Sun Valley Area Drainage Master Plan

TECHNICAL DATA NOTEBOOK

Approximate Zone A Floodplain Delineation Study of White Tank

Fans 4 and 5

Flood Control District of Maricopa County

November 2006

TECHNICAL DATA NOTEBOOK:

APPROXIMATE ZONE A
FLOODPLAIN DELINEATION STUDY
of
WHITE TANK FANS 4 & 5

SUN VALLEY AREA DRAINAGE MASTER PLAN

FCD CONTRACT NO. 2004 C049

Task 11.1.1

Registered Professional Engineer (Civil)
CERTIFICATE NO.
26846
JONATHAN E.
FULLER
Date Signed 11-7-06
ARIZONA, U. S. A.

November 2006

Prepared for:

Flood Control District of Maricopa County

2801 W. Durango Street

Phoenix, AZ 85009

(602) 506-1501

Prepared by:

JE Fuller/ Hydrology & Geomorphology

8400 S. Kyrene Rd., Suite 201

Tempe, Arizona 85284

(480) 752-2124

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

TABLE OF CONTENTS

SECTION 1: INTRODUCTION 1-1
1.1 Study Purpose 1-1
1.2 Study Authority 1-1
1.3 Study Location 1-1
1.4 Methodology 1-5
1.5 Acknowledgements 1-6
1.6 Study results 1-6
SECTION 2: ADWR/FEMA FORMS 2-1
2.1 Study Documentation Abstract for FEMA Submittals 2-1
2.2 FEMA Forms 2-2
SECTION 3: MAPPING AND SURVEY INFORMATION 3-1
3.1 Field Survey Information 3-1
3.2 Mapping 3-1
SECTION 4: HYDROLOGY 4-1
4.1 Method Description 4-1
4.2 Parameter Estimation 4-1
4.3 Problems Encountered During the Study 4-8
4.4 Calibration 4-8
4.5 Final Results 4-8
4.6 References 4-11
SECTION 5: HYDRAULIC ANALYSIS 5-1
5.1 Method Description 5-1
5.2 Work Study Maps 5-1
5.3 Parameter Estimation 5-8
5.4 Cross-section descriptions 5-8
5.5 Modeling Considerations 5-8
5.6 Floodway modeling 5-9
5.7 Special problems encountered during the study 5-9
5.8 Calibration 5-9
5.9 Final Results 5-9
5.10 References 5-11
SECTION 6: SEDIMENT TRANSPORT/EROSION 6-1
SECTION 6A: EROSION AND SEDIMENT TRANSPORT 6-1
SECTION 6B: GEOMORPHOLOGY 6-2
6B.1 Previous Studies 6-2
6B.2 Data Sources 6-5
6B.3 Method Description 6-8
6B.4 Stage 1: Recognizing and Characterizing Piedmont Landforms 6-11
6B.5 Stage 2: Defining Active and Inactive Areas 6-28
6B.6 Stage 3: Defining the Approximate 100-Year Floodplain 6-57
6B.7 Work Study Maps 6-62
6B.8 References 6-63
SECTION 7: DRAFT FIS 7-1
7.1 Summary of Discharges 7-1
7.2 Floodway Data 7-1
7.3 Annotated Flood Insurance Rate Maps 7-1
7.4 Flood Profiles 7-1

Registered Professional Engineer (Civil)
CERTIFICATE NO. 26846
JONATHAN E. FULLER
Date Signed 11-7-06
ARIZONA, U.S.A.

LIST OF FIGURES

Figure 1.1: Location of Study Area 1-3
Figure 1.2: Location of Fan Study Area 1-4
Figure 4.1: Watershed Location on NOAA Atlas II Maps 4-4
Figure 4.2: Slope and Assignment of Existing (Natural) Land Use Types 4-6
Figure 4.3: Comparison of 100-year HEC-1 Results with USGS Regression Equations 4-9
Figure 4.4: Comparison of 100-year HEC-1 Results with USGS Regression Equations 4-10
Figure 6.1: NRCS soils mapping with landform interpretations 6-13
Figure 6.2: AZGS geologic mapping (1:100,000 scale) 6-17
Figure 6.3: Example of AZGS flood hazard mapping 6-21
Figure 6.4: 2005 aerial photography 6-22
Figure 6.5: 10-foot contour interval topography 6-23
Figure 6.6: Locations of flow bifurcations 6-24
Figure 6.7: Stream channel networks 6-25
Figure 6.8: Alluvial fan apex locations 6-28
Figure 6.9: Stage I delineations 6-29
Figure 6.10: Close-up of the SE study area 6-30
Figure 6.11: Close-up of the NE study area 6-31
Figure 6.12: Typical Pleistocene-Aged (Inactive Surface) Soil Profile 6-34
Figure 6.13: Typical Late Holocene-Aged (Active Surface) Soil profile 6-34
Figure 6.14: Varnished Desert Pavement Surface 6-34
Figure 6.15: Aerial Photograph showing Tributary Drainage Network 6-34
Figure 6.16: Topographic Contour Crenulations 6-35
Figure 6.17: Photograph of Older Varnished Pavement Surface 6-35
Figure 6.18: Photograph of Active Surface Topographically Confined 6-35
Figure 6.19: Fan active areas 6-38
Figure 6.20: NRCS soils mapping 6-39
Figure 6.21: AZGS surficial geology 6-40
Figure 6.22: AZGS flood hazard mapping 6-43
Figure 6.23: NRCS, AZGS, and unstable area mapping overlay 6-44
Figure 6.24: 10-foot contour interval mapping 6-45
Figure 6.25: Longitudinal Profiles 6-46
Figure 6.26: Historical aerial photo comparison 6-48
Figure 6.27: Historical thalweg locations 6-49
Figure 6.28: Active/Inactive vegetation characteristics 6-52
Figure 6.29: Stage III delineations 6-59

LIST OF TABLES

Table 4.1: Land Use Types and Hydrologic Parameters 4-7
Table 4.2: 100-Year Peak Discharge and Total Runoff Volume 4-8
Table 4.3: Comparison of 100-Year Peak Discharges 4-11
Table 5.1: HEC-RAS Summary 5-10
Table 6B.1: Collected AZGS geology maps 6-6
Table 6B.2: Collected historical aerial photography 6-7
Table 6B.3: Collected digital topography 6-7
Table 6B.4: NRCS Soil Unit Descriptions 6-14
Table 6B.5: List of Historical Aerial Photographs 6-47
Table 6B.6: Sediment Yield Estimates Based on Ayres (2005) 6-53
Table 6B.7: Flood Hazard Zones 6-59

LIST OF APPENDICES

Appendix A: References
Appendix B: General Documentation and Correspondence
Appendix C: Survey Field Notes
Appendix D: Hydrologic Analysis Supporting Documentation
Appendix E: Hydraulic Analysis Supporting Documentation
Appendix F: Erosion/Sediment Transport
Appendix G: Geomorphology Analyses Supporting Documentation – SEPARATE VOLUME

DISKETTES

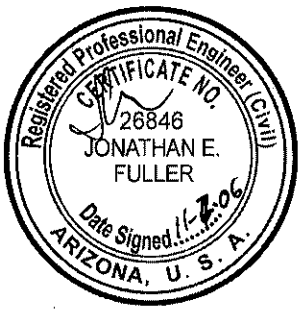
Digital data files on CD with a copy of the "readme" file

EXHIBITS

A. Hydrology Plates
- **Hydrologic Subbasins**
- **NRCS Soils and XKSAT**
- **Existing Land Use**

B. Geomorphology Exhibit Maps
- **Stage 1 - Landform Map**
- **Stage 2 - Stability Map**
- **Stage 3 – Floodplain Map**

C. Hydraulics Study Work Maps



SECTION 1: INTRODUCTION

1.1 Study Purpose

The purpose of this floodplain delineation study is to delineate an approximate method 100-year floodplain for alluvial fan Sites 4 and 5 on the White Tank Piedmont as identified in the Buckeye Sun Valley Area Drainage Master Study (PBSJ, 2005). The names, Fan 4 and 5 will be used frequently in this report to refer to the alluvial fans which are the subject of this report to distinguish them from other alluvial fans on the western piedmont of the White Tank Mountains. This study incorporates the assessment methods for piedmont flood hazards as outlined in Piedmont Flood Hazard Assessment Manual for Maricopa County (PFHAM) (Hjalmarson, 2003) and for alluvial fans in the Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix G: Guidance for Alluvial Fan Flooding Analyses and Mapping (FEMA Guidelines) (FEMA, 2002), as well as approximate method riverine floodplain delineations for reaches upstream of the alluvial fan apex.

1.2 Study Authority

The current study was authorized by the Flood Control District of Maricopa County (District) for the Sun Valley Area Drainage Master Plan (ADMP) under contract FCD 2004 C049, Task 11. The study was performed by JE Fuller/Hydrology & Geomorphology, Inc. on behalf of the District.

1.3 Study Location

Figure 1.1 shows the location of the White Tank Mountain Piedmont study area. Figure 1.2 shows the alluvial fans and their corresponding watersheds. The study area is located in western Maricopa County, Arizona, within the Town of Buckeye and portions of unincorporated Maricopa County. The piedmont watershed heads in the White Tank Mountains and generally drains toward the Hassayampa River, or one of its tributaries. Some piedmont runoff outfalls at the Buckeye Flood Retarding Structures (FRS) before being released into the Hassayampa River.

The study area has a semi-arid desert climate with an average annual precipitation of generally less than 10 inches. Precipitation is typically divided between two seasons with comparable rainfall amounts: summer and winter. Summer storms are associated with warm, moist tropical air masses that enter the state from the Gulf of Mexico and Gulf of California, producing moderate to intense localized thundershowers. Winter precipitation usually originates from the Pacific Ocean and produces light to moderate precipitation over relatively large areas. A third source of precipitation is from dissipating

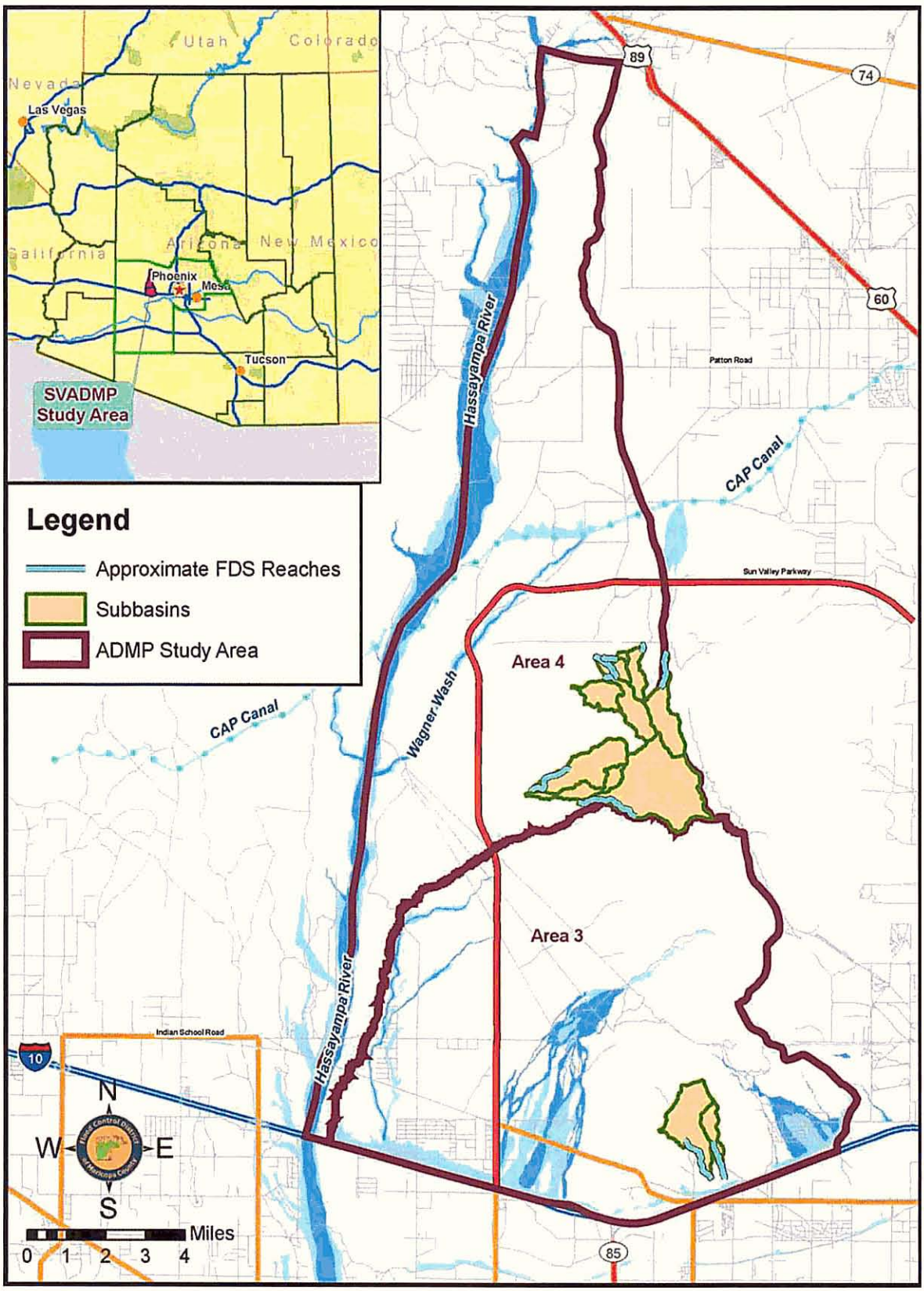


Figure 1.1 Location of Study Area

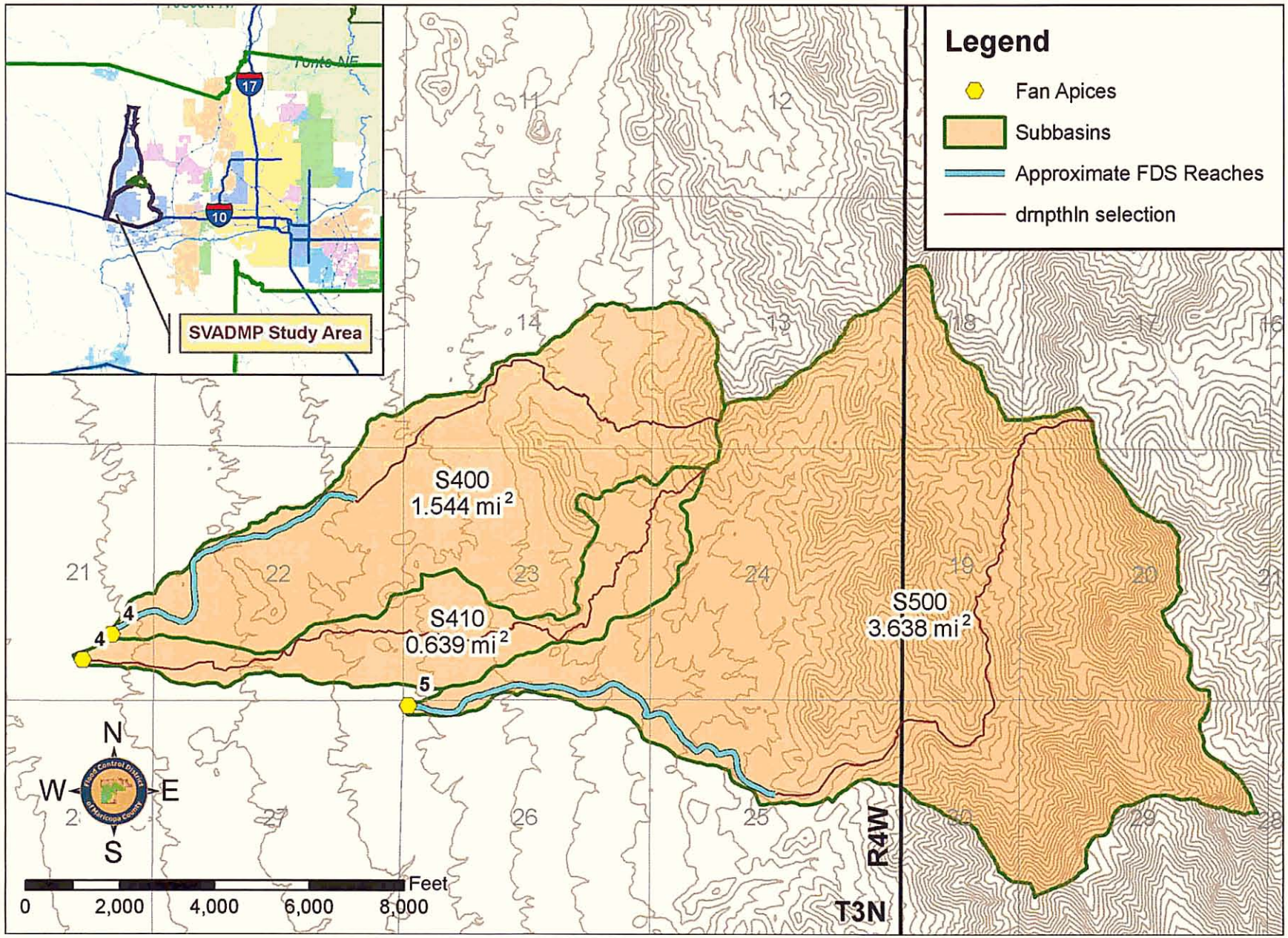


Figure 1.2 Location of Fan 4& 5 Study Area

tropical storm and/or hurricane remnants, which typically occur in fall, and which generate moderate to high rainfall intensities of moderate to long duration.

1.4 Methodology

This study used methods outlined in the Drainage Design Manuals for Maricopa County. In addition, the study uses piedmont flood hazard assessment methods outlined in the District's PFHAM and in the FEMA Guidelines. These two documents were published in response to the National Research Council's Alluvial Fan Flooding report (NRC, 1996). The FEMA Guidelines are targeted at determination of flood hazards on alluvial fan landforms. The PFHAM, which is recommended for use in Maricopa County, Arizona, is intended to be applicable to the entire piedmont, not just alluvial fans. The PFHAM methodology incorporates geomorphic methods into the flood hazard assessment of piedmont surfaces. According to the FEMA Guidelines, the geomorphic approach is considered an "approximate method" (FEMA Guidelines p. G-12, Table G-1) because no base flood elevations are calculated in the geomorphic approach.

1.4.1 Hydrology

The U.S. Army Corps of Engineers HEC-1 model (version 4.1) was used to compute runoff hydrographs and peak discharges. Parameters were processed into HEC-1 through the DDMSW version 3.2.8 software from the FCDMC. Documentation of the hydrologic modeling for this study is provided in Section 4.0 of this Technical Documentation Notebook (TDN).

1.4.2 Hydraulics

The U.S Army Corps of Engineers HEC-RAS model (version 3.1.3) was used to compute the water surface profiles used for the riverine approximate floodplain delineations upstream of the Site 6 alluvial fan hydrographic apex. A description of the approximate method riverine floodplain delineation is provided in Section 5.0 of this TDN.

1.4.3 Geomorphology

Geomorphic methods that incorporate landform characteristics, surficial geologic mapping, soils mapping, field observations and aerial photograph interpretation as described in the PFHAM and FEMA Guidelines were used to delineate floodplains on alluvial fan surfaces. A description of the geomorphic method floodplain delineation is provided in Section 6B of this TDN.

1.5 Acknowledgements

This study was funded entirely by the Flood Control District of Maricopa County. Assistance and review from their staff was critical to the success of this project. In addition, staff at the Town of Buckeye supplied valuable information used in the completion of this project.

1.6 Study results

The study resulted in the delineation of 3.1 miles of approximate riverine 100-year floodplain and 2.37 square miles of alluvial fan floodplain. The inundation areas for the newly delineated floodplains are shown on the maps in Section 5, 6B, and B. and C. Maps at the end of this notebook. The floodplain mapping also includes administrative flood hazard zones defined by the Flood Control District of Maricopa County for the local management of flood hazards on the alluvial fan.

