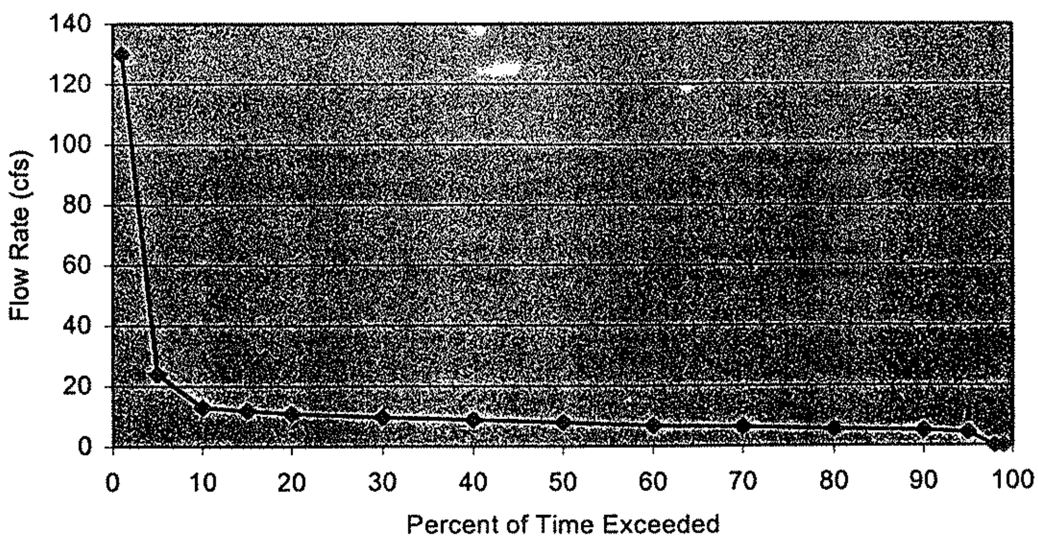
Flow data for Pinal Creek reported by the USGS (Pope et. al, 1999) are summarized in Table 1 and Figures 1 and 2.

Table 1. Flow Data

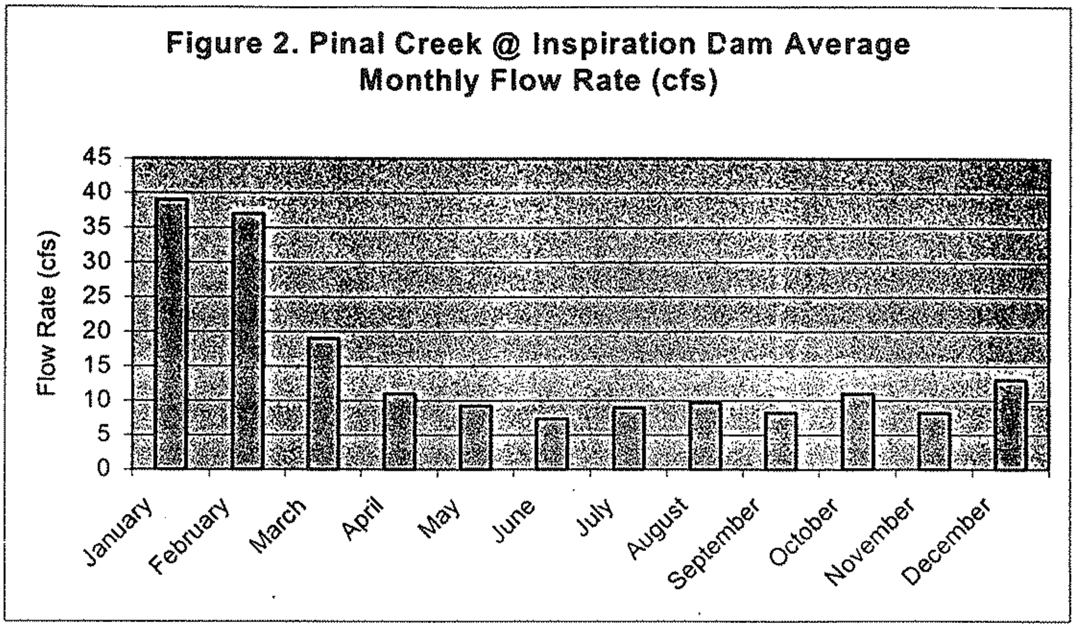
Pinal Creek @ USGS Station 09498400

Period	Discharge (cfs)
Mean Annual Flow	15
90% Flow Duration	5.2
50% Flow Duration	8.1
10% Flow Duration	13
2-Year Flood Peak	1,320

