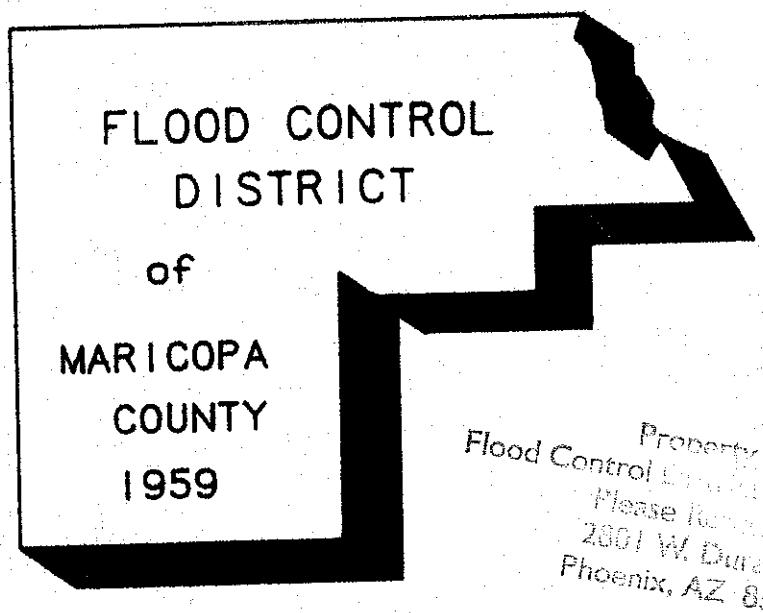

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CAVE CREEK FLOODPLAIN DELINEATION

Cave Buttes Dam to the Arizona Canal Diversion Channel

FCD 88-56

FINAL HYDROLOGY REPORT

Book 2 of 2

January, 1990

Boyle Engineering Corporation
Engineers and Architects

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CAVE CREEK AND EAST FORK OF CAVE CREEK
FLOODPLAIN DELINEATION STUDY
ARIZONA CANAL DIVERSION CHANNEL TO CAVE BUTTE DAM

FINAL HYDROLOGY REPORT
BOOK 2 OF 2

Prepared By

BURGESS & NIPLE, INC.

JANUARY 1990

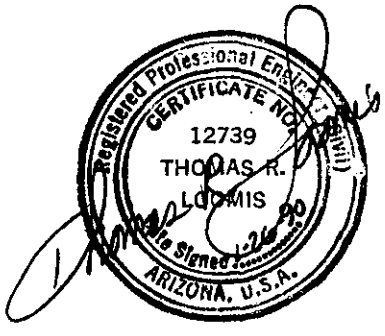


TABLE OF CONTENTS
Book 2 of 2
(Exhibits)

Description

Exhibit "A" - Major Drainage Basin Map and Street Index for Exhibits "B" and "C"

Exhibit "B" - Drainage Basin Land Use Map

Exhibit "C" - Time of Concentration Flow Paths and Flood Routing Map

Exhibit "D" - Hydrograph Routing Diagram

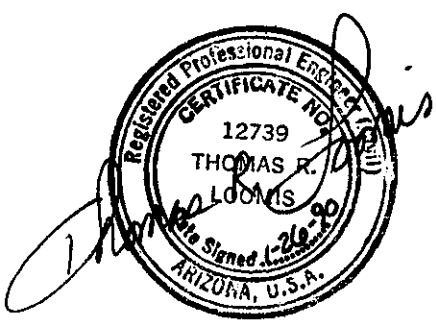
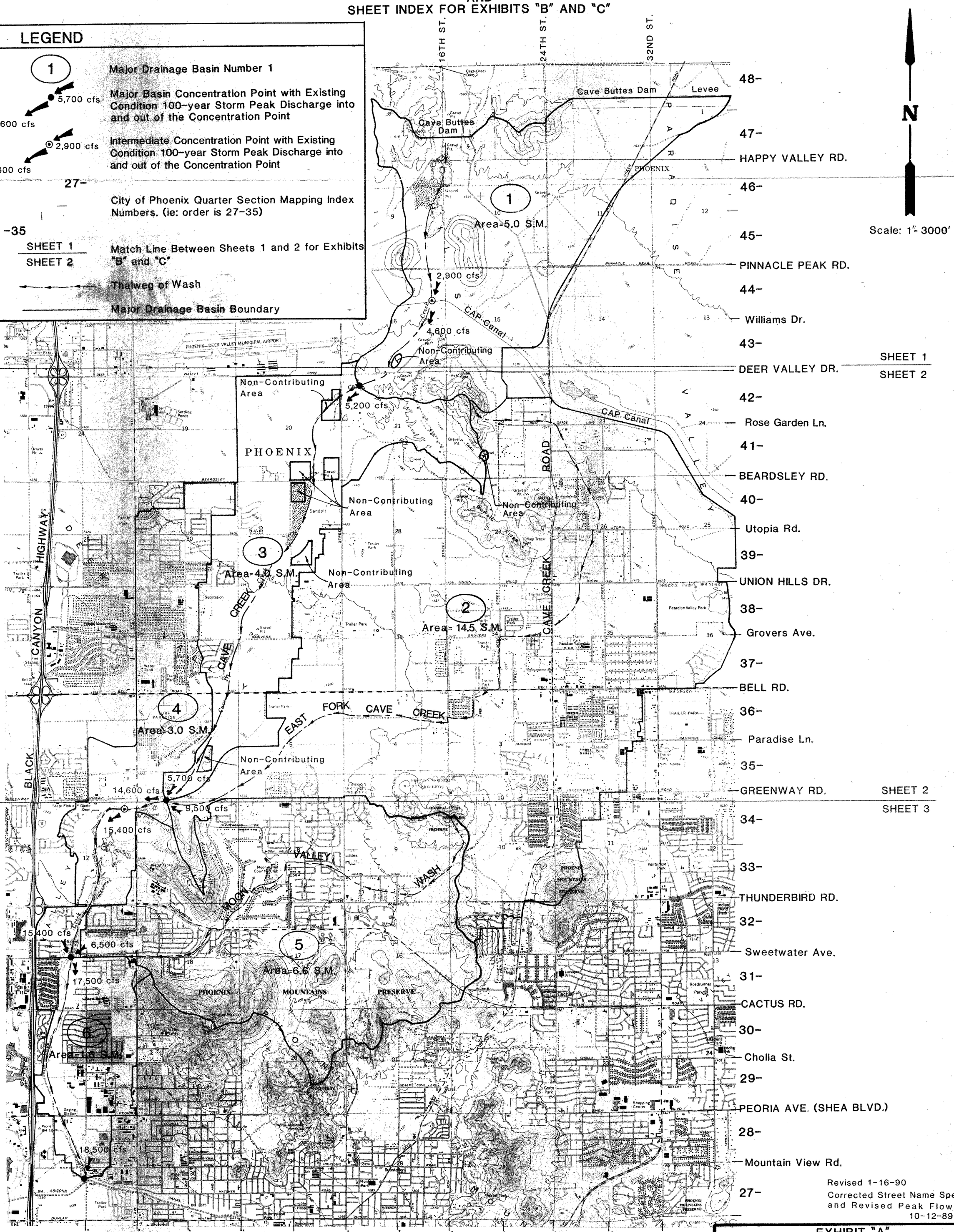