SECTION 2: ADWR/FEMA FORMS

2.1 Study Documentation Abstract for FEMA Submittals

Study Documentation Abstract For FEMA Submittals		Initial Study	Restudy	CLOMR	LOMR	X Other
2.1.1	Date Study Accepted					
2.1.2	Study Prime Contractor	JE Fuller / Hydrology and Geomorphology, Inc.				
	Contact(s)	Brian R. Iserman, P.E. & Jonathan E. Fuller, P.E., R.G., CFM				
	Address	8400 S. Kyrene Rd., Suite 201 Tempe, AZ 85284				
	Phone	(480) 752-2124				
	Internal Reference Number	FCDMC Sun Valley ADMP				
2.1.2	Study Sub-Contractor	None				
	Contact(s)					
	Address					
	Phone					
	Internal Reference Number					
2.1.2	Sub Study Sub-Contractor					
	Contact(s)					
	Address					
	Phone					
	Internal Reference Number					
2.1.3	FEMA Technical Review Contractor	Michael Baker, Jr.				
	Contact(s)	Mounir Boudjemaa				
	Address	3600 Eisenhower Ave. Suite 600 Alexandria, VA 22304				
	Phone	703-960-8800				
	Internal Reference Number					
2.1.4	FEMA Regional Reviewer	Michael Baker, Jr. Engineering				
	Phone	(703) 960-8800				
2.1.5	State Technical Reviewer	None				
	Phone					
2.1.6	Local Technical Reviewer	Flood Control District of Maricopa County (FCDMC) Kathryn Gross, CFM				
	Phone	(602) 506-1501				
2.1.7	Reach Description	White Tank Mountains Fans 4, 5				
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	Daggs Tank, Arizona, 1984 White Tank MTS. NE, Arizona, 1954, Photo revision 1971 Wagner Wash Well, Arizona, 1984 White Tank MTS. SE, Arizona, 1954, Photo revision 1971 Valencia, Arizona, 1954, Photo revision 1978 Buckeye NW, Arizona, 1979				
2.1.9	Unique Conditions and Problems	Alluvial Fan Flooding				
2.1.10	Coordination of Peak Discharges (Agency, Date, Comments)	FCDMC – Sun Valley ADMS (2005); Sun Valley ADMS (2006) Existing Conditions HEC-1 Model Results				

2.2 FEMA Forms

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

☐ CLOMR: A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See Parts 60 & 65 of the NFIP Regulations.)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1530 J	9/30/2005
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1535 H	9/30/2005
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1540 H	9/30/2005
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1545 H	9/30/2005
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1575	Non-Printed Map

2. Flooding Source: White Tank Mountains Fans 4, 5

3. Project Name/Identifier: Approximate Zone A Floodplain Delineation Study of White Tank Fans 4 & 5

4. FEMA zone designations affected: A (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

☐ Physical Change ☒ Improved Methodology/Data

☐ Regulatory Floodway Revision ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following types of flooding and structures (check all that apply)

Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)
☒ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

Structures: ☐ Channelization ☐ Levee/Floodwall ☐ Bridge/Culvert
☐ Dam ☐ Fill ☐ Other, Attach Description

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☐ Yes Fee amount: $____
☒ No, Explanation: New Delineation by Agency

Map changes based on flood hazard information meant to improve upon that shown on the flood map or within the flood study.
Please see the FEMA Web site at http://www.fema.gov/mit/tsd/frm_fees.htm for Fee Amounts and Exemptions.

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Kathryn Gross, CFM, Project Manager	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506 1501	Fax No.: 602-506-4601
	E-Mail Address: kag@mail.maricopa.gov	
Signature of Requester (required):		Date: 11/16/06

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, *including the requirement that no fill be placed in the regulatory floodway, and that all necessary* Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Timothy S. Phillips, P.E., Chief Engineer & General Manager		Telephone No.: 602-506-1501
Community Name: Maricopa County, AZ	Community Official's Signature (required):	Date: 11/30/06

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Jonathan Fuller, PE	License No.: 26846	Expiration Date: March 31, 2008
Company Name: JE Fuller/Hydrology & Geomorphology, Inc.	Telephone No.: 480-752-2124	Fax No.: 480-839-2193
Signature:		Date: 11.7.06

ENSURE THE FORMS THAT ARE APPROPRIATE TO YOUR REVISION REQUEST ARE INCLUDED IN YOUR SUBMITTAL.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☒ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Registered Professional Engineer (Civil)
CERTIFICATE NO.
26846
JONATHAN E.
FULLER
Date Signed 11-7-06
ARIZONA, U.S.A.

D. SIGNATURE (continued)

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Kathryn Gross, CFM, Project Manager	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506 1501	Fax No.: 602-506-4601
	E-Mail Address: kag@mail.maricopa.gov	
Signature of Requester (required):		Date: 11/16/06

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Scott Lowe, PE – Public Works Director		Telephone No.: 623-349-6815
Community Name: Town of Buckeye, AZ	Community Official's Signature (required):	Date: 1 DEC 2006

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Jonathan Fuller, PE	License No.: 26846	Expiration Date: March 31, 2008
Company Name: JE Fuller/Hydrology & Geomorphology, Inc.	Telephone No.: 480-752-2124	Fax No.: 480-839-2193
Signature:		Date: 11-7-6

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. *The burden estimate includes the time for reviewing instructions, searching* existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: White Tank Mountains Fan 4
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☒ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1 [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered. Explanation: Sediment transport is not an element in the local approved hydrologic modeling procedures, nor is it a variable in the local USGS discharge regression equations. Sediment transport is considered explicitly in the alluvial fan floodplain delineation.

B. HYDRAULICS

1. Reach to be Revised: No existing delineations are revised. New approximate riverine delineations are submitted upstream of fan apexes.

	Description	Cross Section	Water-Surface Elevations (ft.)	
			Effective	Proposed/Revised
Downstream Limit	See attached annotated FIRMs			
Upstream Limit	*See attached annotated FIRMs*			

2. Hydraulic Method Used

Hydraulic Analysis HEC-RAS [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/mit/tsd/frm_soft.htm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☒ Yes ☐ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name: zone_a45	Floodway File Name: zone_a45
Revised or Post-Project Conditions Model	Natural File Name:	Floodway File Name:
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at:

http://www.fema.gov/mit/tsd/cn_modl.htm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☐ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:

- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: White Tank Mountains Fan 5
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

3. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☒ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ *Proposed Conditions (CLOMR)* ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1 [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered. Explanation: Sediment transport is not an element in the local approved hydrologic modeling procedures, nor is it a variable in the local USGS discharge regression equations. Sediment transport is considered explicitly in the alluvial fan floodplain delineation.

B. HYDRAULICS

1. Reach to be Revised: No existing delineations are revised. New approximate riverine delineations are submitted upstream of fan apexes.

	Description	Cross Section	Water-Surface Elevations (ft.)	
			Effective	Proposed/Revised
Downstream Limit	See attached annotated FIRMs			
Upstream Limit	See attached annotated FIRMs			

2. Hydraulic Method Used

Hydraulic Analysis HEC-RAS [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/mit/tsd/frm_soft.htm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☒ Yes ☐ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name: zone_a45	Floodway File Name: zone_a45
Revised or Post-Project Conditions Model	Natural File Name:	Floodway File Name:
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at:

http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☐ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:

- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

4. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

FEDERAL EMERGENCY MANAGEMENT AGENCY

O.M.B. No. 3067-0148
Expires September 30, 2005

ALLUVIAL FAN FLOODING FORM

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Fan Site 4

Note: Fill out one form for each flooding source studied

A. THREE-STAGE ANALYSIS (Based on FEMA Guidelines dated February 23, 2000)

1. Stage 1 Analysis
   a. The landform is composed of (check one) ☒ alluvial ☐ debris flow deposits.
   b. Source of data used to determine composition, morphology, and location of the landform:
      NRCS Soils Maps, AZ Geological Survey Geologic Maps, USGS Topographic Maps, Aerial Photos, Field Observation
   c. Is there an NRCS soils survey and soil survey map available? ☒ Yes ☐ No
      If Yes, please include a copy of the map and any pertinent sections of the soil survey
2. Stage 2 Analysis
   a. The alluvial fan exhibits ☐ active ☐ inactive ☒ a combination of active and inactive alluvial fan flooding.
   b. Approximate age of inactive fan surfaces (thousands of years): > 10,000 yrs.
   c. Is there an opportunity for avulsions that could lead channels or sheetfloods across the older fan surfaces?
      ☐ Yes ☒ No
   d. Is there evidence of headcutting that could lead to stream piracy? ☒ Yes ☐ No (Only in active, unstable areas)
   e. Is there geomorphic evidence of past avulsions during the Holocene epoch? ☒ Yes ☐ No (Only in active, unstable areas)
   f. The fan exhibits the following types of flooding (check one):
      ☒ Flooding along stable channels
      ☐ Sheetflow
      ☐ Debris flow
      ☒ Unstable flow path flooding
3. Stage 3 Analysis
   The boundaries of the 1%-annual-chance floodplain have been determined using (check one):
   ☐ Risk-Based Analysis
      ☐ FEMA FAN program (if discharge at the apex is different than that given in the effective FIS, then attach MT-2, Form 2 along with a plot of the flood frequency curve on log-normal probability paper and include the drainage area above the hydrographic apex, and the mean, standard deviation, and skew coefficient of the curve)
   ☐ Sheetflow Methods
   ☐ Hydraulic Analytical Methods
   ☒ Geomorphic Data, Post-Flood Hazard Verification, and Historical Information
   ☐ Composite Methods

B. STRUCTURAL FLOOD CONTROL MEASURES

1. The following structural flood control measures are proposed or built (check one): **No Structural Measures are Proposed**

   ☐ Channelization ☐ *Levee/Floodwall* ☐ *Dam* ☐ *Sedimentation Basin*

2. Do the constructed or proposed structural measures affect flood hazards (including velocity, scour, and sediment deposition) on other areas of the fan? ☐ Yes ☐ No

3. Attach completed Form 3 (Riverine Structures Form).

4. Sediment Transport Considerations:
   Was sediment transport considered? ☐ Yes ☐ No If Yes, then fill out Form 3, Section F (Sediment Transport).
   If No, then attach your explanation for why sediment transport was not considered.

5. Please attach a copy of the formal Operations and Maintenance Plan.

C. MAPPING REQUIREMENTS

Attach a certified topographic work map showing the following:

- The boundaries of the alluvial fan including: toe, topographic and hydrographic apexes, and lateral boundaries
- The delineation of the active and inactive portions of the fan as determined by the Stage 2 analysis
- The revised 1%-annual-chance floodplain boundaries, as determined by the Stage 3 Analysis, that tie into the effective floodplain boundaries
- The correct alignment of all structural features
- The map scale

FEDERAL EMERGENCY MANAGEMENT AGENCY

O.M.B. No. 3067-0148
Expires September 30, 2005

ALLUVIAL FAN FLOODING FORM

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Fan Site 5

Note: Fill out one form for each flooding source studied

A. THREE-STAGE ANALYSIS (Based on FEMA Guidelines dated February 23, 2000)

1. Stage 1 Analysis

a. The landform is composed of (check one) ☒ alluvial ☐ debris flow deposits.

c. Source of data used to determine composition, morphology, and location of the landform:

NRCS Soils Maps, AZ Geological Survey Geologic Maps, USGS Topographic Maps, Aerial Photos, Field Observation

c. Is there an NRCS soils survey and soil survey map available? ☒ Yes ☐ No

If Yes, please include a copy of the map and any pertinent sections of the soil survey

3. Stage 2 Analysis

b. *The alluvial fan exhibits* ☐ active ☐ inactive ☒ a combination of active and inactive alluvial fan flooding.

f. Approximate age of inactive fan surfaces (thousands of years): > 10,000 yrs.

g. Is there an opportunity for avulsions that could lead channels or sheetfloods across the older fan surfaces?
☐ Yes ☒ No

h. Is there evidence of headcutting that could lead to stream piracy? ☒ Yes ☐ No (Only in active, unstable areas)

i. *Is there geomorphic evidence of past avulsions during the Holocene epoch?* ☒ Yes ☐ No (Only in active, unstable areas)

f. The fan exhibits the following types of flooding (check one):

☒ Flooding along stable channels
☐ Sheetflow
☐ Debris flow
☒ Unstable flow path flooding

3. Stage 3 Analysis

The boundaries of the 1%-annual-chance floodplain have been determined using (check one):

☐ Risk-Based Analysis

☐ FEMA FAN program (if discharge at the apex is different than that given in the effective FIS, then attach MT-2, Form 2 along with a plot of the flood frequency curve on log-normal probability paper and include the drainage area above the hydrographic apex, and the mean, standard deviation, and skew coefficient of the curve)

☐ Sheetflow Methods
☐ Hydraulic Analytical Methods
☒ Geomorphic Data, Post-Flood Hazard Verification, and Historical Information
☐ Composite Methods

B. STRUCTURAL FLOOD CONTROL MEASURES

2. The following structural flood control measures are proposed or built (check one): **No Structural Measures are Proposed**

☐ Channelization ☐ Levee/Floodwall ☐ Dam ☐ Sedimentation Basin

2. Do the constructed or proposed structural measures affect flood hazards (including velocity, scour, and sediment deposition) on other areas of the fan? ☐ Yes ☐ No

3. Attach completed Form 3 (Riverine Structures Form).

4. Sediment Transport Considerations:
   Was sediment transport considered? ☐ Yes ☐ No If Yes, then fill out Form 3, Section F (Sediment Transport).
   If No, then attach your explanation for why sediment transport was not considered.

5. Please attach a copy of the formal Operations and Maintenance Plan.

C. MAPPING REQUIREMENTS

Attach a certified topographic work map showing the following:

- The boundaries of the alluvial fan including: toe, topographic and hydrographic apexes, and lateral boundaries
- The delineation of the active and inactive portions of the fan as determined by the Stage 2 analysis
- The revised 1%-annual-chance floodplain boundaries, as determined by the Stage 3 Analysis, that tie into the effective floodplain boundaries
- The correct alignment of all structural features
- The map scale

SECTION 3: MAPPING AND SURVEY INFORMATION

3.1 Field Survey Information

Ground control survey work associated with the topographic mapping was performed by RBF Consulting of Phoenix, Arizona under contract with the FCDMC. The survey data for this project is presented in the North American Datum of 1983 (NAD 83), 1992 Central Zone of Arizona State Plane Coordinate System. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

3.2 Mapping

The topographic mapping was provided by Landata Airborne Systems of Irvine California, under contract with the FCDMC in 2000/2001. The flight dates for the mapping were 12-16-00, 12-17-00, and 12-27-00. The topographic mapping was prepared by photogrammetric methods to national map accuracy standards for 1-inch equals 500 feet with a 10-foot contour interval.

SECTION 4: HYDROLOGY

4.1 Method Description

The methods employed in this study were those outlined in the current Drainage Design Manual for Maricopa County, Volume 1, Hydrology (1995) and 2003 draft revised Hydrology Manual. The DDMSW version 3.2.8 was used to assist in the development of the HEC-1 models. The U.S. Army Corps of Engineers HEC-1 model (version 4.1) was used to compute runoff hydrographs and peak discharges.

Rainfall losses were calculated by use of the Green and Ampt infiltration equation with an allowance for surface retention loss within HEC-1. The Phoenix Mountain S-Graph was used to generate unit hydrographs. Channel routing was performed using the normal depth Modified Puls method.

Peak discharges were estimated at various concentration points. Rainfall-runoff models were generated for the 100-year return period for the 6- and 24-hour durations. The larger estimate is recommended for use in the floodplain delineation.

4.2 Parameter Estimation

4.2.1 Drainage Area Boundaries

The study area watershed and hydrologic subbasins are shown on Plate 1. The total watershed area modeled is approximately 5.8 square miles. Three individual subbasins were modeled varying in size from .64 to 3.64 square miles in size. Subbasin boundaries were delineated in ArcGIS 9.1 based on examination of the 2005 0.8 ft pixel color orthorectified aerial photographs and the 10-foot topography (dated 2001). Watershed areas were computed using XTools within ArcGIS.

4.2.2 Watershed work maps

Refer to Plate 1 for the watershed work map used for the HEC-1 modeling. Plate 2 shows the NRCS soils data and the distribution of saturated conductivity values for the area. Plate 3 shows the existing conditions land use distributions for the watersheds.

4.2.3 Gage data

No streamflow gage data were available for the washes in the study area. Therefore, the results of the rainfall-runoff modeling are compared with the USGS regional regression equations and previous studies in Section 4.5.

Historical Flooding Information

Field (1994) describes significant channel changes resulting from a large tropical storm in 1951 as reported in Kangieser (1969). The National Weather Service (NWS) Buckeye station (#021026) recorded 1.00", 2.60", 0.75", and 0.80" of rainfall on August 27, 28, 29, and 30, 1951, respectively for a total of 5.15". This may be the rainfall event(s) responsible for the large channel changes reported by Field (1994) on Site 36. Other significant channel changes are noted throughout the area on the 1953 aerial photographs of the ADMP study area, particularly in the White Tank Wash watershed. The largest daily total during the period of record for the NWS station is 4.90" recorded on September 2, 1894. The 2nd largest rainfall recorded since March 1893 occurred on September 8, 1916 when 3.29" of rainfall was recorded.

The SCS (1963) indicates that the August 1951 storm inundated 12,240 acres and was similar in magnitude to events in January 1916 and September 1939. In January 1916, 2.26" of rain was recorded over five consecutive days. During September 1939, 4.5" of precipitation was recorded between the 4th and 13th of the month. The highest single daily total during the period occurred on the 4th when 2.27" of rain were recorded at the NWS Buckeye station. It is unknown if the daily values recorded in August 1951 represent a single storm. If they do, it would be one of the highest storm totals in this long record.

CH2M Hill (1992) performed a paleoflood survey that indicated that a flood between 2,000 cfs and 5,000 cfs occurred at some time in the past 100 years. They also report a more recent event of 500 to 1,000 cfs. They suggest that the large flood attributed to a tropical storm in 1951, as reported in Field (1994), may be responsible for emplacing the slackwater deposits used in the 2,000 to 5,000 cfs estimate. The narrow chute of the channel above the apex may be preventing preservation of older paleoflood evidence. The more recent flood reported by CH2M Hill may have been the August 15, 1990 storm recorded by the FCD ALERT gage #5200 which is the largest and most intense rainfall recorded in the 16 years of operation of this station (3.15" in 24 hours and 2.20" in 3 hours).

4.2.4 Statistical parameters

The only statistical data used directly in the study were the precipitation statistics obtained from the NOAA Atlas 2, Arizona. The statistics from the NOAA Atlas were analyzed to develop the rainfall depth-duration-frequency table for the watershed. The analysis was performed using the PREFRE program within DDMSW. The program output is provided in Appendix D.

4.2.5 Precipitation

The rainfall depths used for the HEC-1 model were obtained from the NOAA Atlas 2 maps for Arizona. The NOAA Atlas 2 maps are reproduced in the Hydrology Manual and copies of these are included in Appendix D. Figure 4.1 shows the location of the Sun Valley ADMP study area on the NOAA maps for the data required for input into the PREFRE program. The multiple storm option (JD records) was used to determine the critical storm at each concentration point in the HEC-1 model. The depth-area reduction factors were applied as computed by the DDMSW computer program for use with HEC-1. Note, the point values used for the modeling were taken as the value over the mountainous area. This represents a conservative assessment of the rainfall potential over the primary runoff generating areas for all of the study area watershed contributing to alluvial fan apices.

The storm duration modeled was the 6-hour storm as described in the Drainage Design Manual for Maricopa County. The temporal distributions for the 6-hour storms with the JD records were implemented via the DDMSW program.

The 24-hour storm used was the SCS Type II distribution as coded by the DDMSW as PC records for HEC-1.