**Figure 1. Pinal Creek @ Inspiration Dam
Flow Duration Curve**



Stantec



The flow data summarized above indicate that the lower reach of Pinal Creek is nearly perennial at the USGS gage, with non-zero flows about 98 percent of the time. The average monthly flow rates are all above zero flow, indicating that periods of zero flow are brief, and may be related to seasonal groundwater pumping or other withdrawals. The USGS gage data also indicate that the minimum average monthly flow rates are also above 0 cfs. The typical flow rate is less than 13 cfs about 90 percent of the time, except during the winter months of January, February, and March, or during summer flash floods. The average annual flow rate is only 15 cfs, although the median flow rate (50% duration) is only 8.1 cfs. The flow data reported above generally applies to the lower reach of Pinal Creek. These data do not apply to the Upper Reach, which is not perennial and typically has a dry streambed.

Hydraulics

Rating curves were obtained from USGS records for the USGS gaging station at Inspiration Dam for the lower reach (Table 2), and from a field-surveyed cross section from the upper reach. Hydraulic data reported in Table 3 were obtained from rating curves developed using Manning's equation.

Table 2. ANSAC Pilot Study Level 3 Analysis Pinal Creek @ USGS Gage at Inspiration Dam (Lower Reach)				
	Discharge (cfs)	Depth (ft)	Width (ft)	Velocity (ft)
Mean Annual Flow	15	0.7	15	2.4
90% Flow Duration	5.2	0.4	12	1.7
50% Flow Duration	8.1	0.5	13	1.9
10% Flow Duration	13	0.6	14	2.2
2-Year Flood Peak	1,320	4.5	57	8.2

Table 3. ANSAC Pilot Study Level 3 Analysis Pinal Creek in Upper Reach near Wilbanks Drive				
	Discharge (cfs)	Depth (ft)	Width (ft)	Velocity (ft)
Mean Annual Flow	n/a	0.6	21	1.4
90% Flow Duration	n/a	0.3	18	1.0
50% Flow Duration	n/a	0.4	19	1.2
10% Flow Duration	n/a	0.5	20	1.4
2-Year Flood Peak	1,320	4.8	138	4.1
Note: Provided for only comparison of potential flow depths. Non-flood flow duration data from the USGS gage do not apply to the non-perennial upper reach of Pinal Creek.				

Boating Criteria

The boating criteria cited below were reported in previous detailed navigability studies prepared for the Arizona State Land Department, and are based on the following references:

1. Cooperative Instream Flow Service Group, 1978. Methods of Assessing Instream Flows for Recreation. Instream Flow Information Paper: No. 6. FWS/OBS-78/34. June. Report prepared by U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Heritage Conservation and Recreation Service, and Bureau of Reclamation.

2. Jason M. Cortell and Associates, Inc., 1977, Recreation and Instream Flow, Vol. 1: Flow Requirements, Analysis of Benefits, Legal & Institutional Constraints. Report submitted to U.S. Department of the Interior, Bureau of Outdoor Recreation #BOR D6429. July.

3. Walter B. Langbein, 1962. Hydraulics of River Channels as Related to Navigability. U.S. Geological Survey Water-Supply Paper 1539-W.

4. Jim Slingluff, 1987. Deposition of Jim Slingluff for No. C 569870, Maricopa County, et al and Arizona Center for Law in the Public Interest, et al., and Calmat Co. of Arizona, et al, v. State of Arizona, Arizona State Land Department, M. Jean Hassel, and Milo J. Hassel, et al. November 23, 1987.