EXHIBIT "A"
MAJOR DRAINAGE BASIN MAP
AND
SHEET INDEX FOR EXHIBITS "B" AND "C"

LEGEND

- (1) — Major Drainage Basin Number 1
- 5,700 cfs / 14,600 cfs — Major Basin Concentration Point with Existing Condition 100-year Storm Peak Discharge into and out of the Concentration Point
- 2,900 cfs / 4,600 cfs — Intermediate Concentration Point with Existing Condition 100-year Storm Peak Discharge into and out of the Concentration Point
- 27– / –35 — City of Phoenix Quarter Section Mapping Index Numbers. (ie: order is 27–35)
- SHEET 1 / SHEET 2 — Match Line Between Sheets 1 and 2 for Exhibits "B" and "C"
- Thalweg of Wash
- Major Drainage Basin Boundary



Revised 1-16-90
Corrected Street Name Spelling and Revised Peak Flows
10-12-89

EXHIBIT "A"
DRAINAGE BASIN MAP
AND
SHEET INDEX FOR EXHIBITS "B" AND "C"

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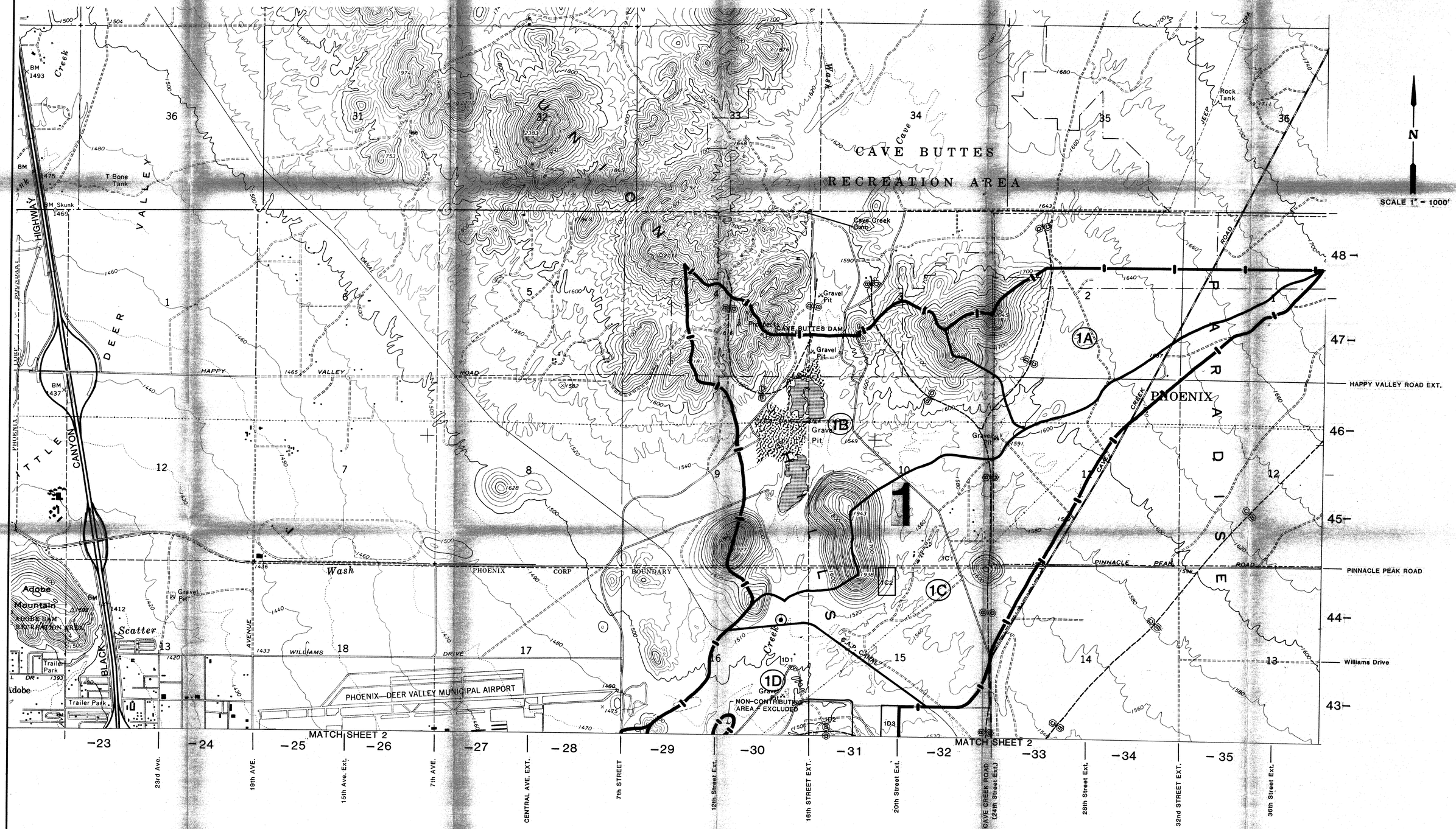
1106 N. Beeline Highway,
Payson, Arizona 85541 (602) 474-5313
b&n 1912