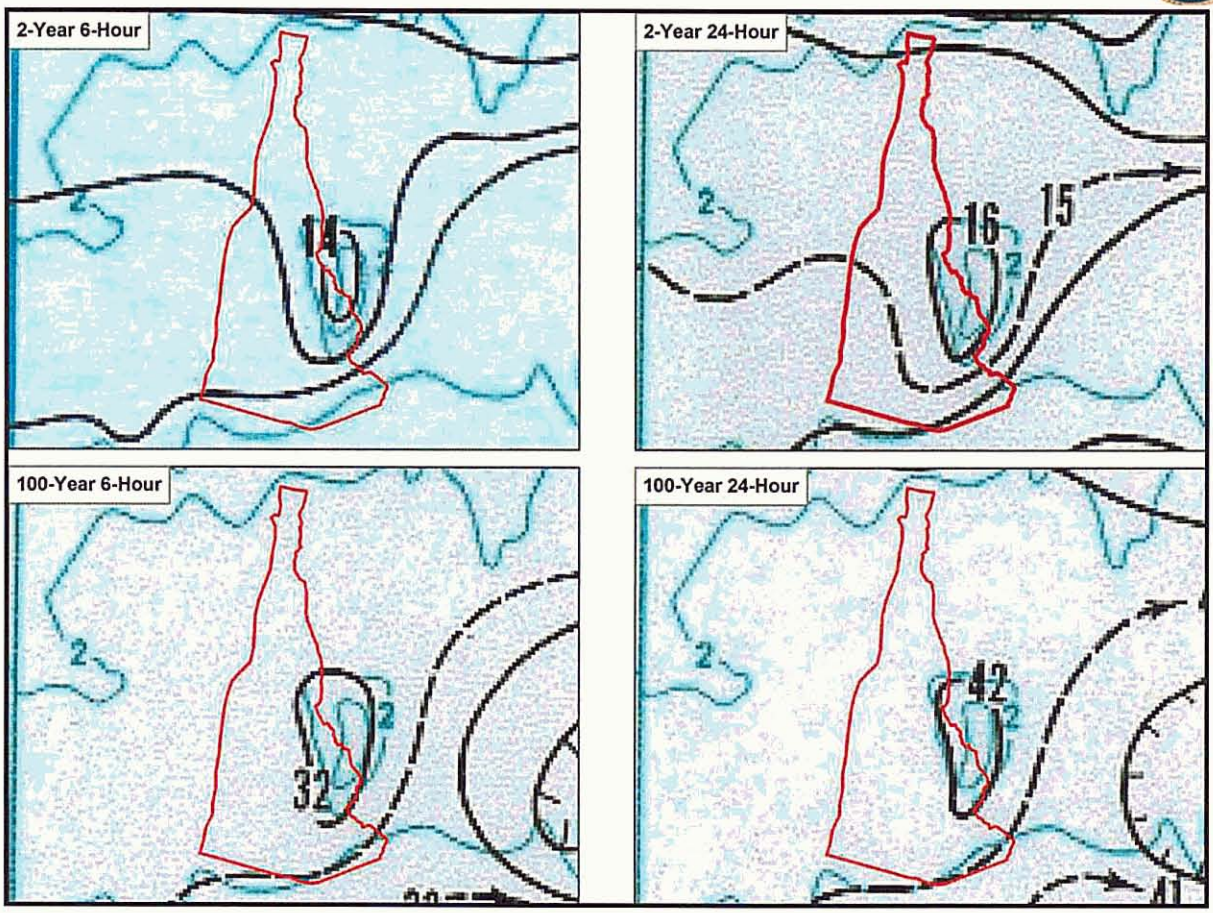


Figure 4.1. Watershed Location on NOAA Atlas II Maps

4.2.6 Physical parameters

Rainfall Losses

Rainfall losses were computed using the Green and Ampt method as outlined in the Drainage Design Manual for Maricopa County, Volume I, Hydrology. The County's preprocessing program for HEC-1, DDMSW, version 3.2.8 was used to perform the lumped parameter calculations and to develop the draft HEC-1 models. The development of the soils, land use, and subbasin data for use in the DDMSW is described briefly below.

Soils

The NRCS (formerly SCS) *Soil Survey of Aguila-Carefree Area* (Camp, 1986) and *Soil Survey of Maricopa County, Central Part* (Hartman, 1977) present the descriptions of the soils in the study watershed. Appendix A and B of the Drainage Design Manual provide loss rate parameters for the map units for this soil survey. The loss rates from the Appendices of the Manual are integrated into the DDMSW. Natural rock outcrop percentages from the Manual were assumed to be 50 percent effective for the purposes of computing RTIMP.

The spatial distribution of the soil map units for the watershed area is shown on Plate 2. Plate 2 also shows the saturated conductivity values (XKSAT) for the soil units in the watershed. Note these values are based on the data in the Appendices of the Drainage Design Manual.

Areas of each soil unit in each subbasin were computed using ArcMap – ArcView 9.1 software. These data were imported into the DDMSW. Average subbasin XKSAT values were then computed using logarithmic averaging as implemented in the DDMSW version 3.2.8.

The subbasin soil data, soil map unit descriptions, and subbasin average results are provided in Appendix D.

Land Use

Existing land use conditions were evaluated based on examination of the aerial photographs and a slope map generated from the 10-foot contour data. Since the entire modeling area was essentially undeveloped at the time of this study, land use categories were assigned based on a range of slope observed. Guidance from the Drainage Design Manual was used to differentiate three land use categories based on slope: 1) Natural Desert Rangeland (slopes 0-5%), 2) Natural Hillslopes, Sonoran Desert (slopes 5-10%), and 3) Natural Mountain Terrain (slopes > 10%). Figure 4.2 shows the shaded slope map overlain with the generalized land use categories delineated for the existing conditions in this study. Existing land uses are also presented on Plate 3. Only the Natural Desert Rangeland and Natural Mountain Terrain categories were selected for the Fan 4 and 5 watersheds as shown on Figure 4.2.

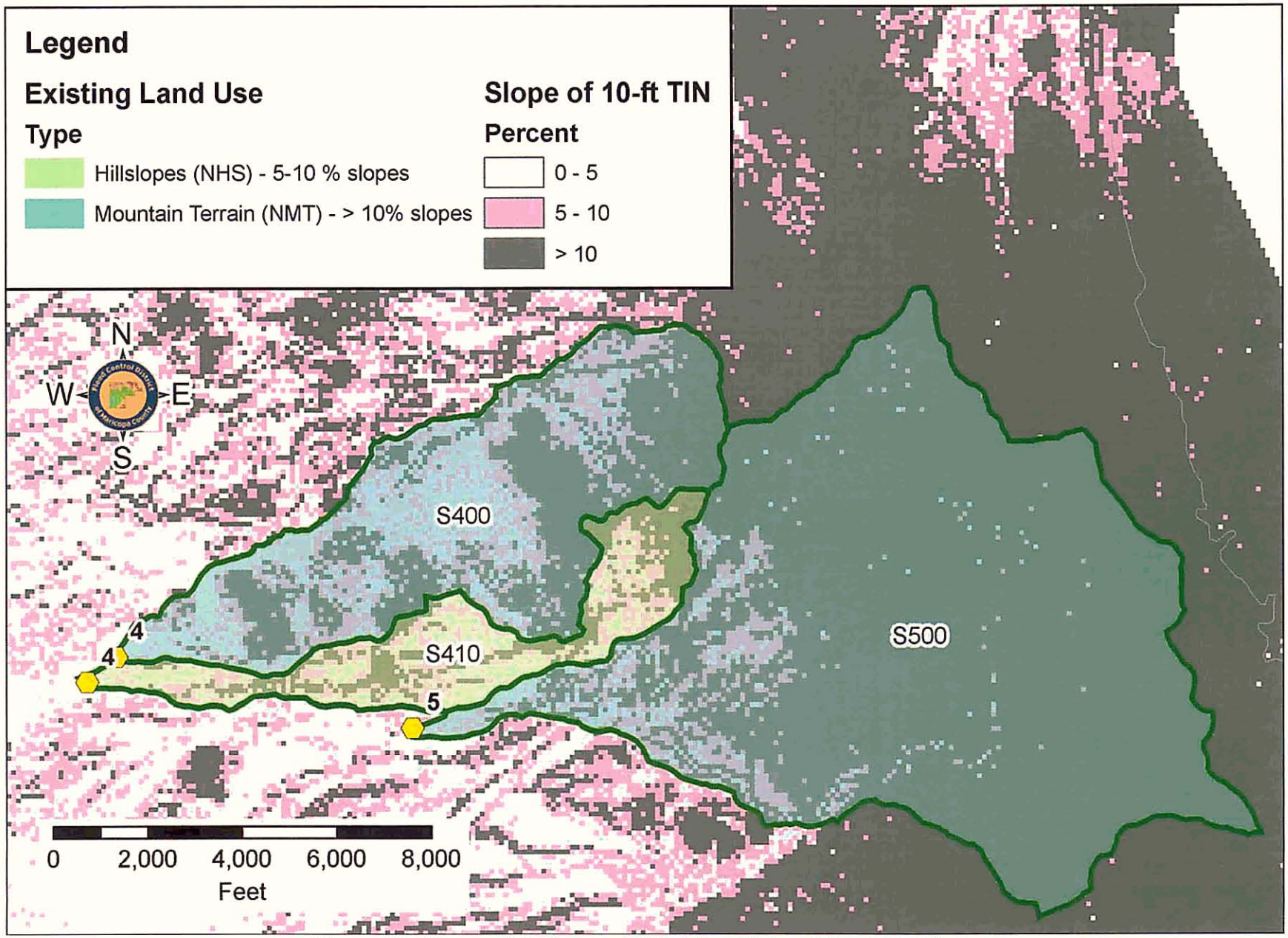


Figure 4.2. Slope and Assignment of Existing (Natural) Land Use Types

Table 4.1 summarizes the hydrologic parameters related to the land use categories used in the analyses for estimation of rainfall excess using the Green and Ampt method and Maricopa County procedures. These parameters include surface retention loss (IA), effective impervious area (RTIMP), basin roughness (Kn), vegetation cover (%), and antecedent moisture conditions (DTHETA Condition).

The subbasin existing land use data are provided in Appendix D.

Table 4.1. Land Use Types and Hydrologic Parameters

Land Use Code	Description	DTHETA Condition	Vegetation Cover (%)	RTIMP (%)*	IA (in)	Kn
920	Natural hillslopes, Sonoran desert, slopes 5 – 10 %	Dry	30	0	0.15	0.04
930	Natural Mountain Terrain, slopes > 10 %	Dry	30	0	0.25	0.05
* Note: RTIMP for natural land use types taken from soils data and assumed 50% effective						

Unit Hydrograph

The S-Graph unit hydrograph method as outlined in the Drainage Design Manual was used in the HEC-1 modeling of the watershed. Watershed drainage areas, lag time flow path lengths, Lca lengths, and slopes were delineated manually based on examination of the 2005 aerial photographs, and 2001 10-foot contour data for the area. Areas, lengths, and subbasin centroids were computed using ArcMap – ArcView 9.1 GIS software.

Dimensionless S-graphs were assigned based on whether the basin was predominantly mountainous terrain or not from examination of the existing land use data. Both watersheds for Fan 4 and 5 were considered mountainous and therefore were assigned the Phoenix Mountain S-graph described in the Drainage Design Manual.

Surface roughness values were assigned as shown in Table 4.1 described above. These values come from guidance provided in Table 5.6 and Appendix D.2 of the 2003 Drainage Design Manual, Volume I, Hydrology. Lag times were calculated based on the geometric and land use parameters for each subbasin. Tables summarizing the lag time calculations and S-graph assignment are provided in Appendix D.

Routing Parameters

No hydrologic routings were performed as part of the hydrology for this study.

4.3 Problems Encountered During the Study

4.3.1 Special problems and solutions

A 5 minute time step was originally specified for the model; however, this resulted in a reported unit hydrograph volume of 0.99 from the HEC-1 output for subbasin S500 that is not acceptable for the unit hydrograph procedure. The problem occurs because the MCUHP2 program output results in a discretized unit hydrograph limited to 50 ordinates. Subbasin S500 has a lag time that would require more than 50 ordinates to fully represent the unit hydrograph. Therefore, a 10 minute time step was selected which enables the unit hydrograph to be fully captured within the MCUHP2 program 50 ordinate limitation.

4.3.2 Modeling warning and error messages

No warnings or error messages occur in the HEC-1 models.

4.4 Calibration

No calibration of the models was performed as part of this study. However, the results were compared to previous studies and regional regression equations and found to be reasonable. In addition, the methods used in this study have been designed for application to the area and have been found to produce reasonable results in hundreds of studies throughout Maricopa County.

4.5 Final Results

4.5.1 Hydrologic analysis results

Table 4.2 shows the peak discharges and total runoff volumes results. The 6-hour storm produces higher peak discharges for drainage areas less than about 1.5 square miles. The 24-hour storm produces the higher 100-year peak discharges for the larger drainage basins.

Table 4.2. 100-Year Peak Discharge and Total Runoff Volume to Fans 4 and 5 Apices

			24-hour					6-hour			
		AREA	Q100	Time	Vol.	Vol.		Q100	Time	Vol.	Vol.
Fan #	KKID	(sq.mi.)	(cfs)	(hrs)	(in)	(ac-ft)		(cfs)	(hrs)	(in)	(ac-ft)
4	S400	1.54	**998**	12.50	1.144	94		982	4.50	1.158	95
4	S410	0.64	492	12.33	1.200	41		**594**	4.50	1.405	48
4*	C410	2.18	**1470**	12.50	1.148	134		1339	4.50	1.113	130
5	S500	3.64	**1981**	12.83	1.340	260		1704	4.83	1.183	230

* = Total potential flow at downstream-most apex location for Fan 4.

4.5.2 Verification of results

Figures 4.3 and 4.4 show plots of the peak discharge results for the 100-year models versus the USGS regional regression equations for Region 12 for Fan 4 and 5 respectively. The model results fall below the 100-year regression curve for the region.

Given the predominance of sandy loam textured soils in the watersheds, these results are considered reasonable. In addition, it should be noted that the average elevation for Fan 4 (about 1700 feet) falls below the "cloud of common values" for Region 12. That is, the data used to develop the Region 12 equations did not include watersheds with average elevations below about 2000 feet. Most of the gages included in the Region 12 datasets drain higher elevation areas from the Bradshaw Mountains and along the Mogollon Rim, including the Salt-Verde River basins. Those watersheds experience higher annual precipitation amounts and have higher 100-year point rainfall statistics than the White Tank Mountains. Therefore, results falling below the regional curves are not considered surprising or unreasonable.

Figure 4.3. Comparison of 100-year HEC-1 Model Results with USGS Regression Equations For Fan 4

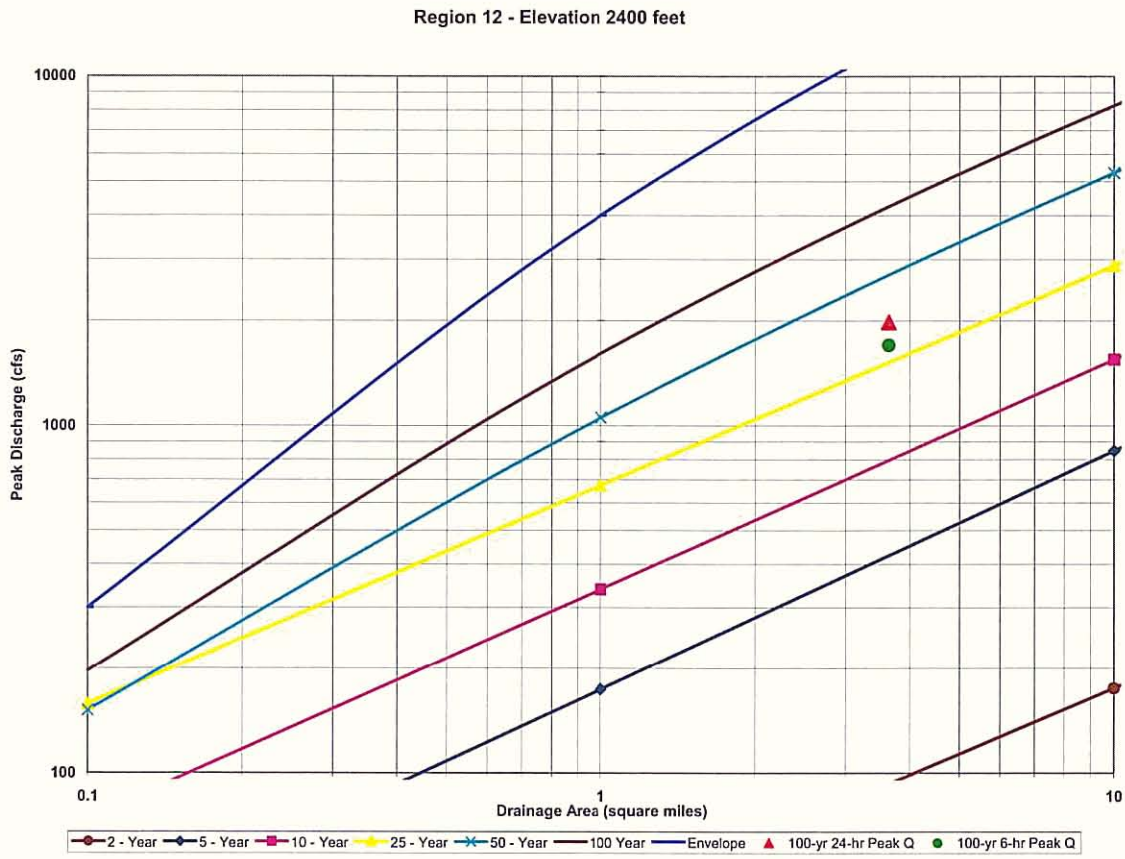


Figure 4.4. Comparison of 100-year HEC-1 Model Results with USGS Regression Equations-Fan 5

4.5.3 Comparison with Previous Studies

Table 4.3 shows a comparison of the results of the existing condition 6-hour and 24-hour models with the previous Floodplain Delineation Study model results by the Alpha Engineering (1994). The FDS used the Phoenix Mountain S-Graphs and the Green-Ampt loss method for computation of rainfall excess. The rainfall data are similar to the models for the current study. The exact drainage basins were not modeled. The current watersheds S400, S410 and S500 are very similar to the Alpha watersheds A1, B1, and C1, respectively. Comparison of the unit discharge (cfs/sq.mi.) shows comparable results between the two studies.

Table 4.3. Comparison of 100-Year Peak Discharges with White Tank Wash FDS (Alpha, 1994)						
Location	Area (sq.mi.)	Alpha 6-hr (cfs)	Alpha 24-hr (cfs)	This Study 6-hr (cfs)	This Study 24-hr (cfs)	Q/A for Controlling Q
S400	1.54			**998**	982	**648 cfs** /sq mi
A1	1.11	559	**1070**			**964 cfs**
S410	0.64			492	**594**	**928 cfs**
B1	0.55	229	**460**			**836 cfs**
S500	3.64			**1981**	1704	**544 cfs**
C1	3.58	1487	**2662**			**744 cfs**

4.6 References

1. Alpha Engineering Group, Inc., 1994, White Tanks Wash Flood Insurance Study, FCD No. 90-64: for FCDMC, Phoenix, Arizona.

2. CH2M Hill, 1992, Alluvial Fan Data Collection and Monitoring Study: Tempe, Arizona, CH2M Hill and R.H. French, Ph.D., P.E. Consulting Engineer for the Flood Control District of Maricopa County, 204 p.

3. Field, John J., 1994, Processes of Channel Migration on Fluvially Dominated Alluvial Fans in Arizona. Arizona Geological Survey OFR 94-13, 40 p.

4. FCDMC, 2003, Drainage Design Manual for Maricopa County – Hydrology.

5. Hjalmarson, H.W., 1994, Potential flood hazards and hydraulic characteristics of distributary-flow areas in Maricopa County, Arizona: U.S. Geological Survey Water Resources Investigations Report 93-4169, 56 p.

6. Hjalmarson, H.W., and Kemna, S.P., 1992, Flood hazards of distributary-flow areas in southwestern Arizona: U.S. Geological Survey Water Resources Investigations Report 91-4171, 68 p.

7. Kangieser, P.C., 1969, Major rainstorms and snowstorms in Arizona 1897-1969 [unpublished report]: Tempe, Arizona, Arizona Weather Bureau, 25 p.

8. National Archive, 1954, Black and white aerial photographs, scale 1:20,000.

9. National Archive, 1949, Black and white aerial photographs, scale 1:20,000.

10. Soil Conservation Service, 1963, Buckeye Watershed: Watershed Work Plan: USDA.

11. Thomas, Blakemore E, Hjalmarson, H.W., and Waltemeyer, S.D., 1997, Methods for Estimating Magnitude and Frequency of Floods in the Southwest United States: U.S. Geological Survey, Water Supply Paper 2433, 195 p.

12. U.S. Army Mapping Service, 1953, Large format black and white aerial photography. From FCDMC archives. Scale = approximately 1:14,400.

13. U.S. Geological Survey, 1988, Wagner Wash Well, Ariz. Quadrangle, 7.5 minute series, Provisional Edition, 1:24,000 (photo date 1984).

14. U.S. Geological Survey, 1982, Buckeye NW, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (photo date 1955, originally published 1958; photo revised in 1982 using 1978 photography).

15. U.S. Geological Survey, 1982, Valencia, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, originally published 1958; photo revised in 1982 using 1978 photography).