The following tables summarize navigability criteria information from references 1 to 4. Note that these data reference recreational boating, not necessarily commercial boating.

Table 4. Minimum Required Stream Width and Depth for Recreation Craft[1]

Type of Craft	Depth (ft.)	Width (ft.)
Canoe, Kayak	0.5	4
Raft, Drift Boat, Row Boat	1.0	6
Tube	1.0	4
Power Boat	3.0	6

[1] After reference #1

Table 5. Minimum and Maximum Conditions for Recreational Water Boating[1]

Type of Boat	Minimum Condition			Maximum Condition		
	Width	Depth	Velocity	Width	Depth	Velocity
Canoe, Kayak	25 ft.	3-6 in.	5 fps	-	-	15 fps
Raft, Drift Boat	50 ft.	1 ft.	5 fps	-	-	15 fps
Low Power Boating	25 ft.	1 ft.	-	-	-	10 fps
Tube	25 ft.	1 ft.	1 fps	-	-	10 fps

[1] After reference 2.

Table 6. Flow Requirements for Pre-1940 Canoe Boating[1]

Boat Type	Depth
Flat Bottomed (Wood or Canvas)	4 in.
Round Bottomed (Wood or Canvas)	6 in.

[1] After reference 4.

Summary

Comparison of the boating criteria and hydraulic data for Pinal Creek shown above indicate that the lower reach could be boated by low draft canoes or kayaks during less than 10 percent of the time, and that boating by larger commercial craft would be unlikely. Field data collected by the author indicates that low-draft recreational boating would be difficult due to overhanging vegetation, fences and other obstructions. No modern or historical accounts of any type of boating in Pinal Creek were obtained during the course of the Small Watercourse Study. A Level 4 study is not recommended for Pinal Creek.

Limitations

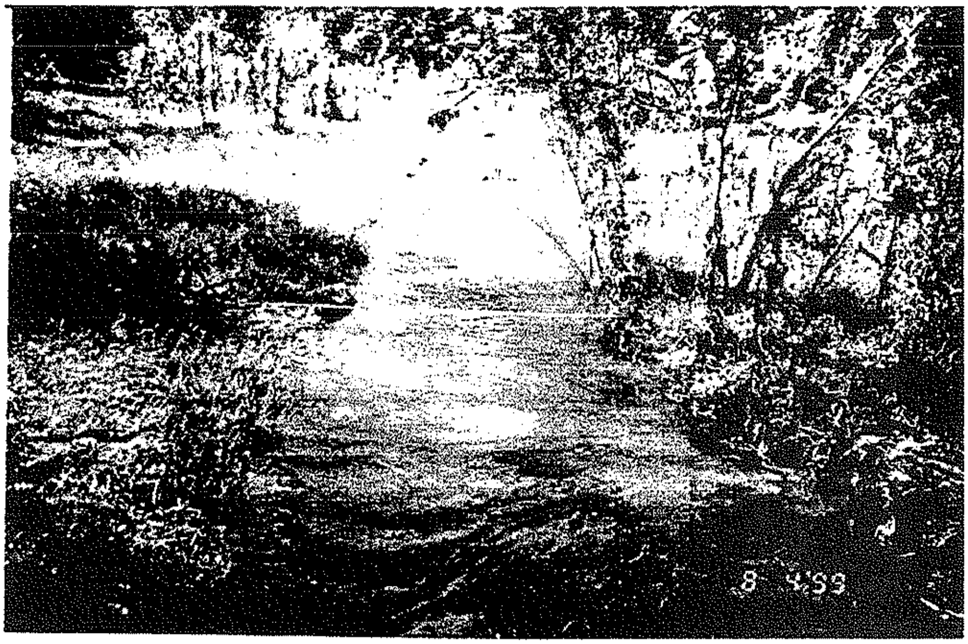
This evaluation is based on readily available information that reflects the level of detail and funding authorized for the ANSAC Small Watercourses Navigability Study. The following limitations apply to the results presented above:

- The hydraulic rating sections may or may not apply to the entire study reach. However, the rating section results probably represent better than order-of-magnitude accuracy for estimates of width, depth, and velocity at any given point within the study reach.