LEGEND

2	MAJOR DRAINAGE BASIN NUMBER 2
(2G)	DRAINAGE SUB-BASIN NUMBER 2G
2G14	SUB AREA NUMBER 2G14
	MAJOR DRAINAGE BASIN BOUNDARY
	DRAINAGE SUB-BASIN BOUNDARY
	SUB AREA BOUNDARY
(B)	HYDROLOGIC SOIL TYPE "B" BOUNDARY
	PARCEL WITH SIGNIFICANT RETENTION (PARCELS AS SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY)
27–	CITY OF PHOENIX QUARTER SECTION MAPPING INDEX NUMBERS (ie: MAP NUMBER 27–35)
–35	
△	LOCATION OF FLOW SPLIT IN STREAM
●	MAJOR DRAINAGE BASIN CONCENTRATION POINT
⊙	INTERMEDIATE CONCENTRATION POINT

NO.	REVISIONS	DATE	BY	CHK.

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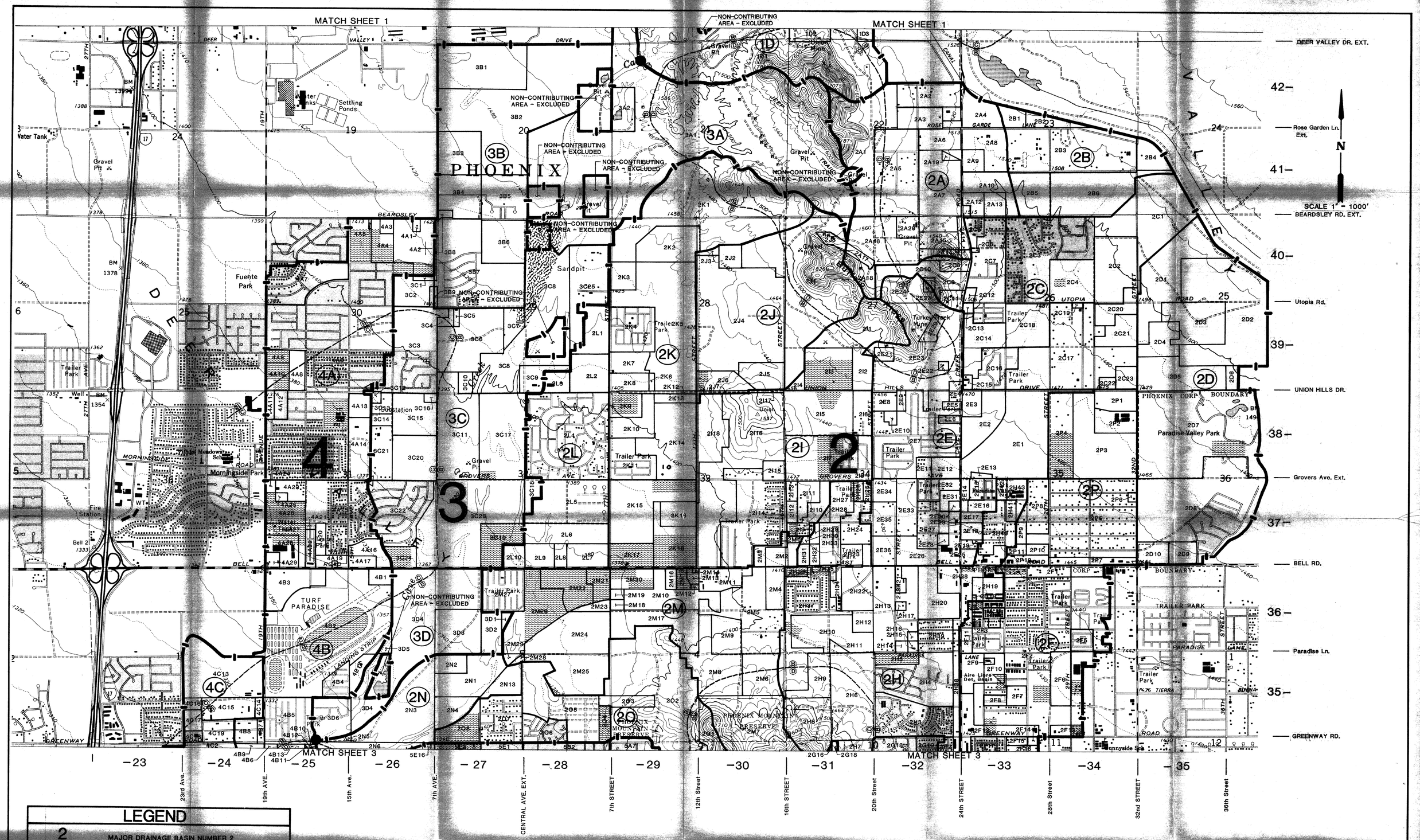
MARICOPA COUNTY FLOOD CONTROL DISTRICT
CAVE CREEK FLOOD INSURANCE STUDY
CAVE BUTTES DAM TO ARIZONA CANAL DIVERSION CHANNEL