16. U.S. Geological Survey, 1978, White Tank Mtns NE, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, published 1957; photo revised 1971, and photo inspected with no changes made in 1978).

17. Waters, Stephen D., 1991, Hydrologic analysis for White Tanks Distributary Flow Area: Phoenix, Arizona, Flood Control District of Maricopa County, 29 p.

SECTION 5: HYDRAULIC ANALYSIS

5.1 Method Description

Approximate method hydraulic modeling was used to delineate riverine floodplains on reaches upstream of the alluvial fan apexes. Normal depth computations for representative cross sections were performed using HEC-RAS to estimate the depth and width of inundation from the 100-year flood. The resultant width was applied to the stream reach for each representative cross section. In some cases, adjustments to the computed floodplain widths were made based on aerial photograph interpretation and application of geomorphic principles.

100-year floodplains were delineated using approximate methods upstream of the hydrographic apexes of White Tank Fans 4 and 5. The U.S. Army Corp of Engineers HEC-RAS v. 3.1.3 was used to perform the hydraulic rating calculations. Cross section locations along the study reaches were selected depending on the variability of the channel geometry. On average, the average cross section spacing for the channels upstream of Sites 4 & 5 is approximately 1,800 feet. Cross section data were collected from the base map using various software tools available in AutoCAD Land Development Desktop 2005. The base map used includes that described in Section 5.2 (below). Appendix E includes the HEC-RAS cross sections and detailed input and output.

5.2 Study Work Maps

The Zone A delineations for the Sites 4 & 5 alluvial fans are shown on 1"= 400', 10' contour interval base mapping with orthographic aerial photography. The work study maps and Index Sheet are presented with this Technical Data Notebook (TDN) on 24"x36" sheets. Reduced-scale copies of the work maps are included on Figure 5.1. The full-size sheets are contained in Exhibit Maps C of the TDN.

The work maps include cross-section locations, floodplain boundaries, zone designations, road names, state-plane coordinate grid, section lines, corporate boundaries and stream names/numbers. The flood zones delineated using approximate method hydraulic modeling of the reaches upstream of the alluvial fan apexes are shown as Zone A administrative floodways on the work maps and annotated FIRM panels.

Portions of the approximate method alluvial fan floodplain delineation overlie detailed riverine floodplain delineations performed for the Hassayampa River. Where administrative floodways delineated for the approximate method alluvial fan floodplain delineation overlie detailed study riverine floodplain fringe, the floodway zones are shown on the FIRM. However, where alluvial fan floodplain delineations that are not administrative floodways overlie the detailed riverine delineation in the riverine floodway fringe, the riverine delineation is shown on the FIRM and work maps.

Federal Emergency Management Agency

Washington, D.C. 20472

OCT 2 4 2007

FLOOD CONTROL DISTRICT
RECEIVED
OCT 31 '07
CH & GM | FINANCE
PIO | LANDS
ADMIN | O&M
REG | P&W
ENG | IT
CONTRACTS
ROUTING
KAG

B.A.D. Letter

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Fulton Brock
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson, 10th Floor
Phoenix, AZ 85003

Community: Maricopa County, AZ
Community No.: 040037

Dear Mr. Brock:

This is in regard to a Letter of Map Revision (LOMR) request dated September 4, 2007, from Ms. Kathryn Gross, CFM, Project Manager, Flood Control District of Maricopa County, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) evaluate the effects that updated flood hazard data for White Tank Mountains Fans 3, 13, 16; 4, 5; 6; 17, 18, 19; 10, 11, and 20 would have on the flood hazard information shown on the effective Flood Insurance Rate Map (FIRM) for your community. This LOMR request is referred to as Case No. 07-09-1894P. This letter is based on the best available flood hazard information and is intended to improve upon that shown on the effective FIRM.

We reviewed the submitted data enclosed in the application package (with appendixes) entitled "Approximate Zone A Floodplain Delineation Study of White Tank – Technical Data Notebook, Fans 3, 13, and 16 – Fans 4, and 5 – Fan 6 – Fans 17, 18, and 19 – Fans 10, 11, and 20," prepared for the Flood Control District of Maricopa County by JE Fuller/Hydrology & Geomorphology, Inc., dated November 2006. We have determined that the submitted data meet the minimum floodplain management criteria of the National Flood Insurance Program (NFIP), but FEMA cannot issue a LOMR or Physical Map Revision at this time.

In accordance with Paragraph 60.3(b)(4) of the NFIP regulations (copy enclosed), we encourage your community to use the draft work maps entitled "Approximate Zone A Floodplain Delineation Study of White Tank Fans 3, 13, & 16, Sheet 2 to 5, FCD 2004C049, Sun Valley Area Drainage Master Plan;" "Approximate Zone A Floodplain Delineation Study of White Tank Fans 4 & 5, Sheet 2 to 6, FCD 2004C049, Sun Valley Area Drainage Master Plan;" "Approximate Zone A Floodplain Delineation Study of White Tank Fan 6, Sheet 2 and 3 , FCD 2004C049, Sun Valley Area Drainage Master Plan;" "Approximate Zone A Floodplain Delineation Study of White Tank Fans 17, 18, & 19, Sheet 2 to 4, FCD 2004C049, Sun Valley Area Drainage Master Plan;" and "Approximate Zone A Floodplain Delineation Study of White Tank Fans 10, 11, & 20, Sheet 2, FCD 2004C049, Sun Valley Area Drainage Master Plan," all dated November 2006, as the best available data for floodplain management purposes until such time as FEMA can physically revise the FIRM or issue a LOMR.

This letter is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the

Special Flood Hazard Area, the area subject to inundation by the base (1-percent-annual-chance) flood. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

If you have questions regarding floodplain management regulations for your community or the NFIP in general, please contact the Consultation Coordination Officer (CCO) for your community. Information on the CCO for your community may be obtained by calling the Director, Mitigation Division of FEMA in Oakland, California, at (510) 627-7175. If you have questions regarding this letter, please call our Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

Max H. Yuan, P.E., Project Engineer
Engineering Management Section
Mitigation Directorate

For: William R. Blanton Jr., CFM, Chief
Engineering Management Section
Mitigation Directorate

Enclosure

cc: The Honorable Bobby Bryant
Mayor, Town of Buckeye

Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County

Ms. Lynn M. Thomas, P.E., CFM
Technical Supervisor
Flood Control District of Maricopa County

Mr. Ted Collins, CFM
Principal Floodplain Coordinator
Flood Control District of Maricopa County

Ms. Kathryn Gross, CFM
Project Manager
Flood Control District of Maricopa County

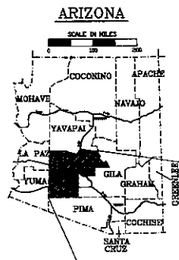
Mr. Scott Lowe, P.E.
Director
Public Works
Town of Buckeye

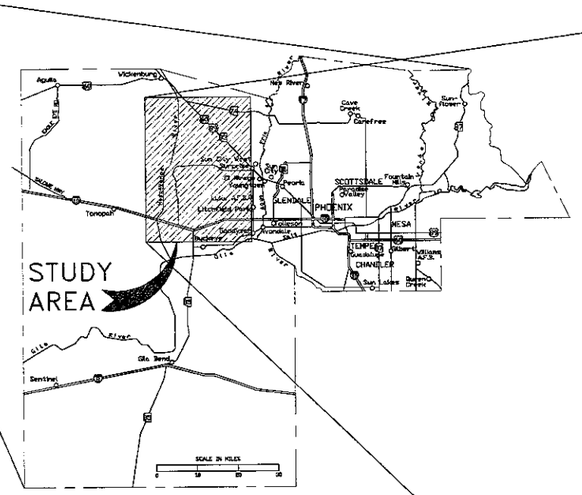
Mr. Brian Cosson, CFM
NFIP Coordinator
Office of Dam Safety and Flood Mitigation
Arizona Department of Water Resources

Jonathan Fuller, P.E.
JE Fuller/Hydrology and Geomorphology, Inc.

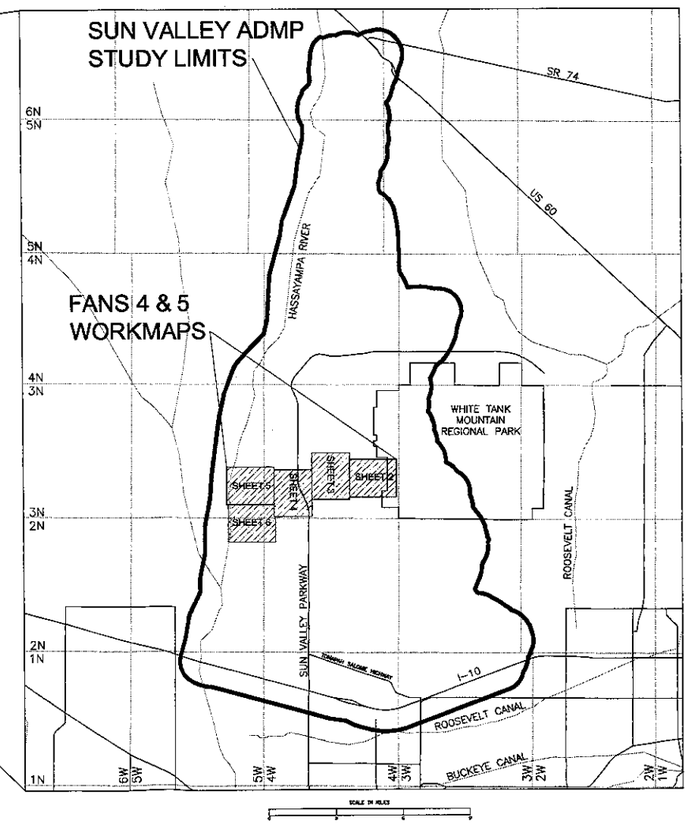
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE FLOODPLAIN DELINEATION STUDY OF THE WHITE TANK MOUNTAIN PIEDMONT FAN SITES 4 & 5 SUN VALLEY AREA DRAINAGE MASTER PLAN, FCD 2004C049





MARICOPA COUNTY



N

NOTES

1. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
2. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

STATEMENTS OF PROFESSIONAL REGISTRANT

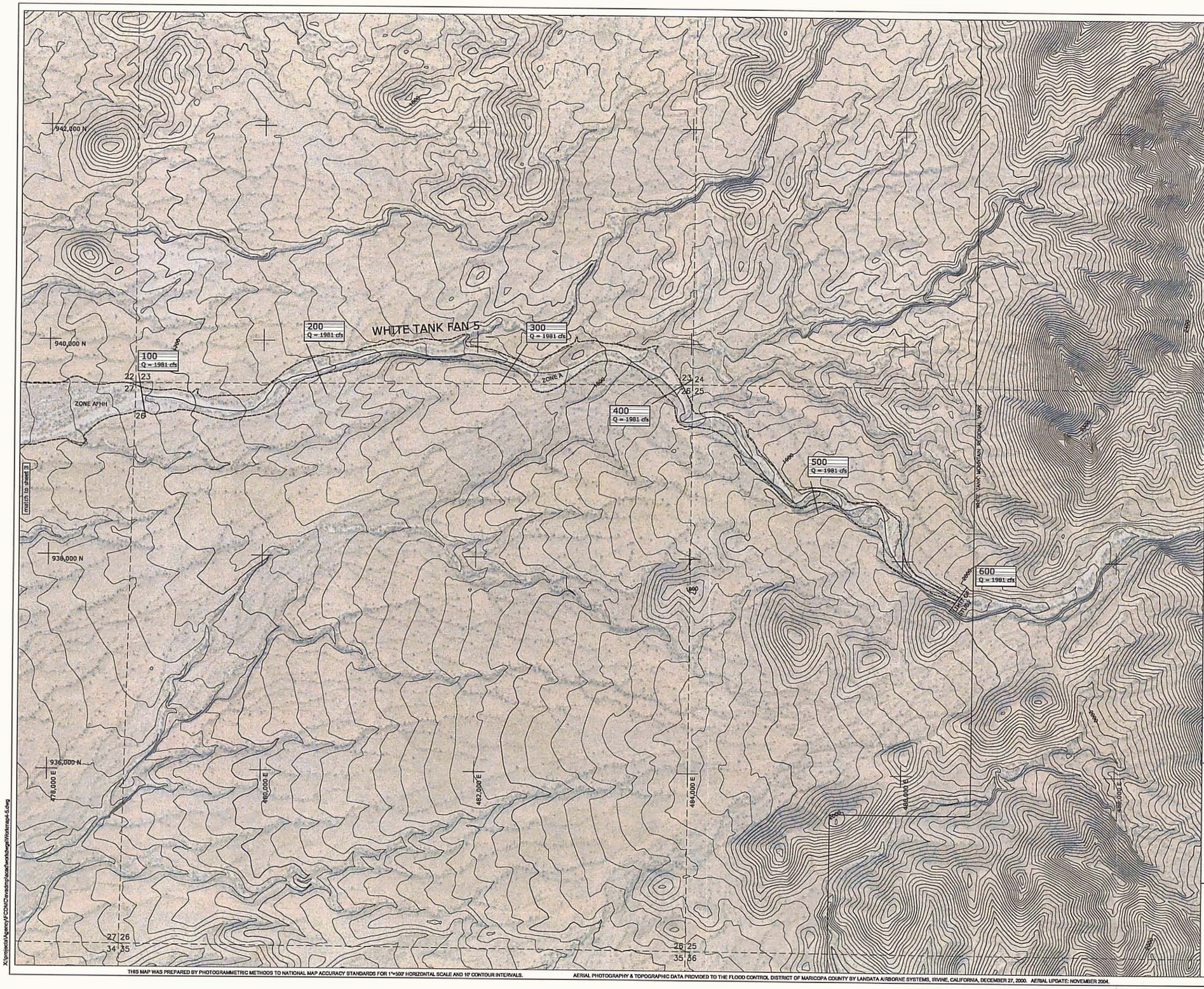
THE FLOODPLAIN DELINEATIONS PRESENTED ON THE FOLLOWING SHEETS WERE PREPARED UNDER MY DIRECT SUPERVISION.

Registered Professional Engineer (Civil) CERTIFICATE NO. 25846 JONATHAN E. FULLER Date Signed ARIZONA, U.S.A.

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

INDEX SHEET

NOVEMBER, 2006



LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N / 648,500 E

ZONE DESIGNATIONS

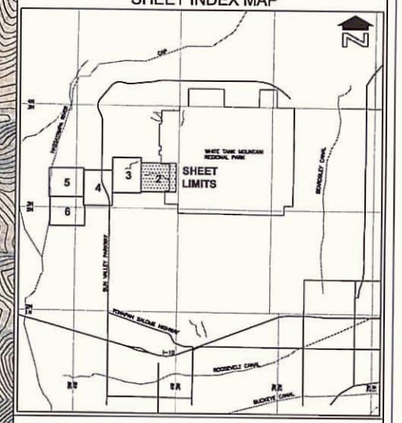
ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

N

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26846 JONATHAN E. FULLER Date Signed ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
5055 E. EVERGREEN ROAD, SUITE 201 TEMPE, ARIZONA 85282
PHONE: 480-752-6160 FAX: 480-898-6150

SHEET 2 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDM\Drainage\sunvalley\whitetanks\4-5.dwg

LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N, 648,800 E

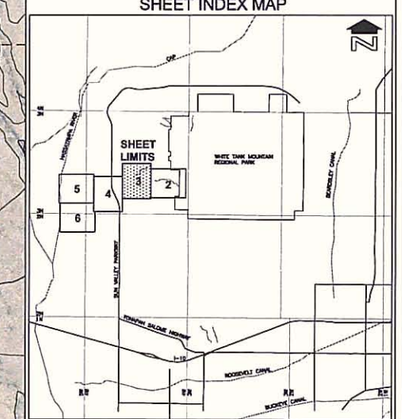
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004C049
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26546 JONATHAN E. FULLER Date Signed ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
3435 S. RYDER ROAD, SUITE 201 TEMPE, ARIZONA 85282
PHONE: 480.839.8100 FAX: 480.839.8110

SHEET 3 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDM\Chrestoy\acad\workdwgs\Workmap4-5.dwg

LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N / 648,800 E

ZONE DESIGNATIONS

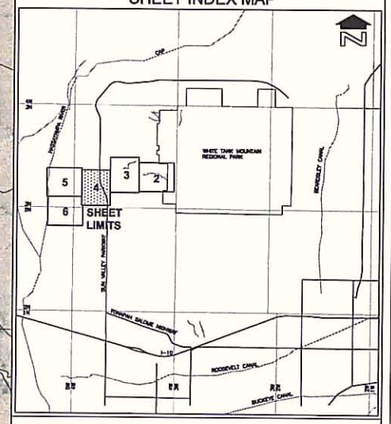
ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

N

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26846 JONATHAN E. FULLER Date Signed 11/17/06 ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.
8055 S. HYDRAULIC ROAD, SUITE B7
TEMPE, ARIZONA 85284
PHONE: 480-730-2126
FAX: 480-838-2150

SHEET 4 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDM\Davsdrnp\acad\wcd\Angel\Workmap4-5.dwg

LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N, 648,600 E

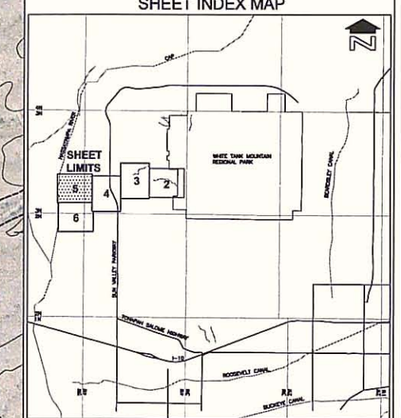
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004C049
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26848 JONATHAN E. FULLER Date Signed ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
5640 S. ARIZONA MILLS, SUITE 201
TEMPE, ARIZONA 85283
PHONE: 480-730-0134
FAX: 480-730-0135

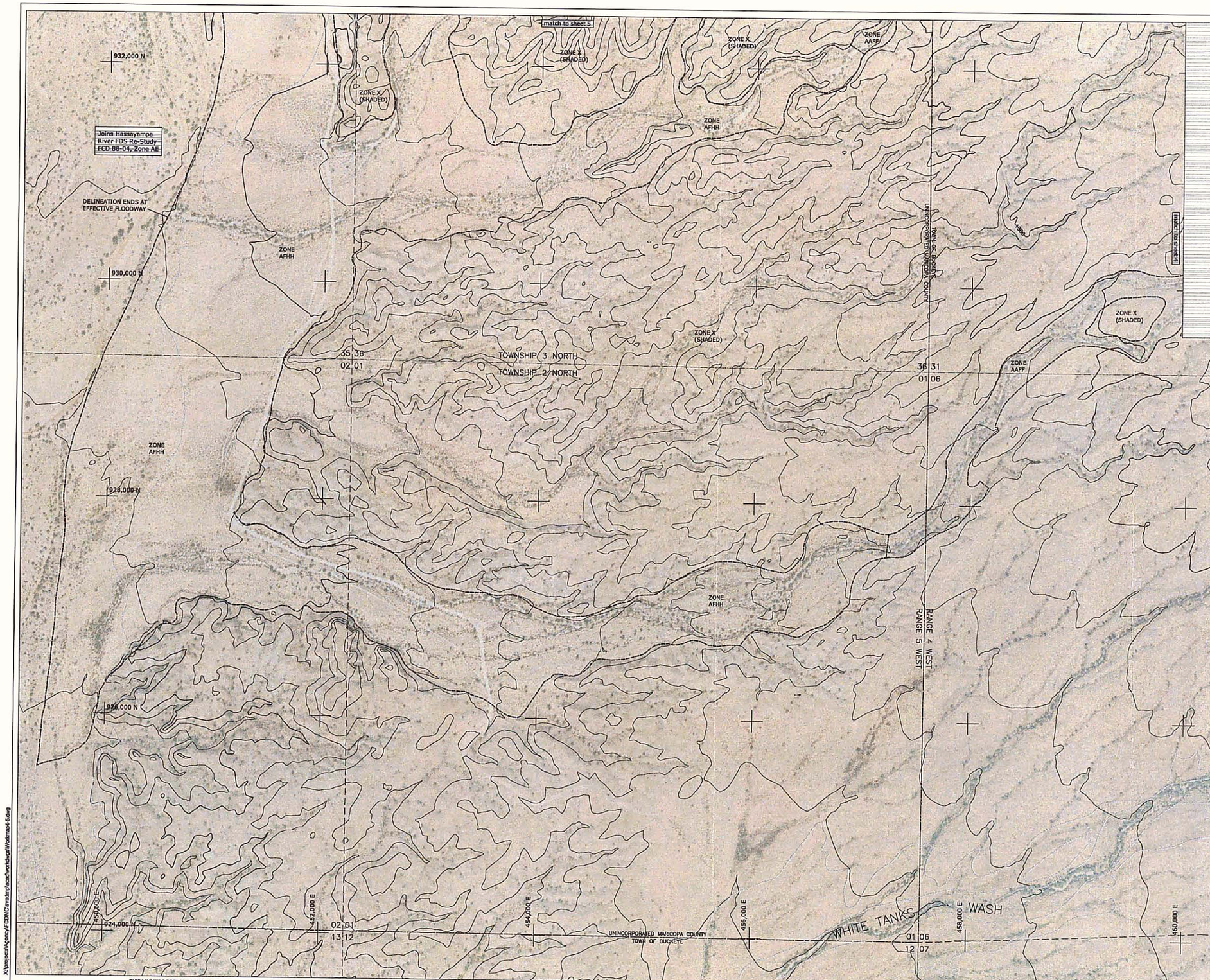
SHEET 5 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDMC\Sevadmin\acad\wcs\Adwgs\Workmaps\4-5.dwg



LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N, 648,800 E

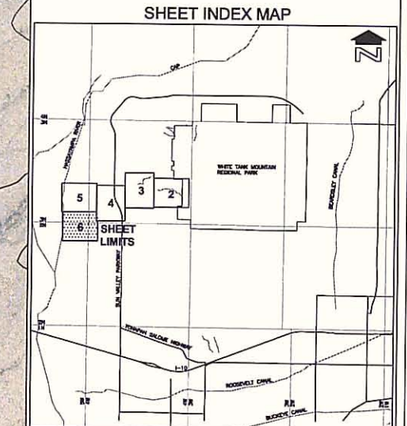
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26846 JONATHAN E. FULLER Date Signed ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
4835 E. BYNEUM ROAD, SUITE 207
TEMPE, ARIZONA 85282
PHONE 480-858-8100
FAX 480-858-8150

SHEET 6 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDM\Canada\projects\workdrawg\Workmap4-5.dwg

5.3 Parameter Estimation

HEC-RAS v3.1.3 was used to determine the flow width and depth for each cross section. All of the reaches were modeled in the sub-critical flow regime and the downstream boundary conditions were set at normal depth.