- Hydrologic data for any stream varies with location within a reach, and with time in response to climatic conditions. The hydrologic information provided is best readily available data for the stream.

- Stream conditions were assumed to represent conditions as of the time of Arizona statehood. Unless stated otherwise, no data were identified during the Level 3 analysis that indicated substantive changes in stream morphology with respect to navigability criteria.

Photographs of Pinal Creek



Photograph #1
Pinal Creek at Inspiration Dam near Globe, at approximately 8 cfs on August 4, 1999 (Lower Reach).

Photograph #2
Pinal Creek upstream of Wilbanks Drive Bridge below Miami Wash at 0 cfs on July 15, 1998 (Upper Reach).

5.0 Conclusions and Recommendations

- A Pilot Study was performed for assessing navigability and susceptibility to navigation for small watercourses in Arizona using the criteria described in *Criteria for Assessing Characteristics of Navigability for Small Watercourses in Arizona* (Stantec, 1998). Project approach and results of the multiple levels of analysis are presented in this document.

- An ArcView GIS master watercourse database was developed and fully populated for data fields relating to the diagnostic criteria evaluated at Level 1 of the multi-level watercourse evaluation system for all small and minor watercourses in Arizona. Satellite databases provide additional informational data fields related to each of the six criterions comprising the Level 1 assessment. The primary utility of the databases is for spatial data interpretation and as a data management tool only. A digital version of those databases was delivered to the ANSAC with this report.

- Information supplied is based on the best available data and information obtainable at the time of delivery. It should be noted that conditions may have been different at the time of statehood in 1912, but those data are lacking. Interpretation of the variation of the conditions represented by the data used herein compared to those found at statehood must be conducted in consultation with the appropriate local, state and federal officials supplying that data.

- The databases need to be continually updated to incorporate new data or information and to reflect future analysis and findings. The work to be conducted by the project team under contract to the ASLD in applying the multi-level evaluation system to all remaining watercourses statewide will serve this purpose, in part.

6.0 References

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Arizona Game and Fish Department, Geospatial Data set: Perennial Waters of Arizona, a digital file submitted to Stantec Consulting, Inc. dated July 9, 1999.

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Stantec Consulting, Inc., (1999), Small and Minor Watercourses Analysis, a proposal submitted to Arizona State Land Department, Phoenix, Arizona on June 1999.

Stantec Consulting, Inc., (1998), Criteria for assessing characteristics of navigability for small watercourses in Arizona, Final Report, submitted to Arizona Navigable Streams Adjudication Commission (ANSAC), on September 1998.

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APPENDIX

TABLE A-1

Summary of Number of Hits for Watercourses Evaluated in Level 1 Analysis

No.	Number of Hits	Watercourses		Total
		Without Names	With Names	
(1)	(2)	(3)	(4)	(5)
0	0	0	1	1
1	1	489	273	762
2	2	9	176	185
3	3	0	62	62
4	4	0	13	13
5	5	0	1	1
6	6	0	1	1
7	Total	498	527	1025

NRL1 Watercourses Evaluated for La Paz County
(Table A-2)