JOB NO.	7833
DESIGNED BY:	AR
DRAWN BY:	JKD
CHECKED BY:	TRL
APPROVED BY:	
DATE:	10/89

EXHIBIT "B"
DRAINAGE BASIN LAND USE MAP

SCALE:	
1" = 1000'	
SHEET NO.	OF
1	3



LEGEND

2	MAJOR DRAINAGE BASIN NUMBER 2
2G	DRAINAGE SUB-BASIN NUMBER 2G
2G14	SUB AREA NUMBER 2G14
	MAJOR DRAINAGE BASIN BOUNDARY
	DRAINAGE SUB-BASIN BOUNDARY
	SUB AREA BOUNDARY
B	HYDROLOGIC SOIL TYPE "B" BOUNDARY
	PARCEL WITH SIGNIFICANT RETENTION (PARCELS AS SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY)
27-	CITY OF PHOENIX QUARTER SECTION MAPPING INDEX NUMBERS (ie: MAP NUMBER 27-35)
-35	
△	LOCATION OF FLOW SPLIT IN STREAM
●	MAJOR DRAINAGE BASIN CONCENTRATION POINT
⊙	INTERMEDIATE CONCENTRATION POINT

NO.	REVISIONS	DATE	BY	CHK.
1	Corrected Street Name Spelling	1/16/90		T.R.L.

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MARICOPA COUNTY FLOOD CONTROL DISTRICT
CAVE CREEK FLOOD INSURANCE STUDY
CAVE BUTTES DAM TO ARIZONA CANAL DIVERSION CHANNEL

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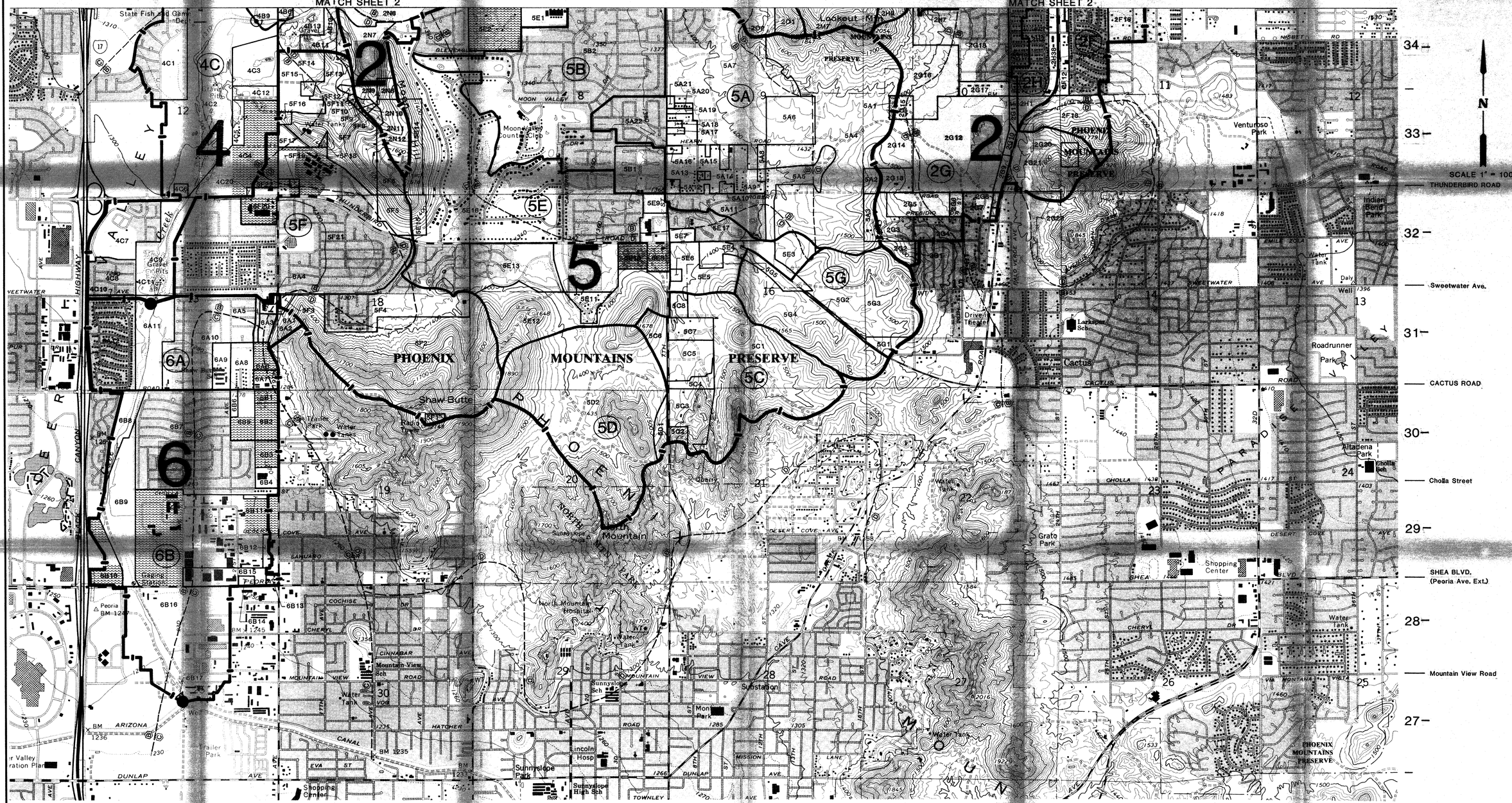
DESIGNED BY:	AR
DRAWN BY:	JKD
CHECKED BY:	TRL
APPROVED BY:	
DATE:	10/89

EXHIBIT "B"
DRAINAGE BASIN LAND USE MAP

SCALE: 1" = 1000'
SHEET NO. 2 OF 3



LEGEND

2	MAJOR DRAINAGE BASIN NUMBER 2
2G	DRAINAGE SUB-BASIN NUMBER 2G
2G14	SUB AREA NUMBER 2G14
	MAJOR DRAINAGE BASIN BOUNDARY
	DRAINAGE SUB-BASIN BOUNDARY
	SUB AREA BOUNDARY
B	HYDROLOGIC SOIL TYPE "B" BOUNDARY
	PARCEL WITH SIGNIFICANT RETENTION (PARCELS AS SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY)
27- |-35 |	CITY OF PHOENIX QUARTER SECTION MAPPING INDEX NUMBERS (ie: MAP NUMBER 27-35)
△	LOCATION OF FLOW SPLIT IN STREAM
●	MAJOR DRAINAGE BASIN CONCENTRATION POINT
⊙	INTERMEDIATE CONCENTRATION POINT

NO.	REVISIONS	DATE	BY	CHK.