5.3.1 Roughness Coefficients

Manning's roughness coefficient (n value) describes the friction attributable to the channel, banks and overbank areas. The n value generally varies with depth of flow, so it is determined assuming a flow depth associated with the 100-year discharge. Manning's "n" values were determined using the methodology outlined in the USGS report titled, "Estimating Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" by B.W. Thomsen and H.W. Hjalmarson, (April, 1991)[3]. Field reconnaissance was undertaken to photograph typical reaches in the study area and to document channel and overbank conditions. The findings of these field investigations were summarized in a separate Manning's n value report produced by JEF for this study for the FCDMC (see Appendix E.1).

5.3.2 Expansion and Contraction Coefficients

The expansion and contraction coefficients used throughout the study were 0.3 and 0.1, respectively. No abrupt changes in the floodplain width were encountered that would warrant modification of these coefficients.

5.4 Cross-section descriptions

Cross section geometry was developed from the elevation contours and refined based on field reconnaissance and interpretation of surficial observations from the aerial base mapping. The most typical refinements to the channel geometry occur in the low flow channel areas that are not adequately represented by the 10' contour interval topography. Cross sections are labeled numerically in intervals of 100 increasing in the upstream direction. Cross section stationing is from left to right if viewed in the downstream direction. Cross section plots are located in Appendix E.2

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and drop analysis

No hydraulic jump or drop analyses were conducted in this study.

5.5.2 *Bridge or Culverts*

No bridge or culvert analyses were conducted in this study.

5.5.3 *Levees and Dikes*

There are no levees or dikes within the project area.

5.5.4 *Islands and Flow Splits*

In general, small islands were not delineated on the work maps.

5.5.5 *Ineffective Flow Areas*

No significant ineffective flow areas exist in the natural channels in this study.

5.5.6 *Supercritical Flow*

Supercritical flow does not occur for significant lengths along any reach in this study.

5.6 Floodway modeling

Floodway modeling was not conducted for this study. The Flood Control District of Maricopa County (FCDMC) manages the approximate floodplain delineations as Administrative floodways and shows them as such on the floodplain workmaps (i.e. floodplain = floodway). In addition, the FCDMC administers certain approximate method alluvial fan zone designations as administrative floodways. The alluvial fan delineations are described in Section 6B.

5.7 Special problems encountered during the study

No special problems were encountered.

5.8 Calibration

No hydraulic calibration was performed during this study.

5.9 Final Results

This portion of this study resulted in 100-year Zone A riverine delineations for 3.1 miles of Fan Sites 4 and 5. A summary of the hydraulic analysis results are provided in Table 5.1 below. Appendix E.3 contains the HEC-RAS model detailed input and output.

Table 5.1. HEC-RAS Summary

River	River Sta	Q Total (cfs)	W.S. Elev (ft)	Crit W.S. (ft)	Vel Total (ft/s)	Top Width (ft)	Max Chl Dpth (ft)	Froude # XS	Sta W.S. Lft (ft)	Sta W.S. Rgt (ft)
FAN 5	600	1981	1969.13	1969.13	10.18	63.27	4.13	1.02	99.89	163.16
FAN 5	500	1981	1910.54	1910.54	7.77	144.44	2.54	1.03	125.92	270.37
FAN 5	400	1981	1830.81	1830.81	6.85	193.66	2.51	0.99	141.16	334.81
FAN 5	300	1981	1776.12	1776.04	8.73	87.96	3.82	0.96	181.6	269.56
FAN 5	200	1981	1729.13	1728.91	6.39	175.58	2.63	0.85	182.01	357.6
FAN 5	100	1981	1685.8	1685.8	6.75	189.91	2.8	0.96	59.75	286.66
FAN 4	500	998	1648.06	1647.84	5.01	169.58	1.66	0.81	59.35	228.93
FAN 4	400	998	1621.25	1621.23	4.48	309.88	1.25	0.93	196.1	505.98
FAN 4	300	998	1594.58	1594.43	5.4	145.9	1.58	0.85	17.86	163.77
FAN 4	200	998	1567.45	1567.41	4.93	224.74	1.45	0.92	83.31	444.36
FAN 4	100	998	1539.6	1539.44	4.65	231.45	1.6	0.85	96.08	353.48

5.10 References

1. Phillips, J. V. and Ingersoll, T.L., 1998, *Verification of Roughness Coefficients for Selected Natural and Constructed Stream Channels in Arizona*: U.S. Geological Survey Professional Paper 1584, 77 p.

2. Thomsen, B.W. and Hjalmarson, H.W., 1991, *Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona*. U.S. Geological Survey: Tucson, Arizona, 126 p.

3. U.S. Army Corps of Engineers, HEC-RAS River Analysis System Users Manual, Version 3.1, November, 2002.

4. U.S. Army Corps of Engineers, HEC-RAS River Analysis System Hydraulic Reference Manual, Version 3.1, November, 2002.

5. U.S. Army Corps of Engineers, HEC-RAS River Analysis System, Version 3.1.3, May, 2005.

SECTION 6: SEDIMENT TRANSPORT/EROSION

SECTION 6A: EROSION AND SEDIMENT TRANSPORT

No specific erosion or sediment transport analyses were conducted as part of this study. However, implicit to the geomorphic assessment of the active alluvial fan areas were considerations of sedimentary processes on the White Tank Mountain Piedmont. Therefore, areas of erosion hazards associated with the active alluvial fan flooding have been included in the floodplain delineation.

Sediment yield estimates were performed for the Buckeye Sun Valley ADMS (Ayres, 2004) and are used without modification for this study.

SECTION 6B: GEOMORPHOLOGY

This section of the Technical Data Notebook describes the geomorphic methods used to delineate the flood hazards on the Fan 4 and 5 alluvial fans. Section 6B is organized to follow the outline of the Piedmont Flood Hazard Assessment Manual (PFHAM) (Hjalmarson, 2003) format, as well as the FEMA Guidelines (FEMA, 2002). Hydrology and hydraulic data used in the delineation are described in Sections 4 and 5 of this TDN. Both the PFHAM and the FEMA Guidelines describe a three stage delineation process. The FEMA Guidelines are intended only for alluvial fans, whereas the PFHAM is applicable to a wider range of piedmont surfaces. The three stage delineation process includes the following steps:

- Stage 1: Recognizing and Characterizing Alluvial Fan Landforms
- Stage 2: Defining Active and Inactive Areas of Erosion and Deposition
- Stage 3: Defining the 100-Year Floodplain

Downstream of the hydrographic apex, geomorphic methods, historical data, and limited post-flood hazard verification data were used to delineate the flood hazard zones, as specified in Table G-1 of the FEMA Guidelines. Upstream of the hydrographic apex, geomorphic methods were used to complement and refine conventional approximate normal-depth hydraulic methods, as described in Section 5 of the TDN.

6B.1 Previous Studies

Several previous studies of the geomorphology and relative flood hazards have been conducted in and around the study area. These studies include the following:

- Hjalmarson and Kemna (1991) *Flood Hazards of Distributary-Flow Areas in Southwestern Arizona*: U.S. Geological Survey Water Resources Investigations Report 91-4171.

  This report identified White Tank Piedmont Sites 36-39 and described methods of identifying flood hazards associated with distributary flow networks.

- CH2M Hill (1992) *Alluvial Fan Data Collection and Monitoring Study*: Tempe, Arizona, CH2M Hill and R.H. French, Ph.D., P.E. Consulting Engineer for the Flood Control District of Maricopa County, 204 p.

  This report identified Site 36 as an active alluvial fan, included geomorphic mapping and historical data, and recommended a flood monitoring and data collection program.

- Field & Pearthree (1991), *Surficial Geology around the White Tank Mountains, Central Arizona.* AZGS Open File Report 91-8.

  This mapping effort included nine 7.5' quadrangles around the White Tank Mountain piedmont. Piedmont mapping distinguished Holocene fans (Y) from Pleistocene fans (M).

- Field & Pearthree (1992), *Geologic Mapping of Flood Hazards in Arizona: An Example from the White Tank Mountains, Maricopa County.* AZGS Open File Report 91-10.

  This mapping effort related surficial characteristics to the degree flood hazard on piedmont surfaces surrounding the White Tank Mountains. Primary flow paths were also identified.

- Alpha Engineering Group, Inc., 1994, *White Tanks Wash Flood Insurance Study, FCD No. 90-64*: for FCDMC, Phoenix, Arizona.

  This detailed riverine floodplain delineation for White Tank Wash, the axial drainage for White Tank Piedmont Sites 6, and 36-39. The delineation extended from the Buckeye FRS to Sun Valley Parkway and included a tributary that is one of the primary flow paths for Fan 39.

- Field (1994), Surficial Processes on Two Fluvially Dominated Alluvial Fans in Arizona, AZGS Open File Report 94-12. Also: Field (1994), *Processes of Channel Migration on Fluvially Dominated Alluvial Fans in Arizona*, AZGS Open File Report OFR-94-13.

  These studies document the importance of stream piracy processes in developing distributary flow networks and causing channel movement on fans dominated by fluvial processes. Historical evidence from White Tank Piedmont Site 36 is used as one of five case histories presented.

- Hjalmarson (1994), *Potential Flood Hazards and Hydraulic Characteristics of Distributary-Flow Areas in Maricopa County, Arizona*: U.S. Geological Survey Water Resources Investigations Report 93-4169, 56 p.

  This study defined measurable parameters intended to assess the degree of flood hazard on distributary flow systems. White Tank Piedmont Sites 36-39 were used as example sites.

- JE Fuller/Hydrology & Geomorphology, Inc. (1999), *Approximate Floodplain Delineation Study for White Tank Fan (Site 36).* TDN prepared for the Flood Control District of Maricopa County.

  This approximate method floodplain delineation study used the NRC three-stage process to delineate the floodplain for Site 36. The study established the TDN format for alluvial fan floodplain delineation studies in Maricopa County.

- Robinson (2002), *Cosmogenic Nuclides, Remote Sensing, and Field Studies Applied to Desert Piedmonts*. ASU Geology Department PhD Dissertation.

  This study used remote sensing techniques to perform geomorphic mapping of portions of the White Tank Piedmont.

- Ferguson and others (2004), *Geologic Map of the Wagner Wash Well 7.5' Quadrangle, Maricopa County, Arizona.*

  This mapping project is the most recent AZGS geologic and surficial mapping of the White Tank Piedmont area.

- Field and others (2004), *Geologic Map of the Buckeye NW 7..5' Quadrangle, Maricopa County, Arizona.*

  This mapping project is the most recent AZGS geologic and surficial mapping of the White Tank Piedmont area.

- Ayres Associates (2004), Buckeye Sun Valley ADMP Piedmont Landform Delineations Technical Memorandum to the Flood Control District of Maricopa County.

  This report describes the results of Stage 1 and Stage 2 delineations from the NRC three-stage alluvial fan delineation process. In general, the Ayres results were not relied on for the current delineation study.

- Ayres Associates (2004), Buckeye Sun Valley ADMP Sediment Yield Analysis. Technical Memorandum to the Flood Control District of Maricopa County.

  This report summarizes an analysis of potential sediment yield to the Buckeye FRS.

In addition to this TDN, other TDN's have been or are being prepared for alluvial fans located along the White Tank Piedmont. These TDN's include the following alluvial fan flooding sources:

- Alluvial Fan Floodplain Delineations by JE Fuller/Hydrology & Geomorphology, Inc. for the Flood Control District of Maricopa County Sun Valley ADMP:
  - White Tank Piedmont Fan Sites 10-11-20
  - White Tank Piedmont Fan Sites 1-2
  - White Tank Piedmont Fan Sites 4-5
  - White Tank Piedmont Fan Site 6
  - White Tank Piedmont Fan Sites 3-13-16
  - White Tank Piedmont Fan Sites 17-19

- Alluvial Fan Floodplain Delineations by Others:
    - White Tank Piedmont Fan Site 37 and Portions of Fan Site 36. TDN prepared by Coe & Van Loo Consulting, Inc. for Lennar Properties.
    - White Tank Piedmont Fan Site 38. TDN prepared by David Evans & Associates for Stardust Properties.
    - White Tank Piedmont Fan Site 39. TDN prepared by CMX, Inc for Pulte Homes.
    - White Tank Piedmont Fan Sites 7, 8, 12, 9. TDN prepared by David Evans & Associates for Stardust Properties.

An alluvial fan floodplain delineation was also previously prepared by the Flood Control District of Maricopa County for the Skyline Wash Alluvial Fan, which is located on the southern flank of the White Tank Mountain Piedmont, as documented in the PFHAM Section 5.3. Finally, preliminary alluvial fan delineations (Stage 1-2) were prepared but not finalized by WEST Consultants, Inc. for portions of the northeast flank of the White Tank Piedmont as part of the Flood Control District of Maricopa County Wittmann Area Drainage Master Study Update. Except where specifically referenced or noted as such, this study does not rely on any of the previous or on-going alluvial fan floodplain delineation studies cited above.

6B.2 Data Sources

6B.2.1 NRCS Soils Map Unit Interpretation

The soils data used in this study were derived from two soil survey reports prepared by the Soil Conservation Service (SCS), presently called the Natural Resources Conservation Service (NRCS). The two hard copy reports titled *Soil Survey of Maricopa County, Arizona, Central Part* (Hartman, 1977) and *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona* (Camp, 1986) contain detailed soil surveys conducted for use by land planners, farmers, ranchers, agronomists, rangeland managers, community officials, geologists, engineers, developers, builders, home buyers, and watershed and wildlife managers. In 1999 the NRCS converted the soil survey data from the Hartman (1977) report to a digital database and GIS format. The Camp (1986) soil survey data was converted to a digital format in 2001. These data are readily available at no cost from the NRCS soil data mart website. The digital versions of the data were the primary source used for this study. The landform designations that are shown in Figure 6.1were interpreted from the soil descriptions found in the hard copy soil survey reports.

6B.2.2 AZGS Map Unit Interpretation

The Arizona Geological Survey (AZGS) has published multiple surficial geologic maps at varying scales within the SVADMP study area. Table 6B.1 lists the AZGS maps used in this study.

Table 6B.1. Collected AZGS geology maps

Map Name	Map Format	Map Scale	Year Published	Authors
Geologic Map of Wagner Wash Well 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	C.A. Ferguson, J.E. Spencer, P.A. Pearthree, A. Youberg, J.J. Field
Geologic Map of the Buckeye NW 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	J.J. Field, P.A. Pearthree, C.A. Ferguson
Geologic Map of the Vulture Mine 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	M.J. Grubensky, T.C. Shipman
Geologic Map of the Daggs Tank 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	P.A. Pearthree, A. Youberg, J.J. Field, C.A. Ferguson, J.W. Spencer
Geologic Map of the White Tank Mountains, Central Arizona	Scanned raster	1:24,000	2002	S.J. Reynolds, S.E. Wood, P.A. Pearthree, J.J. Field
Geologic Map of the Wickenburg SW 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	T.C. Shipman, M.J. Grubensky
Geologic Map for the Buckeye 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2002	S.J. Skotnicki
Geologic Map of the Phoenix North 30' x 60' Quadrangle, Central Arizona	Digital GIS	1:100,000	1997	S.J. Reynolds, M.J. Grubensky
Geologic Map of the Phoenix South 30' x 60' Quadrangle, Central Arizona	Digital GIS	1:100,000	1997	S.J. Reynolds, S.J. Skotnicki

6B.2.3 Aerial Photography

Modern Orthophotography. Color, digital, orthophotography covering the entire SVADMP study area was collected from the Flood Control District of Maricopa County. Over 400 image tiles were collected, each covering approximately 0.90 square miles at a resolution of 1-foot/pixel.

Historical Aerial Photography. Historical aerial photography was collected from the Flood Control District of Maricopa County. The photos were provided as digital image files scanned from the original photo prints. Table 6B.2 lists the years of historical photos collected.

Table 6B.2. Collected historical aerial photography		
Photo Year	Original Photo Print Scale	Format
1942	1:15,000	B&W scanned
1949	1:20,000	B&W scanned
1953	1:20,000	B&W scanned
1954	1:20,000	B&W scanned

6B.2.4 Topographic Mapping

The primary mapping source used in this study was 10-foot contour interval, digital topography collected from the Flood Control District of Maricopa County. The mapping was conducted on a county-wide scale in December 2000. Additional 2- to 4-foot digital topography was collected from the Flood Control District of Maricopa County for limited areas within the SVADMP study area. Table 6B.3 lists the digital topographic data collected for this study.

Table 6B.3. Collected digital topography		
Contour Interval	Mapping Year	FCDMC Source Project
10-foot	2000	County-wide mapping
2-foot	1990	White Tanks-Agua Fria ADMS
4-foot	1990	Wickenburg ADMS
2-foot	1991	Buckeye Area FDS
4-foot	1991	White Tanks Wash FDS
4-foot	1991 and 1993	Salt/Gila River Master Plan
2-foot	1992	Daggs Wash FDS
2-foot	1994	Buckeye FRS
2-foot	1997	Skyline Wash FDS
2-foot	2002	Buckeye/Sun Valley Mapping
2-foot	2002	Wittmann ADMP Mapping
2-foot	2002	Hassayampa North Extension Mapping

6B.3 Method Description

The PFHAM alluvial fan floodplain delineation methodology is based on the three stage process outlined in the National Research Council's (NRC, 1996) report, *Alluvial Fan Flooding*. Both the PFHAM and NRC documents describe a three stage method used to identify alluvial fan flood hazards, which was later

adapted for the FEMA Guidelines Appendix G (2002). The PFHAM broadens the three-stage delineation approach to cover a variety of piedmont landforms.