No.	Name of Watercourse	Segments	Miles	Counties	Perennial	Modern Boating	Historical Boating	Fish	Special Status	Dam Impacted	Perrenial [Brown]	Hits	Hits [Brown]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	Date Creek	54	49.2629	La Paz/Yavapai	Yes	No	No	Yes	No	No	Yes	2	2
2	H70_0317	1	0.1576	La Paz/Mohave	Yes	No	No	No	No	No	No	1	0
3	H70_0520	1	0.0659	La Paz/Mohave	Yes	No	No	No	No	No	No	1	0
4	H34_0297	1	0.0934	La Paz	Yes	No	No	No	No	No	No	1	0
5	H34_0299	1	0.2758	La Paz	Yes	No	No	No	No	No	No	1	0
6	H34_0460	1	0.0291	La Paz	Yes	No	No	No	No	No	No	1	0
7	H34_1395	1	2.8275	La Paz	Yes	No	No	No	No	No	No	1	0
8	H34_2321	5	0.7047	La Paz	Yes	No	No	No	No	No	No	1	0
9	H34_2322	1	0.1978	La Paz	Yes	No	No	No	No	No	No	1	0
10	H34_2323	1	0.0741	La Paz	Yes	No	No	No	No	No	No	1	0
11	H34_2324	1	0.4562	La Paz	Yes	No	No	No	No	No	No	1	0
12	H34_2325	1	0.0517	La Paz	Yes	No	No	No	No	No	No	1	0
13	H34_2372	1	0.0174	La Paz	Yes	No	No	No	No	No	No	1	0
14	H34_2377	2	0.7972	La Paz	Yes	No	No	No	No	No	No	1	0
15	H34_2378	2	0.8832	La Paz	Yes	No	No	No	No	No	No	1	0
16	H34_2380	1	0.5760	La Paz	Yes	No	No	No	No	No	No	1	0
17	H34_3004	1	0.0318	La Paz	Yes	No	No	No	No	No	No	1	0
18	H34_3006	1	0.0501	La Paz	Yes	No	No	No	No	No	No	1	0
19	H34_3007	1	0.1192	La Paz	Yes	No	No	No	No	No	No	1	0
20	H34_3008	1	0.1308	La Paz	Yes	No	No	No	No	No	No	1	0
21	H34_3009	1	0.1283	La Paz	Yes	No	No	No	No	No	No	1	0
22	H34_3010	1	0.0439	La Paz	Yes	No	No	No	No	No	No	1	0
23	H34_3011	1	0.1799	La Paz	Yes	No	No	No	No	No	No	1	0
24	H34_3012	1	0.1130	La Paz	Yes	No	No	No	No	No	No	1	0
25	H34_3044	1	0.0557	La Paz	Yes	No	No	No	No	No	No	1	0
26	H70_0518	1	0.2099	La Paz	Yes	No	No	No	No	No	No	1	0

NRL1 Watercourses Evaluated for Mohave County
(Table A-3)