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MARICOPA COUNTY FLOOD CONTROL DISTRICT
CAVE CREEK FLOOD INSURANCE STUDY
CAVE BUTTES DAM TO ARIZONA CANAL DIVERSION CHANNEL

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APPROVED BY:	
DATE:	10/89

EXHIBIT "B"
DRAINAGE BASIN LAND USE MAP

SCALE: 1" = 1000'
SHEET NO. 3 OF 3

LEGEND

2	MAJOR DRAINAGE BASIN NUMBER 2
2G	DRAINAGE SUB-BASIN NUMBER 2G
	MAJOR DRAINAGE BASIN BOUNDARY
	DRAINAGE SUB-BASIN BOUNDARY
27– / –35	CITY OF PHOENIX QUARTER SECTION MAPPING INDEX NUMBERS (ie: MAP NUMBER 27–35)
6 9000 cfs	FLOW COMBINATION POINT AT NODE 6. PEAK DISCHARGE FROM THE 100-YR. 24-HR. STORM IS 9000 cfs
8	FLOW DIVERSION POINT AT NODE 8
	MAJOR DRAINAGE BASIN CONCENTRATION POINT
	INTERMEDIATE CONCENTRATION POINT
	DRAINAGE SUB-BASIN CONCENTRATION POINT
	ROUTING STREAM FLOW PATH
1354	TIME OF CONCENTRATION FLOW PATH & REACH DELIMITER AT ELEVATION 1354

NO.	REVISIONS	DATE	BY	CHK.
1	Changed Flow Path for Subbasin 1B	9/16/90		T.R.L.

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MARICOPA COUNTY FLOOD CONTROL DISTRICT
CAVE CREEK FLOOD INSURANCE STUDY
CAVE BUTTES DAM TO ARIZONA CANAL DIVERSION CHANNEL

JOB NO.	7833
DESIGNED BY:	AR
DRAWN BY:	JKD
CHECKED BY:	TRL
APPROVED BY:	
DATE:	10/89

EXHIBIT "C"
TIME OF CONCENTRATION FLOW PATHS & FLOOD ROUTING MAP

SCALE:	
1" = 1000'	
SHEET NO.	OF
1	3

MATCH SHEET 1

MATCH SHEET 1

PHOENIX

DEER VALLEY DR. EXT.

Rose Garden Ln. Ext.

SCALE 1" = 1000'

BEARDSLEY RD. EXT.

Utopia Rd.

UNION HILLS DR.

Grovers Ave. Ext.

BELL RD.

Paradise Ln.

GREENWAY RD.

MATCH SHEET 3

MATCH SHEET 3

23rd Ave. | 19th AVE. | 15th Ave. | 7th AVE. | CENTRAL AVE. EXT. | 7th STREET | 12th Street | 16th STREET | 20th Street | Cave Creek Road (24th Street Ext.) | 28th Street | 32nd STREET | 36th Street

LEGEND

2	MAJOR DRAINAGE BASIN NUMBER 2
(2G)	DRAINAGE SUB-BASIN NUMBER 2G
	MAJOR DRAINAGE BASIN BOUNDARY
	DRAINAGE SUB-BASIN BOUNDARY
27– / –35	CITY OF PHOENIX QUARTER SECTION MAPPING INDEX NUMBERS (ie: MAP NUMBER 27-35)
(6) 9000 cfs	FLOW COMBINATION POINT AT NODE 6. PEAK DISCHARGE FROM THE 100-YR. 24-HR. STORM IS 9000 cfs
(8)	FLOW DIVERSION POINT AT NODE 8
	MAJOR DRAINAGE BASIN CONCENTRATION POINT
	INTERMEDIATE CONCENTRATION POINT
	DRAINAGE SUB-BASIN CONCENTRATION POINT
	ROUTING STREAM FLOW PATH
1354	TIME OF CONCENTRATION FLOW PATH & REACH DELIMITER AT ELEVATION 1354

NO.	REVISIONS	DATE	BY	CHK.
1	Corrected Street Names, Labeled Node 20, Corrected Node 20	5/16/90		T.R.L.

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MARICOPA COUNTY FLOOD CONTROL DISTRICT
CAVE CREEK FLOOD INSURANCE STUDY
CAVE BUTTES DAM TO ARIZONA CANAL DIVERSION CHANNEL

JOB NO.	7833
DESIGNED BY:	AR
DRAWN BY:	JKD
CHECKED BY:	TRL
APPROVED BY:	
DATE:	10/89

EXHIBIT "C"
TIME OF CONCENTRATION FLOW PATHS & FLOOD ROUTING MAP

SCALE: 1" = 1000'
SHEET NO. 2 OF 3

MATCH SHEET 2

MATCH SHEET 2

SCALE 1" = 1000'

THUNDERBIRD ROAD

Sweetwater Ave.

CACTUS ROAD

Cholla Street

SHEA BLVD. (Peoria Ave. Ext.)

Mountain View Road

34 33 32 31 30 29 28 27

23 24 25 26 27 28 29 30 31 32 33 34 35

7th AVE. CENTRAL AVE. 7th STREET 12th Street 16th STREET EXT. 20th Street Ext. 24th STREET EXT. 28th Street Ext. 32nd STREET 36th Street Ext.