Stage 1 of the PFHAM/FEMA alluvial fan methodology is the recognition and characterization of piedmont landforms. The intent of the Stage 1 analysis is to distinguish alluvial fan landforms from riverine, sheet flow, ponding, or coastal landforms.[1] If the landform in question is identified as an alluvial fan, then the delineation may proceed using the PFHAM/FEMA Stage 2 and 3 procedures. If the landform is not an alluvial fan, then more traditional floodplain delineation procedures should be applied. The Stage 1 delineation relies on the following types of information:

- Composition. Alluvial fans are composed of loose, unconsolidated materials transported by fluvial or debris flow processes (a.k.a., "alluvium").
- Morphology. Alluvial fans have the shape of a partially or fully extended fan as observed on topographic maps or aerial photographs.
- Location. Alluvial fans are usually found at a topographic break where stream channels become less confined than upstream of the break.
- Boundaries. The downstream boundary of an alluvial fan is called the "toe," which is located at an axial stream, lake or landform not dominated by alluvial fan flooding processes. The lateral boundaries of the fan are defined by a transition from alluvial fan flooding processes to riverine processes, although an alluvial fan may also coalesce into adjacent alluvial fans to form a bajada.[2]

Data sources for the Stage 1 delineation included topographic maps, NRCS soil surveys, geologic mapping, aerial photographs, and field observations. These data were used to differentiate piedmont landforms which included mountains, inselbergs[3], alluvial fans, pediments, and riverine floodplains. The locations of the topographic and hydrographic apexes on the alluvial fan were also identified in Stage 1. The topographic apex is the extreme upstream extent of the alluvial fan landform, which is often located at the mountain front or within a mountain front embayment. The hydrographic apex is the location at which flow of water and sediment becomes unconfined and spreads out rapidly. Sudden expansion of flow at the hydrographic apex causes sediment deposition, uncertain flood flow paths, and uncertain flow distribution below the apex. The complex hydraulics associated with this flow expansion and sediment deposition create significant

[1] FEMA Guidelines, p. G-6, 1st paragraph.

[2] A bajada is "a low-lying area of confluent pediment slopes and alluvial fans at the base of mountains around a desert" (The New Penguin Dictionary of Geology, 1996).

[3] An inselberg is "an isolated residual knob or hill, rising abruptly from a lowland erosion surface." (Dictionary of Geological Terms, Anchor Books, 1984)

uncertainties (unpredictability) that "cannot be set aside in the realistic assessment of the flood hazard" (FEMA, 2002), which is the defining characteristic for alluvial fan flooding.

The White Tank Piedmont consists of an extensive bajada that rings the White Tank Mountains, rather than a series of distinct, separate alluvial fans. The active fan areas within the bajada are located well away from the mountain front, and are inset within the original alluvial fans, sometimes with two or more hydrographic apexes on what was once (in geologic time) a single alluvial fan landform. This bajada landform, in conjunction with the complicated hydrographic apex locations, makes delineating individual alluvial fan landforms somewhat problematic. Therefore, because of the bajada condition, and because JE Fuller/ Hydrology & Geomorphology, Inc. was under contract to delineate alluvial fan floodplain over much of the White Tank Piedmont, the Stage 1 delineation was performed for the entire White Tank Piedmont area, rather than just the portion of the bajada surrounding the Site 4 and 5 alluvial fans.

Stage 2 of the PFHAM/FEMA alluvial fan methodology consists of defining active and inactive[1] areas portions of the alluvial fan landform. Active areas are those locations where uncertainties about channel geometry and hydraulic conditions of water and sediment discharge cannot be set aside in the realistic assessment of flood hazard. Active areas on alluvial fans experience sediment deposition, erosion and unstable flow paths in addition to flood inundation. Generally, active alluvial fans have experienced these processes within the past 10,000 years (the Holocene Epoch). Inactive alluvial fan areas are the portions of the alluvial fan where active fan processes do not occur. Generally, inactive alluvial fans have not experienced such processes within the past 10,000 years, but may have done so during much older geologic periods (the Pleistocene Epoch or Tertiary Period). Stage 2 also identifies portions of the piedmont subject to various types of flooding such as stable riverine flooding, active alluvial fan flooding, inactive alluvial fan flooding, and sheet flooding.

According to FEMA Guidelines, a Stage 2 delineation may be completed using a geomorphic-based approach, if the alluvial fan has little or no urbanization (Table G-1, FEMA, 2002), as is the case for Fan 4 and 5. In the geomorphic approach, the following surficial stability characteristics are compiled and evaluated:

- Detailed Soils Mapping. Detailed soils maps prepared by the USDA Natural Resource Conservation Service (NRCS) are available for the entire study area. NRCS soils maps describe soil composition, as well as provide some degree of landform interpretation.
- Surficial Geologic Mapping. The Arizona Geological Survey (AZGS) has prepared several types of surficial geology and flood hazard assessment maps for the entire study area. The AZGS maps indicate surface age, degree of flood hazard, and landform type.

[1] FEMA uses the terms "active" and "inactive." The PFHAM uses "stable" and "unstable," respectively, for the same concept.

- Topographic Mapping. Topographic data to be considered include the fan profile, degree of contour crenulation index (a measure of incision), fan shape, and slope. 10-foot contour interval topographic data are available for the study area. Topographic data are also used to estimate flow containment when defining fan boundaries. The topographic data were also used to construct longitudinal profiles of the alluvial fans.
- Vegetation. Vegetation patterns can be used to identify flow paths or areas of more frequent inundation (dense vegetation), sheet flow (uniform vegetation), the degree soil development (e.g., ocotillo are a marker species for carbonate soil horizons), soil material (e.g., saguaro cacti prefer rocky, well drained soils), surface age (e.g., old surfaces have more slow growing species, creosote clone rings are wider on older surfaces), and surface boundaries (e.g., vegetation suites change with soil types and landform).
- Surficial Characteristics. Older, inactive surfaces tend to have well developed surficial features such as desert varnish, desert pavement, soil reddening, and incised, well-defined drainage patterns.
- Sediment Delivery Potential Sediment yield estimates can be used to estimate fan aggradation rates and define a zone of aggradation more likely to experience active fan processes.
- Drainage Pattern. Inactive fans tend to have tributary drainage patterns with well defined divides. Active fans tend to have distributary drainage patterns with poorly defined divides and/or perched flow paths.
- Historical Aerial Photographs. Channel positions from historical 1953 aerial photographs were digitized and compared with channel positions on 2005 aerial photographs to identify areas of known channel movement and changes in channel pattern.
- Numerical Procedures. Hjalmarson's (1994) procedures for assessment the degree of flood hazard were applied to the alluvial fan data.

The White Tank Piedmont Fan 4 and 5 described in this TDN included active and inactive alluvial fan areas, but also included extensive flow corridors located downstream of the primary active alluvial fan areas in which flow distribution uncertainty exists. These flow paths downstream of the active fan areas are often relatively stable, at least within an engineering time scale of several hundred years, and are typically separated by stable, older, topographically-higher surfaces. Because of the flow path uncertainty in the active, unstable area upstream, accurate determination of a peak discharge for the downstream (more stable) flow corridors is not possible. Also, because these downstream flow corridors often have complicated distributary channel patterns, and because the study area has "little or no urbanization" (FEMA Guidelines, Table G-1), the downstream flow corridor floodplains where delineated using geomorphic methods.

Stage 3 of the PFHAM/FEMA alluvial fan methodology involves identifying the areas subject to flooding in a 100-year flood event. Stage 3 methodologies range from conventional detailed or approximate hydraulic methods using fixed-bed hydraulic models, such as Manning's equation, to geomorphic interpretation based field observations and aerial photographs. For this study, geomorphic methods were used for all of the alluvial fan reaches downstream of the hydrographic apex, including the "stable" reaches downstream of unstable, active alluvial fan areas.

6B.4 Stage 1: Recognizing and Characterizing Piedmont Landforms

Stage 1 of the PFHAM/FEMA alluvial fan methodology consists of recognizing and characterizing piedmont landforms. The primary objective of the Stage 1 analysis is to distinguish alluvial fan landforms from riverine, sheet flow, ponding, or coastal landforms. If an alluvial fan landform is identified, the location of the topographic and hydrographic apexes also must be determined. The Stage 1 assessment uses geomorphic characteristics obtained from soils maps, surficial geology maps, topographic maps, and aerial photographs, as well as field observations. As described above, a Stage 1 delineation was performed for the entire White Tank Piedmont, which includes Fan 4 and 5.

The White Tank Mountain Piedmont consists of an alluvial fan bajada that rings the entire White Tank Mountains. Although minor portions of the upper White Tank Mountain Piedmont have been mapped as a pediment, and a large number of inselbergs crop out within the bajada, the vast majority of the piedmont is composed of alluvium deposited below the mountain front in a radiating (albeit coalesced) pattern. The White Tank Piedmont is bounded by the Wagner Wash floodplain to the north and northwest and the Hassayampa River floodplain to the west. Historically, along the southern boundary, the piedmont transitioned gradually into the geologic floodplain of the Gila River. Today, a series of flood control dams (FRS – Flood Retarding Structures) truncate the piedmont upstream of the Interstate 10 alignment (Figure 1.1). The FRS were originally constructed by the USDA Soil Conservation Service (SCS) in the 1970's and are currently operated and maintained by the Flood Control District of Maricopa County. The FRS fully contain (at least) the 100-year flood, with adequate capacity for antecedent and flood sedimentation.

6B.4.1 Composition

NRCS soils maps (Figure 6.1; adapted from Camp, 1986; Hartman, 1977) and AZGS surficial geology maps (Figure 6.2; adapted from Field and Pearthree, 1991) show that the entire White Tank Mountain Piedmont is composed of alluvial sediments, with the exception of a few inselbergs.

6B.4.1.1 Soils Data

Figure 6.1 shows the NRCS soil map units overlain on the USGS topographic quadrangles. The soil unit polygons were obtained from the Soil Survey of Aguila-Carefree Area (Camp, 1986) and the Soil Survey of Maricopa County, Central Part (Hartman, 1977). Table 6B.1 gives a list and description of the NRCS soil units within the study area. In addition to showing the map unit boundaries and designations, Figure 6.1 shows by color the setting or type of landforms generally associated with each of the various map units as distinguished by the NRCS. The three main categories of landforms distinguished by the NRCS map unit descriptions are: 1) drainageways, floodplains, and alluvial fans, 2) alluvial fan terraces, and 3) mountains and hillslopes. Complete soil unit descriptions for the study area are provided in Camp (1986) and Hartman (1977).

The NRCS soils map units are grouped into broad soil associations as shown on the General Soils Maps provided in the NRCS soils reports. On the General Soils Maps, the bedrock areas of the White Tank Mountains are mapped as the Gachado-Rock Outcrop-Quilotosa Association (Camp, 1986), or as the Cherioni-Rock Outcrop Association (Hartman, 1977), both of which consist of very shallow and shallow gravelly soils and rock outcrop on hill slopes and mountain slopes. The majority of the piedmont bounding the mountain bedrock core is mapped as Gunsight-Rillito-Chuckawalla Association (Camp, 1986), which is found on gently to moderately steep slopes and consists of gravelly and very gravelly loamy soils on fan terraces, or the Gunsight-Rillito-Perryville Association (Hartman, 1977), which is found on nearly level to moderately steep surfaces and consists of gravelly loams and loams on old alluvial fans and valley plains. The northern portion of the piedmont is mapped (Camp, 1986) as the Mohall-Contine Association, which consists of loamy and clayey soils on fan terraces. Hartman (1977) mapped portions of the southern piedmont near the Buckeye FRS as the Antho-Valencia Association, a sandy loam soil on recent alluvial fans and valley plains.

Table 6B.1 also shows the relationship between the detailed NRCS soil map units and the White Tank Piedmont landforms. As can be seen from the table, each soil map unit is actually comprised of several soil series. Each series has its own associated position or landform which is identified in the table. Characteristics important to the soil series age, stability, and flood history are also presented in Table 6B.1. These characteristics help identify the landform type, as well as the stability and the flood history and flood potential of the unit, as described in the Stage 2 analysis.

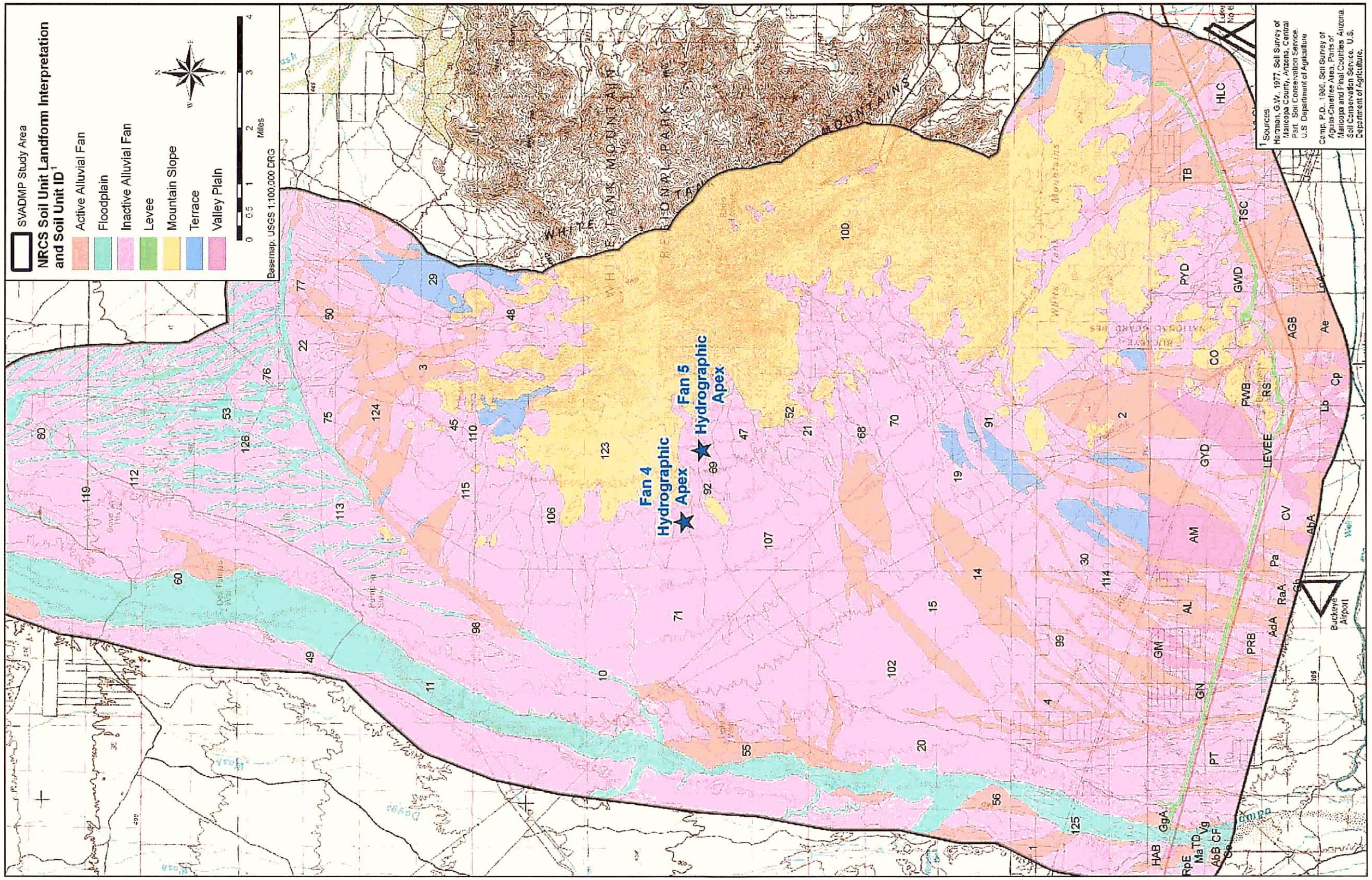


Figure 6.1. NRCS soils mapping with landform interpretations

Table 6B.4 NRCS Soil Unit Descriptions for Fan 4 and 5							
Map Symbol	**Soil Name**	**Geomorphic Position**	**Description**	**Subgroup**	**Order**	**Age (years)**	**PFHAM Landform**
2	Antho gravelly sandy loams	On floodplains, alluvial fans, and drainageways	55% with non-calcareous surface layer & calcareous below, 25% calcareous throughout; main limitation to development is hazard of flooding	Typic Torrifluvents	Entisols	Few hundred to 800 years	Inactive Alluvial Fan
11	Brios-Carrizo complex, low precipitation, 1 to 5 percent slopes	On desert drainageways	Calcareous below 21 inches, slow runoff, severe erosion hazard, channeling, deposition, and streambank erosion occur during flooding.	Typic Torrifluvents, Typic Torri	Entisols	Few hundred years	Active Alluvial Fan
15	Carrizo-Gunsight complex, 1 to 5 percent slopes	On fan terraces	Slow runoff, slight erosion hazard.	Typic Torriorthents, Typic Calci	Entisols, Arids	Few hundred years	Active Alluvial Fan
20	Chuckawalla-Gunsight complex, low precipitation, 1 to 8 percent slopes	On fan terraces	Chuckwalls is on tops of fan terraces, Gunsight is on sides of fan terraces. Surface is covered with varnished desert pavement. Rapid runoff, slight erosion hazard.	Typic Haplargids, Typic Calciort	Aridsols	-	Mountain Slope
55	Gilman loams	On floodplains and alluvial fans	Slow runoff, slight erosion hazard. Where unprotected, the soils are subject to rare periods of flooding.	Typic Torrifluvents	Entisols	Few hundred to 1,000 yea	Inactive Alluvial Fan
69	Gunsight-Cipriano complex, low precipitation, 1 to 7 percent slopes	On fan terraces	Runoff is slow, erosion hazard is slight. Depth to hardpan ranges from 4 to 20 inches.	Typic Calciorthids, Typic Durort	Aridsols	7,000 to 10,000 years	Inactive Alluvial Fan

71	Gunsight-Rillito complex, low precipitation, 1 to 40 percent slopes	On fan terraces	Runoff is slow to medium, moderate erosion hazard. Weakly cemented calcic horizon at 4 to 36 inches	Typic Camborthids	Aridsols	7,000 to 10,000 years	Active Alluvial Fan
92	Momoli-Carrizo complex, low precipitation	On fan terraces	Soil in some areas are noncalcareous to a depth of 20 inches or more. Soils are typically extremely cobbly or extremely gravelly. Runoff is slow, erosion hazard is slig	Typic Camborthids, Typic Torrior	Aridsols	-	Active Alluvial Fan
98	Pinamt-Tremant complex, 1 to 10 percent slopes	On fan terraces	Yellowish red B horizons which are strongly to violently effervescent; light reddish brown B horizons, caclic horizon at 5 to 24 inches, strongly to violently effervescen	Typic Haplargids	Aridisols	900,000 years	Inactive Alluvial Fan
100	Quilotosa-Vaiva-Rock outcrop complex, 20 to 65 percent slopes	On hillslopes and mountain slopes	Mapped on surfaces with 20 to 65% slopes; basically thin hillslope soils in the mountains	Lithic Torriorthents	Entisols	-	Floodplain
102	Rillito gravelly loam, 1 to 8 percent slopes	On fan terraces	Strongly calcareous soils. Runoff is slow, erosion hazard is slight.	Typic Calciorthids	Aridsols	7,000 to 10,000 years	Mountain Slope

107	Sal-Cipriano complex, low precipitation, 1 to 10 percent slopes	On fan terraces	The Sal soil is on the tops of terraces, and the Cipriano soil is on side slopes and in areas on the tops of terraces that do not have a desert pavement. Runoff is rapic	Typic Durargids, Typic Durorthid	Aridsols	-	Inactive Alluvial Fan
123	Vaiva very gravelly loam, 1 to 20 percent slopes	On hillslopes	Runoff is medium, erosion hazard is slight. Below the subsoil to a depth of 17 inches is red, highly fractured granite overlying unweathered granite.	Lithic Haplargids, Lithic Cambor	Aridsols	-	Active Alluvial Fan

The key facts derived from the NRCS soils mapping with respect to the Stage 1 delineation are that the piedmont area is underlain by alluvium and that soils are associated with alluvial fans, fan terraces (inactive alluvial fans), and alluvial plains. The NRCS soil descriptions provided in Table 6B.1 are consistent with the common soil types for alluvial fans shown in Table 2.1 of the PFHAM.