No.	Name of Watercourse	Segments	Miles	Counties	Perennial	Modern Boating	Historical Boating	Fish	Special Status	Dam Impacted	Perennial [Brown]	Hits	Hits [Brown]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
0	Kanab Creek	47	72.516	Mohave/Coconino	Yes	No	No	Yes	Yes	No	Yes	3	3
1	Beaver Dam Wash - Mohav	1	9.589	Mohave	Yes	No	No	Yes	Yes	No	Yes	3	3
2	Francis Creek	20	23.796	Yavapai/Mohave	No	No	No	Yes	Yes	No	No	2	2
3	Trout Creek	43	54.226	Yavapai/Mohave	Yes	No	No	Yes	No	No	Yes	2	2
4	Short Creek	35	26.203	Mohave	Yes	No	No	No	No	Yes	No	2	1
5	Truxton Wash	71	77.324	Yavapai/Mohave	Yes	No	No	Yes	No	No	No	2	1
6	Boulder Wash	1	1.628	Mohave	Yes	No	No	No	No	No	Yes	1	1
7	Cottonwood Creek 3 - Moh	5	8.447	Mohave	Yes	No	No	No	No	No	Yes	1	1
8	Diamond Creek 1	22	25.383	Coconino/Mohave	No	No	No	Yes	No	No	Yes	1	1
9	H23_0601	2	4.598	Mohave	No	No	No	No	No	Yes	No	1	1
10	H57_0490	2	1.836	Mohave	No	No	No	No	No	Yes	No	1	1
11	H64_0498	7	6.570	Yavapai/Mohave	No	No	No	No	No	Yes	No	1	1
12	Meriwhitica Canyon	8	11.575	Mohave	No	No	No	Yes	No	No	No	1	1
13	Travertine Canyon	1	1.114	Mohave	No	No	No	Yes	No	No	No	1	1
14	Wrights Canyon	1	2.994	Mohave	No	No	No	Yes	No	No	No	1	1
15	Spencer Canyon	26	27.430	Mohave	No	No	No	No	No	No	Yes	0	1
16	Grand Wash	68	43.375	Mohave	Yes	No	No	No	No	No	No	1	0
17	H07_0740	1	0.286	Mohave	Yes	No	No	No	No	No	No	1	0
18	H07_0741	1	0.171	Mohave	Yes	No	No	No	No	No	No	1	0
19	H07_1662	1	0.524	Mohave	Yes	No	No	No	No	No	No	1	0
20	H07_1664	1	0.336	Mohave	Yes	No	No	No	No	No	No	1	0
21	H21_1365	2	0.797	Mohave	Yes	No	No	No	No	No	No	1	0
22	H21_1366	3	0.766	Mohave	Yes	No	No	No	No	No	No	1	0
23	H21_1367	1	0.025	Mohave	Yes	No	No	No	No	No	No	1	0
24	H21_1368	1	0.137	Mohave	Yes	No	No	No	No	No	No	1	0
25	H21_1369	1	0.432	Mohave	Yes	No	No	No	No	No	No	1	0
26	H21_1370	1	0.074	Mohave	Yes	No	No	No	No	No	No	1	0
27	H64_0073	1	0.136	Mohave	Yes	No	No	No	No	No	No	1	0
28	H70_0211	4	1.448	Mohave	Yes	No	No	No	No	No	No	1	0
29	H70_0317	1	0.158	La Paz/Mohave	Yes	No	No	No	No	No	No	1	0
30	H70_0520	1	0.066	La Paz/Mohave	Yes	No	No	No	No	No	No	1	0
31	Hualapai Wash	47	26.244	Mohave	Yes	No	No	No	No	No	No	1	0
32	Rock Canyon - Mohave	13	23.672	Mohave	Yes	No	No	No	No	No	No	1	0
33	South Moccasin Wash	8	8.127	Mohave	Yes	No	No	No	No	No	No	1	0
34	Topock Marsh	50	32.037	Mohave	Yes	No	No	No	No	No	No	1	0
35	Twomile Wash	2	5.741	Mohave	Yes	No	No	No	No	No	No	1	0

NRL1 Watercourses Evaluated for Yuma County
(Table A-4)

No.	Name of Watercourse	Segments	Miles	Counties	Perennial	Modern Boating	Historical Boating	Fish	Special Status	Dam Impacted	Perennial [Brown]	Hits	Hits [Brown]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	Cementosa Wash	7	7.727	Yuma/La Paz	Yes	No	No	No	No	No	No	1	0
2	H34_2568	1	0.469	Yuma	Yes	No	No	No	No	No	No	1	0
3	H34_2569	1	0.714	Yuma	Yes	No	No	No	No	No	No	1	0
4	H34_2570	1	0.537	Yuma	Yes	No	No	No	No	No	No	1	0
5	H34_2571	1	0.027	Yuma	Yes	No	No	No	No	No	No	1	0
6	H40_0652	1	0.170	Yuma	Yes	No	No	No	No	No	No	1	0
7	H44_0128	1	0.574	Yuma	Yes	No	No	No	No	No	No	1	0
8	H44_0130	1	0.218	Yuma	Yes	No	No	No	No	No	No	1	0
9	H44_0138	1	0.703	Yuma	Yes	No	No	No	No	No	No	1	0
10	H44_0444	1	0.829	Yuma	Yes	No	No	No	No	No	No	1	0
11	H44_0445	1	0.190	Yuma	Yes	No	No	No	No	No	No	1	0
12	H44_0446	1	0.107	Yuma	Yes	No	No	No	No	No	No	1	0
13	H44_0450	1	0.701	Yuma	Yes	No	No	No	No	No	No	1	0
14	H44_0451	1	0.390	Yuma	Yes	No	No	No	No	No	No	1	0
15	H44_0452	1	0.171	Yuma	Yes	No	No	No	No	No	No	1	0
16	H44_0453	1	0.085	Yuma	Yes	No	No	No	No	No	No	1	0
17	H47_0126	1	0.011	Yuma	Yes	No	No	No	No	No	No	1	0