32nd Ave. Ext. 19th AVE. 15th Ave.

LEGEND

- 2 — MAJOR DRAINAGE BASIN NUMBER 2
- 2G — DRAINAGE SUB-BASIN NUMBER 2G
- MAJOR DRAINAGE BASIN BOUNDARY
- DRAINAGE SUB-BASIN BOUNDARY
- 27 — CITY OF PHOENIX QUARTER SECTION MAPPING INDEX NUMBERS (ie: MAP NUMBER 27-35)
- CITY OF PHOENIX DETENTION BASIN PARCEL
- 6 — 9000 cfs — FLOW COMBINATION POINT AT NODE 6. PEAK DISCHARGE FROM THE 100-YR. 24-HR. STORM IS 9000 cfs
- FLOW DIVERSION POINT AT NODE 8
- MAJOR DRAINAGE BASIN CONCENTRATION POINT
- INTERMEDIATE CONCENTRATION POINT
- DRAINAGE SUB-BASIN CONCENTRATION POINT
- ROUTING STREAM FLOW PATH
- 1354 — TIME OF CONCENTRATION FLOW PATH & REACH DELIMITER AT ELEVATION 1354

NO.	REVISIONS	DATE	BY	CHK.
1	Updated Qs at HC 27, HC 28, HC 29 & HC11	2/22/90	TRL	

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MARICOPA COUNTY FLOOD CONTROL DISTRICT
CAVE CREEK FLOOD INSURANCE STUDY
CAVE BUTTES DAM TO ARIZONA CANAL DIVERSION CHANNEL

JOB NO.	7833
DESIGNED BY:	AR
DRAWN BY:	MWB
CHECKED BY:	TRL
APPROVED BY:	
DATE:	10/89

EXHIBIT "C"
TIME OF CONCENTRATION FLOW PATHS & FLOOD ROUTING MAP

SCALE: 1" = 1000'
SHEET NO. 3 OF 3

EXHIBIT "D"

HYDROGRAPH ROUTING DIAGRAM

1A — 0.50 — **1** — 850' N. of C.A.P. Canal

MUSKINGUM ROUTE
Channel Flow-N
L=9900',T=1591,B=1515
Assume Trap.,10'B,2:1,S=0.8%
D=3,n=.04',V=5.4 fps,X=.2
Time=.51 hrs.,NSteps=3

1B — 1 — 0 — **1C** — 2 — C.A.P. Canal

NO ROUTE DONE
Channel Flow-N
L=850',T=1515,B=1506
Assume Trap.,20'B,3:1,S=1%
D=4',n=.04',V=7.4 fps
Time=.03 hrs.,NSteps=1
(FEMA V=7.5 fps)
RM2-3 K Lengthened
1C Lag Lengthened

3B — 0.50

MUSKINGUM ROUTE
Street Flow
L=4500',T=1410,B=1388
Roll Curb,S=0.5%
V=2.5 fps,X=.3
Time=0.5 hrs.,NSteps=6

4A — RET — 0.75 — FL-8 — FLOW 8 — Renee Dr. and 13th Ave

MUSKINGUM ROUTE
Street Flow
L=8,200',T=1388,B=1353
Vert. Curb,S=0.4%
V=3 fps,X=.2
Time=.76 hrs.,NSteps=4

DT8

MUSKINGUM ROUTE
Street Flow
L=2,750',T=1388,B=1376
Trian.,Z=20,D=.5'
S=0.4%,V=3.5 fps,X=.3
Time=.22 hrs.,NSteps=3

0.16

500' South of Deer Valley Drive — 24.26 — **3** — **1D**

MUSKINGUM ROUTE
Channel Flow-N
L=6100',T=1506,B=1463
Assume Trap.,50'B,3:1,S=0.7%
D=4',n=.035,V=7.9 fps,X=.2
Time=0.21 hrs.,NSteps=3
(FEMA V=7.6 fps)

0.25

MUSKINGUM ROUTE
Channel Flow-N
L=6800',T=1463,B=1428
Assume Trap.,25'B,3:1,S=0.5%
D=5',M=.035,V=7.0 fps,X=.3
Time=0.27 hrs.,NSteps=3
(FEMA V=7.8 fps)

0.25

3 — 1000' South of Beardsley Road — 22.97 — **4** — **3A**

MUSKINGUM ROUTE
Channel Flow-N
L=11,450',T=1428,B=1367
Assume Trap.,30'B,2:1,S=0.6%
D=5',n=.035,V=8.0 fps,X=.3
Time=0.40 hrs.,NSteps=5
(FEMA V=6.3 fps)

0.42

Grovers and 13th Ave — FL-9 — FLOW 9 — 0.59

10 — 19th Ave & Bell Road — FL-10 — FLOW — Flow Leaves Watershed West in Bell Road — DT10

MUSKINGUM ROUTE
Street Flow
L=5,750,T=1376,B=1353
Vert. Curb,S=0.4%
V=3 fps,X=.2
Time=.53 hrs.,NSteps=3

0.50

MUSKINGUM ROUTE
Street Flow
L=3950',T=1376,B=1367
Roll Curb,S=0.2%
V=2 fps,X=.2
Time=0.54 hrs.,NSteps=6

Bell Rd. — **3C** — RET — 20.80 — **5** — **5.1**

NORMAL DEPTH CHANNEL ROUTE
Channel Flow-CB
L=6,400',T=1367,B=1320
Trap.,26'B,3:1,S=0.7%
Q=5400',n=.03,V=12.7 fps
Time=0.14 hrs.,D=8.3',NSteps=2
(FEMA V=7.6 fps)