6B.4.1.2 Surficial Geology

Figure 6.2 shows the 1:100,000 scale surficial geologic mapping of the White Tank Piedmont adapted from Reynolds and Grubensky (1997) and Reynolds and Skotnicki (1997) of the Arizona Geological Survey (AZGS). Figure 6.2 shows the entire piedmont study area is composed of alluvium of either Pleistocene or Holocene in age. More detailed AZGS surficial mapping at a scale 1:24,000 indicates pediment surfaces near the deeply embayed mountain front and around many of the bedrock inselbergs. Phil Pearthree (personal communication, 1999) indicated that the pediment designation was identified solely on the basis of the inselbergs and that no subsurface data were used in the delineation of the pediment boundary shown on the AZGS maps. The 1:24,000 scale surficial mapping is difficult to interpret when illustrating the entire study area (as in Figure 6.2), thus the 1:100,000 scale mapping was used. The more detailed 1:24,000 scale mapping is shown later in this report in Figure 6.21.

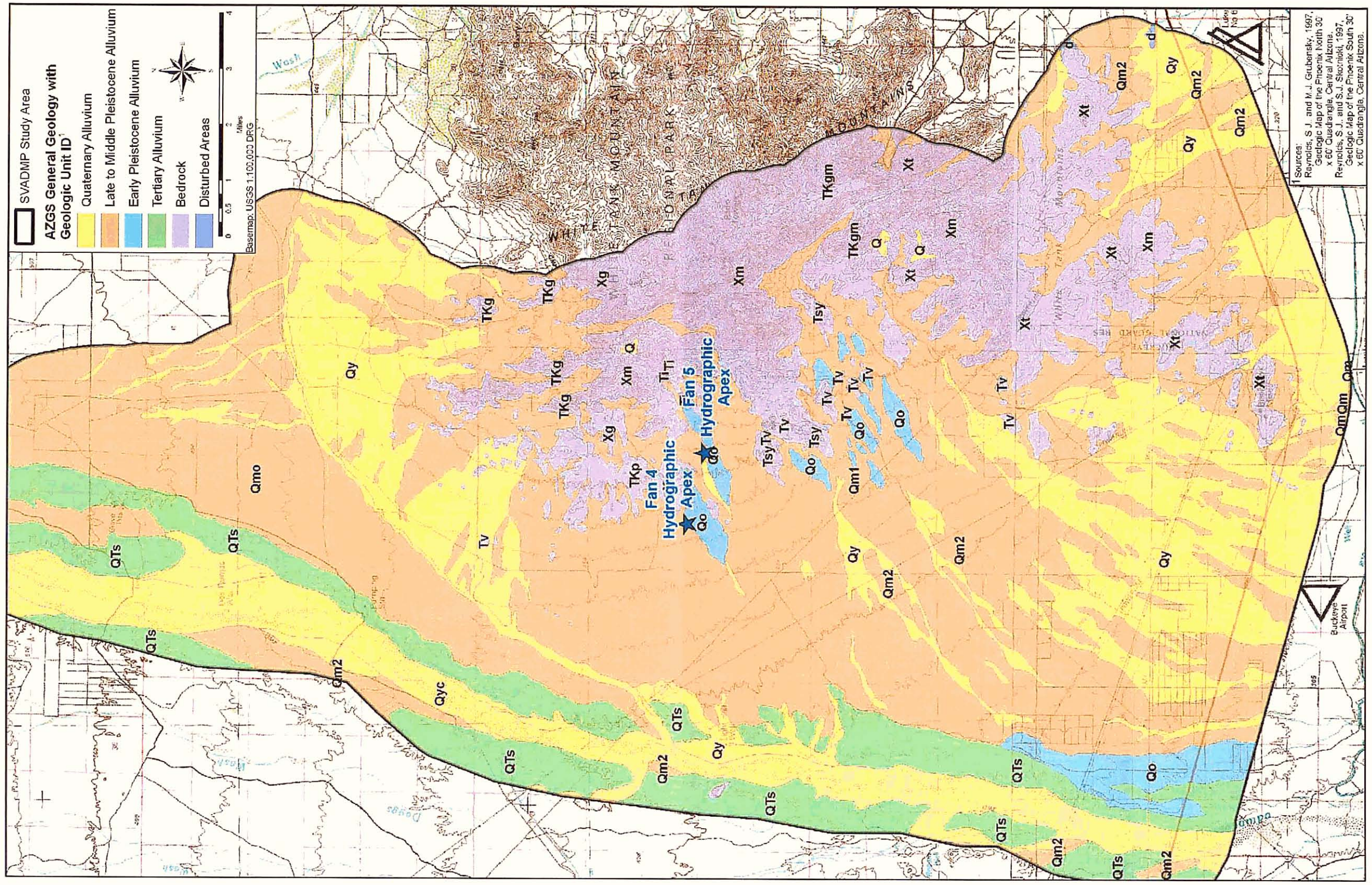


Figure 6.2. AZGS geologic mapping (1:100,000 scale)

Figure 6.2 shows the 1:100,000 scale surficial geologic mapping of the White Tank Piedmont adapted from Reynolds and Grubensky (1997) and Reynolds and Skotnicki (1997) of the Arizona Geological Survey (AZGS). Figure 6.2 shows the entire piedmont study area is composed of alluvium of either Pleistocene or Holocene in age. More detailed AZGS surficial mapping at a scale 1:24,000 indicates pediment surfaces near the deeply embayed mountain front and around many of the bedrock inselbergs. Phil Pearthree (personal communication, 1999) indicated that the pediment designation was identified solely on the basis of the inselbergs and that no subsurface data were used in the delineation of the pediment boundary shown on the AZGS maps. The 1:24,000 scale surficial mapping is difficult to interpret when illustrating the entire study area (as in Figure 6.2), thus the 1:100,000 scale mapping was used. The more detailed 1:24,000 scale mapping is shown later in this report in Figure 6.21.

Complete descriptions of the 1:24,000 scale surficial geologic units are provided in Ferguson et al. (2004). The following units were mapped by the AZGS within the Fan 4 and 5 areas:

- Late Holocene to Modern Floodplain Deposits from the Hassayampa River (Qy2r). Sand, silt, and gravel deposits associated with slightly higher (three meters above the active channel) terraces along the Hassayampa River. Surfaces are covered with fine-grained floodplain deposits.
- Late to Early Holocene Stream Channel and Alluvial Fans Deposits (Qy2 and Qy1). These surfaces have experienced active deposition and erosion during the last 10,000 years. The Qy2 unit is the youngest unit. It is found in active stream channels, low terraces, and alluvial fans. The Qy1 unit is found on alluvial fans and terraces.
- Middle Pleistocene River Deposits (Qi1r). Deposits associated with a set of high terraces (10 to 20 meters above the active channel) along the Hassayampa River. Terraces are flat or gently sloping toward the river, and are dissected by tributary drainage.
- Middle to Late Pleistocene Deposits (Qi3, Qi2, and Qi). The Qi units are of Pleistocene age, that is, greater than 10,000 years old, and have been subject to erosion and transport in recent geologic time. Qi3 deposits are the youngest and are found on inactive alluvial fans and terraces. Qi2 deposits are associated with older, relict alluvial fans. Qi units are undifferentiated alluvial fan and terrace deposits.
- Early Pleistocene River Deposits (Qor). Deposits associated with high (20 to 30 meters above the active channel) terraces along the Hassayampa that record the maximum degradation of the river. Surfaces are moderately to deeply dissected by tributary drainage.

- Early Pleistocene to Late Pliocene Alluvial Fan Deposits (Qo). High, very old relict alluvial fan deposits. Surfaces are moderately to deeply dissected with two to 10 meters of relief. Original fan surfaces have been removed by erosion.
- Pliocene to Early Pleistocene River Deposits (QTsr). Moderately thick sequence of old Hassayampa River deposits consistent of river sand, gravel, and silt.
- Bedrock Units (TKap, TKg, TKq, Xgd, Xm)

The surficial geology as mapped by the AZGS shows a general pattern of decreasing alluvial surface age moving downslope from the White Tank Mountains, and generally broader extent of younger surfaces with distance from the mountain front. Field and Pearthree (1991) hypothesized that the location of active alluvial fan and distributary flow areas on the piedmont has not shifted significantly since the Pleistocene, and that the younger M2, Y1, and Y2 surfaces in the middle and lower piedmont were derived primarily by erosion of the M1 and O surfaces on the upper piedmont. That is, most of the sediment deposited on the lower piedmont is being eroded from older upstream piedmont surfaces, rather than from the upper mountainous watersheds. The differing sediment source areas may be responsible for the contrast in sediment size and surface texture between the gravelly active alluvial fan areas on the piedmont immediately below the hydrographic apexes and the silty-sand younger surfaces near the toe of portions of the piedmont.

In addition to the surficial geology, the AZGS generated a series of flood hazard maps for the White Tank Mountains (Field and Pearthree, 1992). These maps identify areas of high, intermediate, and low flood hazard. Figure 6.3

is an example map for a portion of the White Tank Piedmont. Figure 6.22 shows the site-specific flood hazard mapping for this analysis.

6B.4.1.3 Field Observations

Extensive field work was completed as part of the alluvial fan floodplain delineations studies performed by JE Fuller/Hydrology & Geomorphology, Inc. In addition, aerial photography was inspected to identify features consistent with alluvial deposits. Field observations made throughout the White Tank Piedmont and aerial photographic interpretation confirm that the piedmont is composed of alluvial materials, except where inselbergs crop out.

6B.4.1.4 Summary

The NRCS soils mapping, AZGS surficial geologic mapping, and field observations all report similar findings regarding the alluvial composition of the White Tank Piedmont. Therefore, it is concluded that the White Tank Piedmont is composed of non-consolidated alluvium deposited by fluvial processes, which meets the composition criteria specified in the PFHAM and FEMA Guidelines.

6B.4.2 Morphology

According to the National Research Council definition (1996), "alluvial fans are landforms that have the shape of a fan, either partly or fully extended." The White Tank Piedmont study area consists of a series of coalescing landforms each with the shape of a partially extended alluvial fan. These coalescing alluvial fans comprise a bajada (Figure 6.5) which also shows a somewhat distorted, partially extended fan shape wrapped around the White Tank Mountains. The coalesced fan shape is readily visible on aerial photographs of the study area (Figure 6.4).

Topographic contour data also support the morphological definition of an alluvial fan. The USGS 7.5-minute quadrangle topographic maps, as well as the District's 10-foot contour interval mapping (Figure 6.5), show slightly radial patterns across the piedmont surface. The contour crenulations, which range from highly crenulated to smooth radial lines, indicate the degree of fan incision and channel confinement, but uniformly depict a extended fan shape. The central west portion of the fan is the most highly crenulated, whereas the northern and southern portions of the piedmont have the smoothest contours.

Other morphologic features which support delineation of the White Tank Piedmont as an alluvial fan landform include the slope, drainage patterns, and surficial characteristics. The piedmont slope ranges from less than one percent to almost four percent (1-4%), which is much steeper than nearly all valley riverine drainage systems in central Arizona, which typically have slopes of less than one percent. Steep slopes are characteristic of alluvial fan landforms, which provide a transition from steep mountain slopes to flatter axial valley streams. The drainage pattern on the White Tank Piedmont includes vast areas of distributary channels, as illustrated by the plot of flow bifurcations in Figure 6.6 and the stream channel network plot shown in Figure 6.7. Surficial characteristics indicative of an alluvial fan landform observed in the study area on aerial photographs and in the field included non-linear (i.e., riverine) and radial surface distributions, low divides between adjacent flow paths, small poorly integrated channels, perched flow paths, decreasing channel widths and depths in the downstream direction transitioning to sheet flow, and a rapid decrease in bed sediment sizes.

Based on the analysis of the topographic and morphologic data, it is concluded that the shape of the White Tank Piedmont meets the PFHAM/FEMA Guidelines definition of an alluvial fan landform.

6B.4.3 Location

The NRC (1996) definition of an alluvial fan landform states that "alluvial fan landforms are located at a topographic break where long-term channel migration and sediment accumulation become markedly less than upstream of the break." The White Tank Piedmont abuts the steep mountain front of the White Tank Mountains as indicated by the change in the topographic contour density shown on Figure 6.5. The mountain front is deeply embayed, which reflects the age and long erosion history of the mountains and creates a sinuous upstream boundary at the topographic break. At the mountain front, the fluvial environment transitions from one of net erosion and bedrock outcrop to a depositional environment and alluvium.