0.08 — **2L** — RET — **20**

CREEK

3D — 19.60 — **6** — 6.2 — Confluence with East FORK Cave Creek — **2N**

EAST FORK CAVE

NO ROUTE DONE
Channel Flow-CG
L=2,250',T=1320,B=1306
Trap.,60'B,4:1,S=0.6%
Q=11,000,D=8.8,N=.03,V=13.1 fps
Time=.05 hrs.,NSteps=1
(FEMA V=10.3 fps)

0

NORMAL DEPTH CHANNEL ROUTE
Channel Flow-N
L=2700',T=1333,B=1320
Trap.,60'B,2:1,S=0.5%
D=6',n=.035,V=8.8 fps
Time=.09 hrs.,NSteps=1
(FEMA V=7.8 fps)

0.08

Coral Gables and 7th Ave. — **22** — 0.61 — RET — **20**

0.16

21 — 1.30 — RET — **2M** — Paradise Lane and Central Avenue

NORMAL DEPTH CHANNEL ROUTE
Channel Flow-CE
L=4,150',T=1350,B=1333
Trap.,70'B,2:1,S=0.4%
D=5',n=.035,V=7.1 fps
Time=.16 hrs.,NSteps=2
(FEMA V=6.6 fps)

MUSKINGUM ROUTE
Street Flow
L=6850',T=1353,B=1306
Vert. Curb,S=0.7%
V=4 fps,X=.2
Time=.48 hrs.,NSteps=6

0.50

4B — RET — 19.17 — **7** — 500' South of Greenway Road 600' West of 19th Avenue

NORMAL DEPTH CHANNEL ROUTE
Channel Flow-N
L=8900',T=1306,B=1276
Trap.,50'B,2.5:1,S=0.3%
D=10',n=.035,V=8.9 fps
Time=0.28 hrs.,NSteps=4
(FEMA V=9.4 fps)

0.25

4C — RET — 17.49 — **11.1** — **11.2** — **11** — Confluence with Moon Valley Wash

5F — RET — **5E** — RET — Thunderbird Road West of Coral Gables — MOON VALLEY WASH

MUSKINGUM ROUTE
Channel Flow-CC (Supercritical)
L=7,000',T=1313,B=1280
Trap.,38'B,1:1,S=0.5%
D=4',n=.02,V=11.9 fps,X=.3
Time=.16 hrs.,NSteps=2

0.16 — **29** — 0.08 — **28** — 0.28 — **26** — 0.09 — **5G**

7th Street and Roberts Road

MUSKINGUM ROUTE
Channel Flow-CE
L=2550',T=1392,B=1369
Trap.,10'B,2:1,S=0.9%
D=3',n=.035,V=6.5 fps,X=.3
Time=.11 hrs.,NSteps=1

RESERVOIR ROUTE
City of Phoenix Detention Basin No. 2b
Volume at Spillway Flowline=48 Ac-Ft.

MUSKINGUM ROUTE
Channel Flow-CG
L=2150',T=1325,B=1313
Trap.,25'B,2:1,S=0.6%
D=2.5',n=.03,V=6.2 fps,X=.3
Time=.10 hrs.,NSteps=1

MUSKINGUM ROUTE
Channel Flow-CB
L=5,500',T=1369,B=1325
Trap.,15'B,2:1,S=0.8%
D=2',n=.025,V=7.2 fps,X=.3
Time=.21 hrs.,NSteps=3

NO ROUTE DONE
COE STA. 104+00,Channel Flow-CC
(Supercritical Flow)
L=2700',T=1276,B=1259
Trap.,84'B,2:1,S=0.6%
Q=12,000,D=6.7',n=.015,V=22.2 fps
Time=.03 hrs., NSteps=1
(FEMA V=9.1 fps)
RM12-13 K Lengthened

0

MUSKINGUM ROUTE
Channel Flow-CG
L=6,700',T=1368,B=1313
Trap.,10'B,2:1,S=0.8%
D=2',n=.03,V=5.8 fps,X=.3
Time=.32 hrs.,NSteps=4

0.34

KINEMATIC WAVE
Pipe Flow
L=2400,T=1390,B=1369
Assume 54" CMP,S=0.9%
V=6.4 fps
full

0

5C — RESERVOIR ROUTE
City of Phoenix Detention Basin No. 2a
Volume at Spillway Flowline=60 Ac-Ft.

RESERVOIR ROUTE
City of Phoenix Detention Basin No.7
Volume at Spillway Flowline=120 Ac-ft.

6A — RET — 16.98 — **12** — Cactus Road

6B — RET — 15.28 — **13** — Arizona Canal Diversion Channel

MUSKINGUM ROUTE
Channel Flow-CC
Average COE Cross Section
(Supercritical Flow)
L=9000',T=1259,B=1223
Trap.,68'B,2:1,S=0.4%
Q=13,000,D=7.5',n=.015,V=21.0 fps
Time=0.12 hrs.,NSteps=2,X=.2
(FEMA V=8.1 fps)

0.17

5D

Moon Valley Golf Course Between Moon Valley Drive and Tam -O- Shanter Drive — **5B** — **27** — 0.25 — **5A**

MUSKINGUM ROUTE
Channel Flow-CG
L=3600',T=1342,B=1326
Trap.,35'B,2:1,S=0.4%
D=2',n=.03,V=4.6 fps,X=.3
Time=.22 hrs.,NSteps=3

MUSKINGUM ROUTE
Channel Flow-CG
L=900',T=1326,B=1325
Trap.,20'B,2:1,S=0.1%
D=2',n=.03,V=2.2 fps,X=.3
Time=.11 hrs.,NSteps=1

0.09

TO A.C.D.C.

2A — **2B** — Beardsley Road East of Cave Creek Road — 5.82 — **14**

MUSKINGUM ROUTE
Channel Flow-N
L=5600',T=1491,B=1465
Assume Trap.,10'B,2.5:1,S=0.5%
D=4',n=.04,V=4.9 fps,X=.3
Time=.32 hrs.,NSteps=4
(FEMA V=6.0 fps)

0.34

2J — RET — 0.50

MUSKINGUM ROUTE
Street Flow
L=7600',T=1418,B=1378
Vert. Curb,CS=2%,S=0.6%
V=4 fps,X=.2
Time=.53 hrs.,NSteps=3

2I — RET — 0.17 — Union Hills Dr. — 4.76 — **15** — **2C** — RET

MUSKINGUM ROUTE
Street Flow
L=2650',T=1393,B=1378
Vert. Curb,S=0.6%
V=4 fps,X=.2
Time=.18 hrs.,NSteps=1

MUSKINGUM ROUTE
Channel and Street Flow-CG
L=5400',T=1465,B=1434
Trap.,20'B,2:1,S=0.6%
D=4',n=0.03,V_c=7.9 fps
L=2600',T=1434,B=1425
Vert. Curb,S=.3%
V_c=3.6 fps,X=.3
Time=.39 hrs.,NSteps=5
(FEMA V=5.5 fps)

0.41

2 — **2E** — 3.74 — **16** — 20th Street and Bell Road

2K — RET — **19** — 7th Street and Bell

MUSKINGUM ROUTE
Street Flow
L=3950',T=1425,B=1402
Vert. Curb,S=0.6%
V=4 fps,X=.3
Time=.27 hrs.,NSteps=3
(FEMA V=6.3 fps)

0.33

2H — RET — **17** — 16th Street 1000' North of Paradise Lane

FL-19 — FLOW — DT19

MUSKINGUM ROUTE
Street Flow
L=1000',T=1378,B=1375
Vert. Curb,S=.3%
V=3.6 fps, Time=.08hrs.
NSteps=1,X=.3

0.09

0.25

MUSKINGUM ROUTE
Street Flow
L=2,350',T=1378,B=1368
Vert. Curb,S=0.4%
V=3 fps,X=.3
Time=.22 hrs.,NSteps=3

3.0 — **17.1** — 0.16 — **25** — 1350' West of Cave Creek Road and 400' South of Paradise Lane

NORMAL DEPTH CHANNEL ROUTE
Channel Flow-UC
L=5250',T=1402,B=1375
Trap.,40'B,2:1,S=0.5%(8')
D=4',n=.03,V=7.8 fps
Time=.19 hrs.,NSteps=3
(FEMA V=5.1 fps)

0.08

0.17 — **2G**

MUSKINGUM ROUTE
Street and Channel Flow
Use Channel for V.-CE
L=2360',T=1424,B=1416
Trap.,15'B,2:1,S=0.4%
D=3',n=.03,V=6.3 fps,X=.3
Time=.12 hrs.,NSteps=2

7th Street 1000' South of Bell Road — 2.0 — **18**

NORMAL DEPTH CHANNEL ROUTE
Channel Flow-CE
L=3,700',T=1375,B=1350
Trap.,50'B,2:1,S=0.7%(10')
D=5',n=.03,V=10.7 fps
Time=.10 hrs.,NSteps=2
(FEMA V=5.2 fps)

0.08

Bell Road and Central Ave — **20** — 0.17

MUSKINGUM ROUTE
Channel Flow-N
L=3150',T=1368,B=1350
Assume Trap.,20'B,2:1,S=0.6%
D=2.5',n=.035,V=5.2 fps,X=.3
Time=.17 hrs.,NSteps=2

1.30 — **21** — RET — **2M** — Paradise Lane and Central Avenue

NORMAL DEPTH CHANNEL ROUTE
Channel Flow-CE
L=4,150',T=1350,B=1333
Trap.,70'B,2:1,S=0.4%
D=5',n=.035,V=7.1 fps
Time=.16 hrs.,NSteps=2
(FEMA V=6.6 fps)

2D — FL-2D — FLOW — Flow Leaves Watershed South on 32nd Street — DT2D

MUSKINGUM ROUTE
Street Flow
L=3900',T=1454,B=1436
Vert. Curb,S=0.5%
V=3.5 fps,X=.3
Time=0.31 hrs.,NSteps=4

0.33

26th St. & Bell Rd. — **23** — RET — **2P**

MUSKINGUM ROUTE
Street Flow
L=4400',T=1436,B=1422
Roll Curb,S=0.3%
V=2.6 fps,X=.3
Time=.47 hrs.,NSteps=6

0.50

2F — RET — **24** — Cave Creek Road 600' South of Paradise Lane

NO ROUTE DONE
Channel Flow-CE
L=1200',T=1422,B=1416
Trap.,20'B,2:1,S=0.5%
D=3',n=.03,V=6.2 fps,X=.3
Time=.05 hrs.,NSteps=1
RM23-24 K Lengthened
2F Lag Lengthened

0

Original 10-12-89
Revised 1-16-90
Changed Muskingum Coefficients
Added Channel Types
Added Reach Calculated Flow Times
Revised 3-15-91 Changed Basin 3 Boundary

LEGEND

- Major Drainage Basin Boundary
- 2J — Hydrograph Calculation for Subbasin 2J
- RET — Diversion Calculation to Subtract Onsite Retention Volume
- FLOW 9 — Diversion Calculation to Simulate Flow Split, Node Number 9
- 11 — 17.49 — Combine Hydrograph Operation, Node Number 13, location is 17.49 miles above confluence with the Salt River
- coe — Hydrograph Routing Operation - 0.08 hrs. HEC-1 calculated travel time.
- Direction of Flow
- 6B — Sub-Basin 6B
- 4 — Major Basin 4

CHANNEL TYPES

N = Natural
CE = Constructed - Earthen
CG = Constructed - Grass Lined
CB = Constructed - Bank Protection
CC = Constructed - Concrete Lined
UC = Under Construction

EXHIBIT "D"
HYDROGRAPH ROUTING DIAGRAM

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