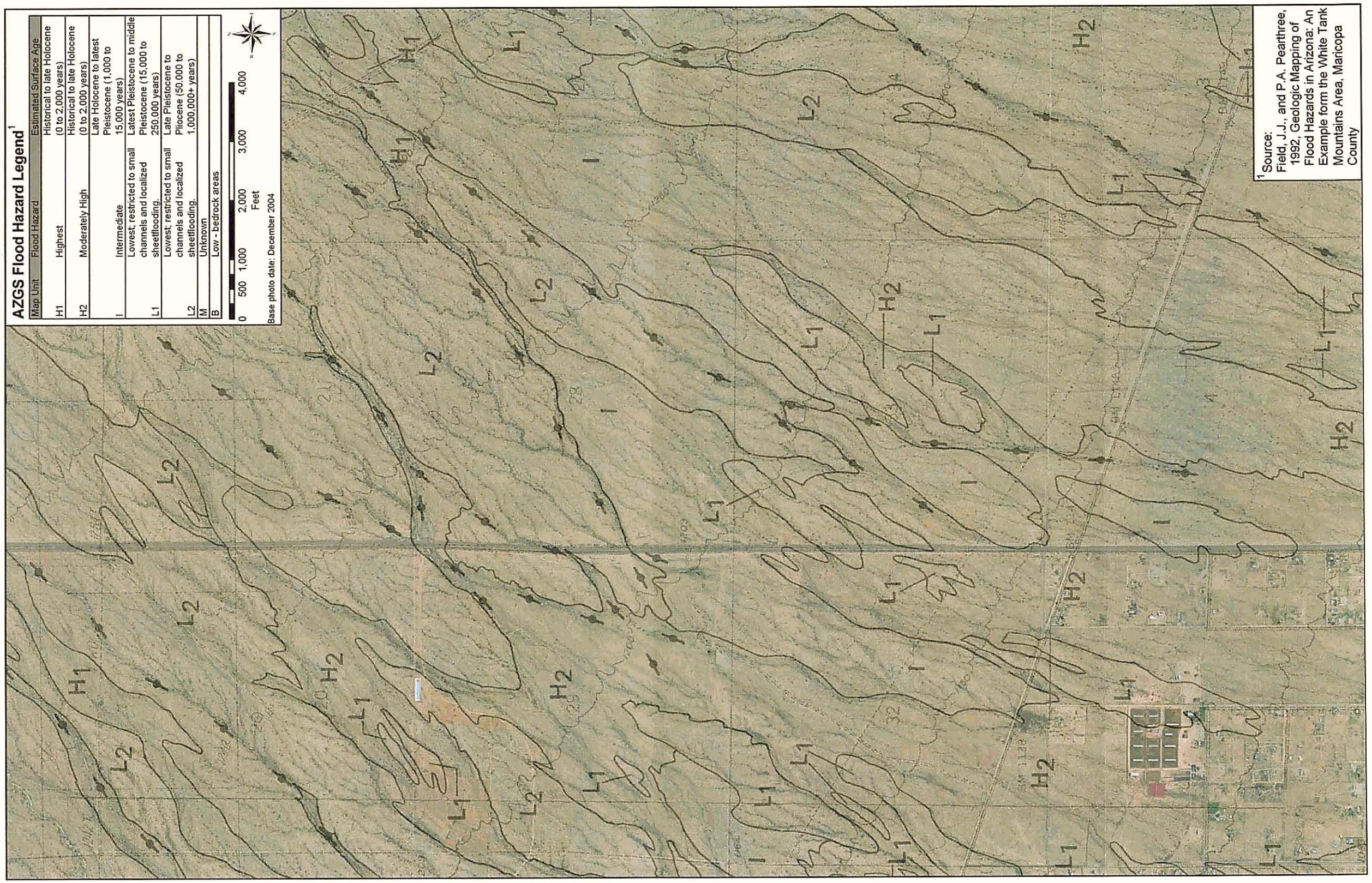


Figure 6.3. Example of AZGS Flood Hazard mapping within the SVADMP study area

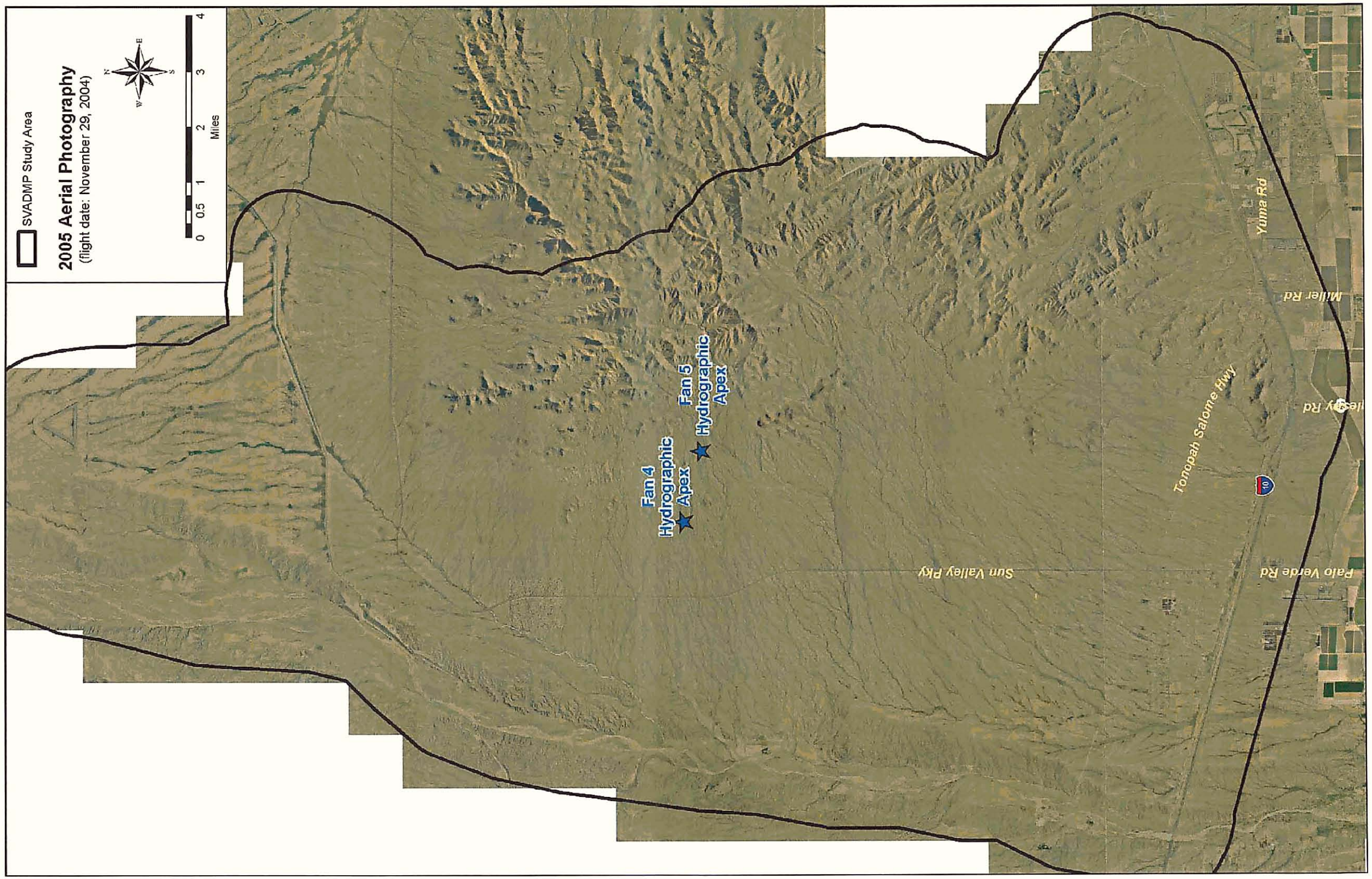


Figure 6.4. 2005 aerial photography

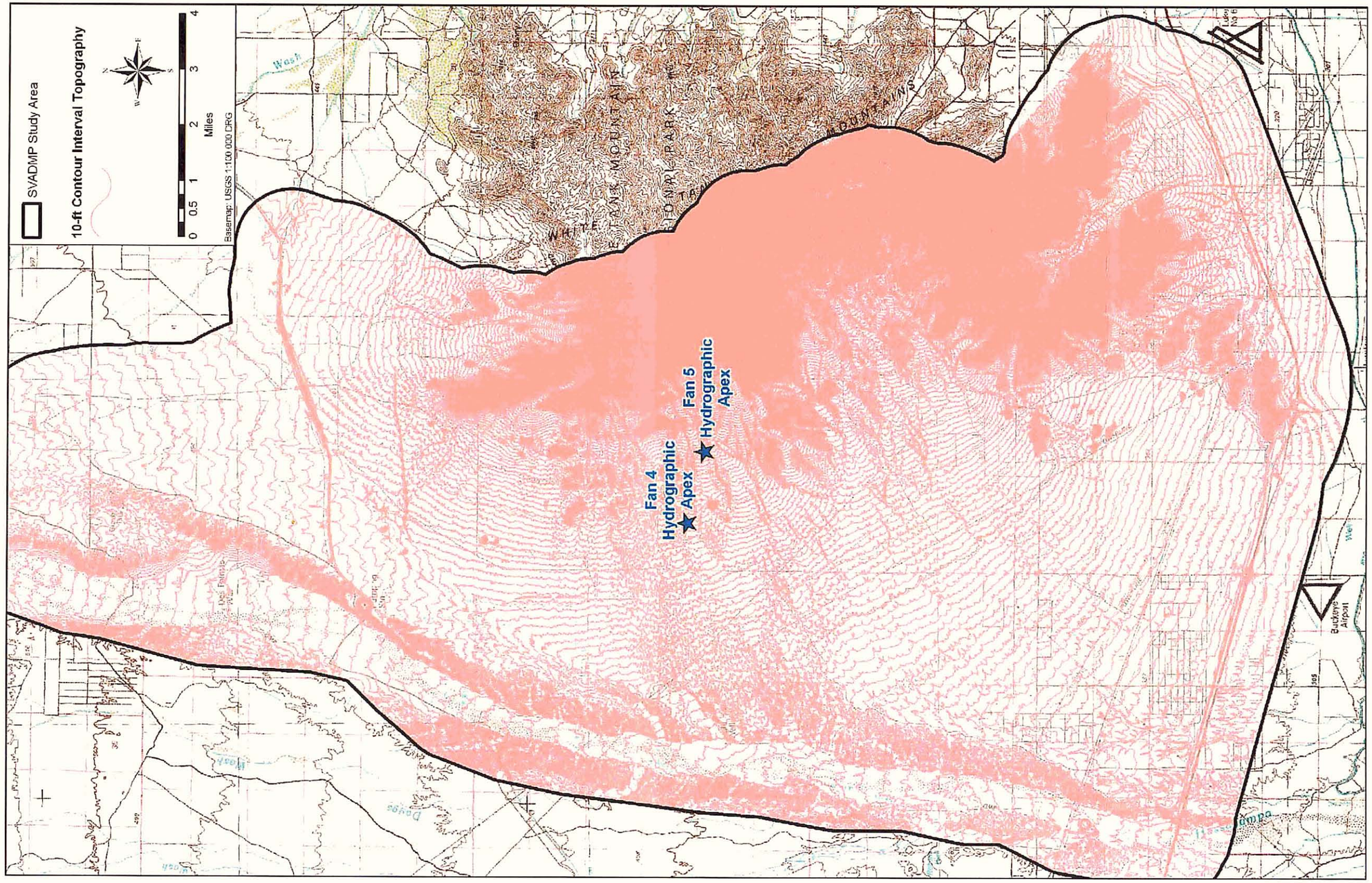


Figure 6.5. 10-foot contour interval topography

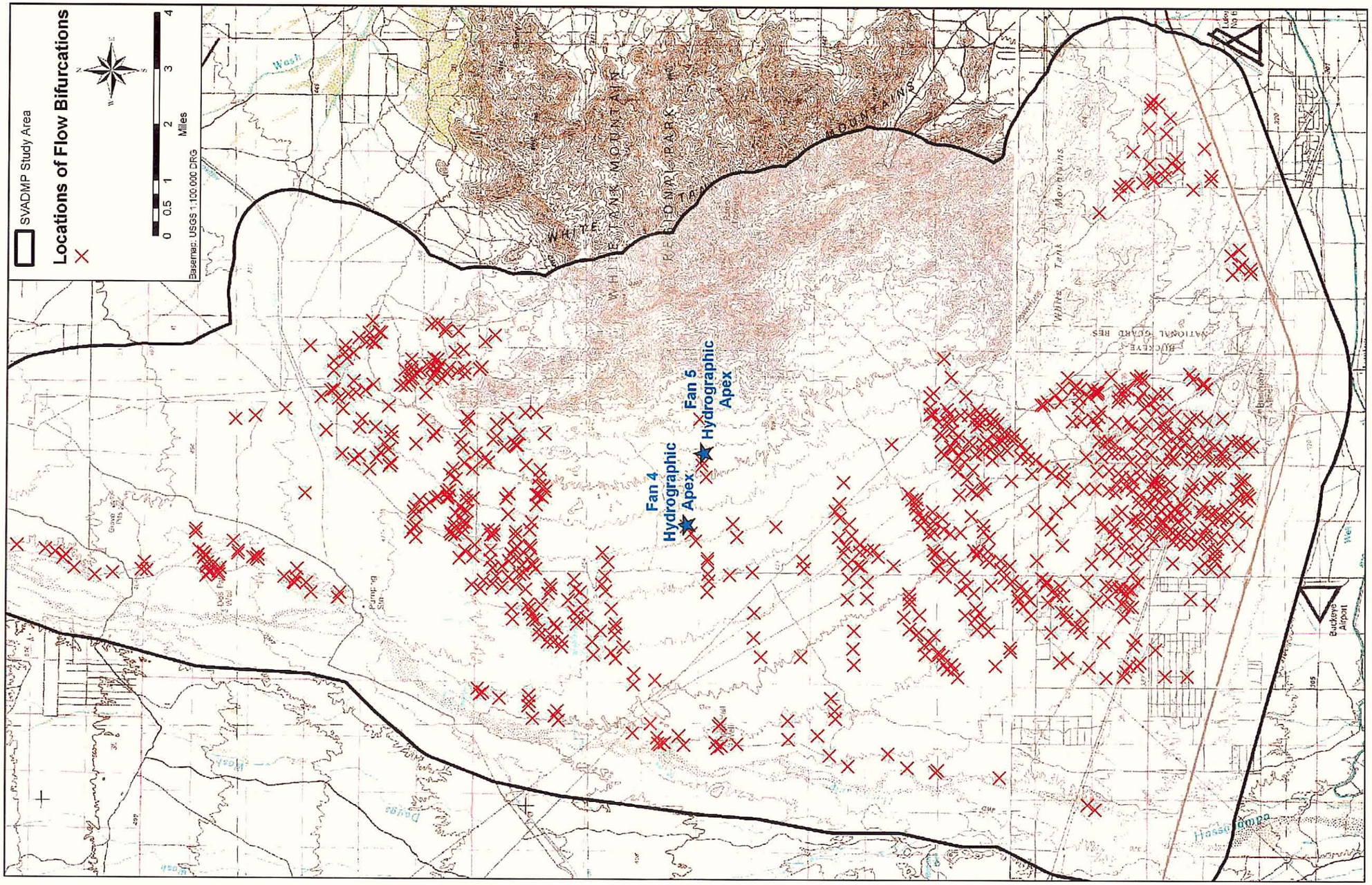


Figure 6.6. Locations of flow bifurcations

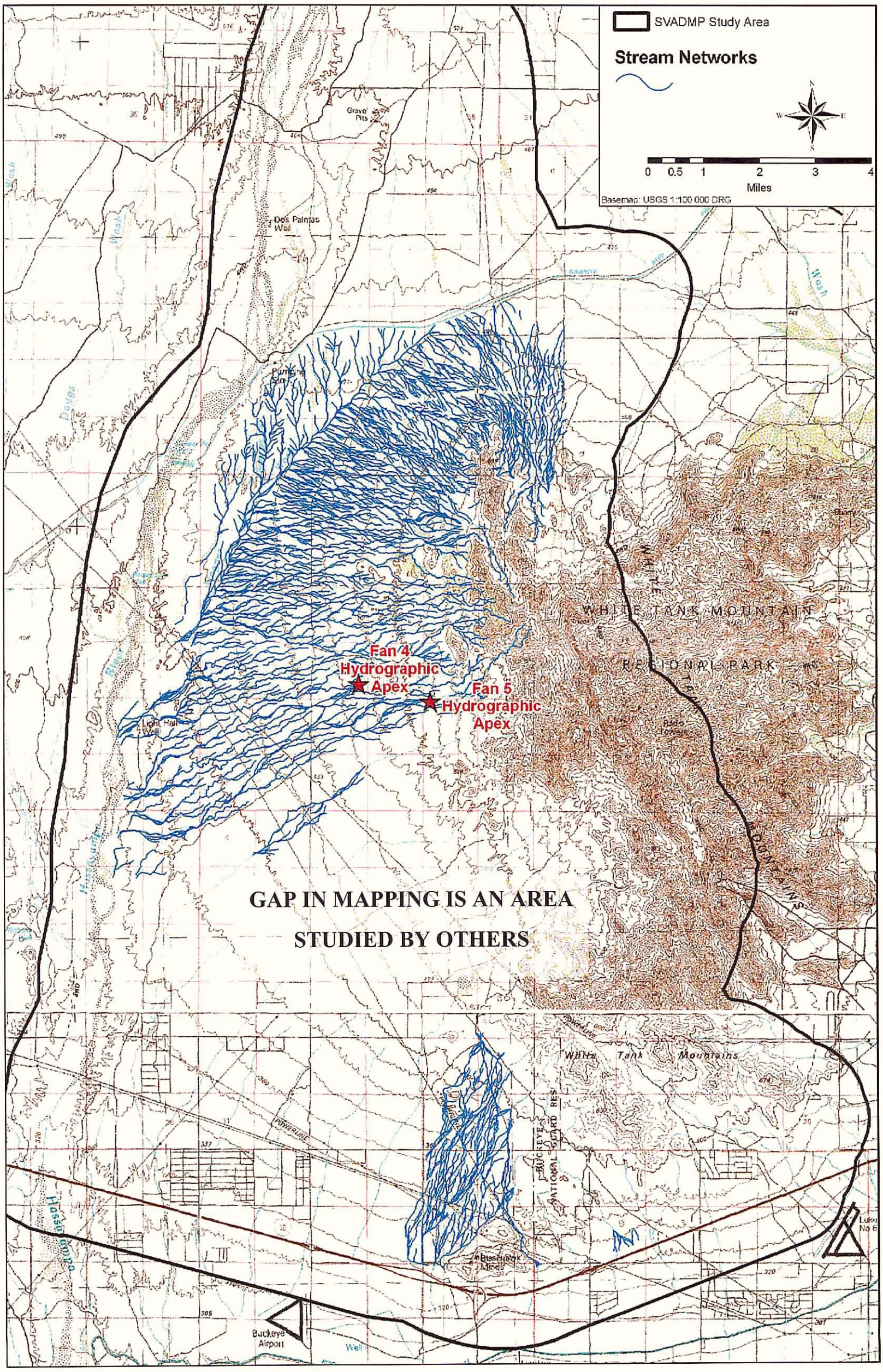


Figure 6.7. Stream channel networks

Fan 4 & 5 Approximate FDS
Sun Valley ADMP

A second topographic break occurs at the toe of the piedmont where alluvial fan landform is truncated by Wagner Wash and the Hassayampa River, the (riverine) axial valley streams.

6B.4.4 Hydrographic and Topographic Apex Location

Topographic apexes occur at the mountain front, and represent the extreme upstream extent of the alluvial fan landform. For the White Tank Piedmont, the topographic apexes reflect locations where deposition of alluvium began in the geologic past. In all cases, the topographic apexes are located on relict or inactive alluvial fans, and are well upstream of the hydrographic apexes. Topographic apexes were identified by aerial photograph interpretation, consideration of AZGS surficial and geologic mapping, field observations, and review of topographic and morphologic features in the study area. The topographic apex locations identified for the White Tank Piedmont are shown in Figure 6.8.

Hydrographic apexes are located at the highest point on an alluvial fan landform where there is physical evidence of flow bifurcation and/or significant flow outside the defined channel. The hydrographic apexes were defined by plotting the location of flow bifurcations observed on aerial photographs (Figure 6.6), in conjunction with field observations and geomorphic mapping. In some cases, the point of flow bifurcation is indicated a split stream symbol or a stippled pattern (deposition) on the USGS topographic maps. Interestingly, the longitudinal profiles often have a slight hump at the hydrographic apex, which probably reflects recent local aggradation. Experience indicates that the hydrographic apexes should be located where the Holocene surfaces that bound the main channels are pinched out by older, stable surfaces, points which are often upstream of the existing flow bifurcations (JEF, 2000). These Holocene surfaces represent areas that are still receiving alluvial deposits and are subject to overbank flows, and thus are vulnerable to flow path movement, either by avulsion or piracy. In some cases, the upstream limits of the Holocene surfaces were coincident with the flow bifurcation points. The hydrographic apex locations identified for the White Tank Piedmont are shown in Figure 6.8, and use the alluvial fan naming conventions established by Hjalmarson and Kemna (1994) and continued by Ayres (2004) for the Sun Valley Buckeye ADMS. Note that five new hydrographic apexes were defined (#16-20) by JE Fuller/Hydrology & Geomorphology, Inc. for the Sun Valley ADMP.

6B.4.5 Boundaries

The lateral and distal limits of the White Tank Piedmont alluvial fan landform were determined from examination of the NRCS soil and AZGS surficial geologic mapping, field observations, interpretation of recent and historical aerial photographs, and experience. The extreme northeast lateral limit of the landform shown in Figure 6.9 were dictated by the scope of services, but were extended to logical limits with defined physical characteristics. That is, the White Tank Piedmont also extends along the east flank of the White Tank Mountains, but that area is outside the limits of the currently authorized study. The southeast study limit was extended to a bedrock ridge that extends from the mountain area to the FRS just west of Skyline Wash (Figure

6.10). The northeast study limit was extended to the margin of the active alluvial fan surfaces that topographically and geologically abuts active flow paths that originate at Fan Site #2 (Figure 6.11)..

The upper limit of the White Tank Piedmont alluvial fan landform is defined by the mountain front, as indicated by the topographic break described above. The toe or distal terminus of the White Tank Piedmont alluvial fan landform is defined by the intersection of the long sloping piedmont plain with the flatter slopes of the Hassayampa River and White Tank Wash floodplains on the west, the Wagner Wash floodplain to the west and north, and the Gila River geologic floodplain on the south. In the existing condition, the Buckeye FRS truncates the southern margin of the White Tank Piedmont, and now forms the effective toe of the alluvial fan landform, at least with respect to alluvial fan flooding. The Buckeye FRS impounds, stores and diverts the entire 100-year hydrograph and sediment load.[1] Further, the Flood Control District of Maricopa County established the FRS as the downstream limit of study for the Sun Valley ADMP floodplain mapping tasks.

6B.4.6 Conclusion

The NRCS soil mapping, AZGS surficial geologic mapping data, and field observations clearly show that the White Tank Piedmont is composed of sedimentary deposits (alluvium). The topographic mapping shows that the White Tank Piedmont landform is located at the base of a mountain front and has the shape of a partially extended fan, has steep slopes, and radiating contours. Morphologic data, such as the drainage pattern, surface distribution, relief, and channel geometry, are also characteristic of an alluvial fan landform. Therefore, it can be concluded that, with the exception of a few bedrock islands, the White Tank Piedmont in the study area is an alluvial fan landform.

6B.5 Stage 2: Defining Active and Inactive Areas

Stage 2 of the PFHAM/FEMA alluvial fan methodology consists of defining active and inactive areas within specific portions of the White Tank Piedmont alluvial fan landform, as well as characterizing the nature and types of flooding that are associated with a specific hydrographic apex. The hydrographic apexes for Fan 4 and 5 were identified in the Stage 1 analysis and are located as shown in Figure 6.8. Active areas on an alluvial fan consist of those portions of the landform where uncertainties about channel geometry and hydraulic conditions of water and sediment discharge cannot be realistically set aside in the assessment of the flood hazard. Active areas on alluvial fans experience sediment deposition, erosion and unstable flow paths in addition to flood inundation. Inactive alluvial fan areas are the portions of the alluvial fan landform where active fan processes do not occur. Inactive portions of the alluvial fan are those areas where flow path uncertainty can "be set aside in realistic assessments of flood risk.

[1] Studies are currently underway by the Flood Control District of Maricopa County to evaluate the Probable Maximum Flood (PMF) capacity of the Buckeye FRS and to upgrade, repair, or replace the FRS. Regardless of the outcome of the PMF and FRS evaluation, the FRS is known to control at least the 100-year event and remove any alluvial fan flooding from downstream reaches.

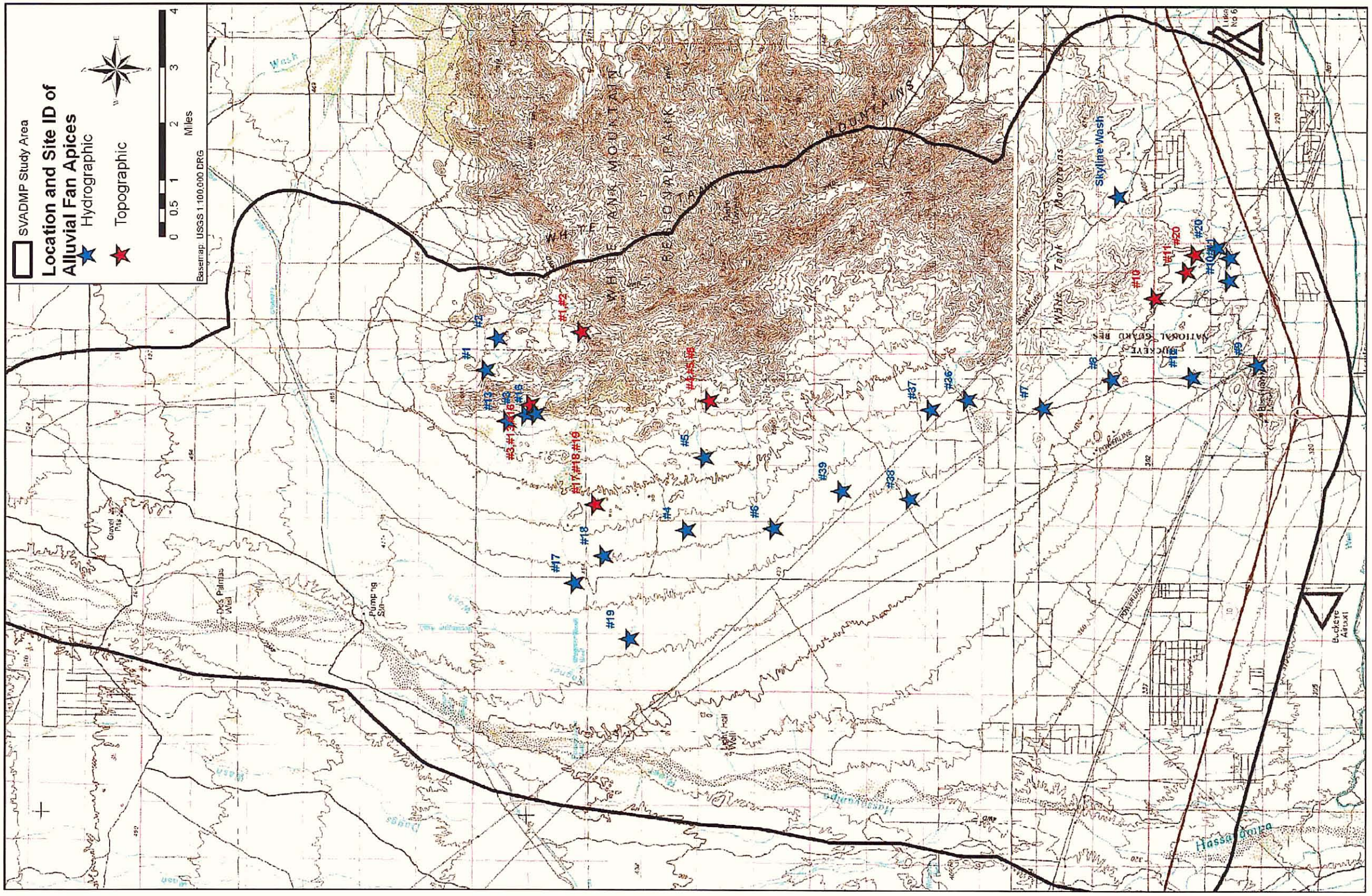


Figure 6.8. Alluvial fan apex locations

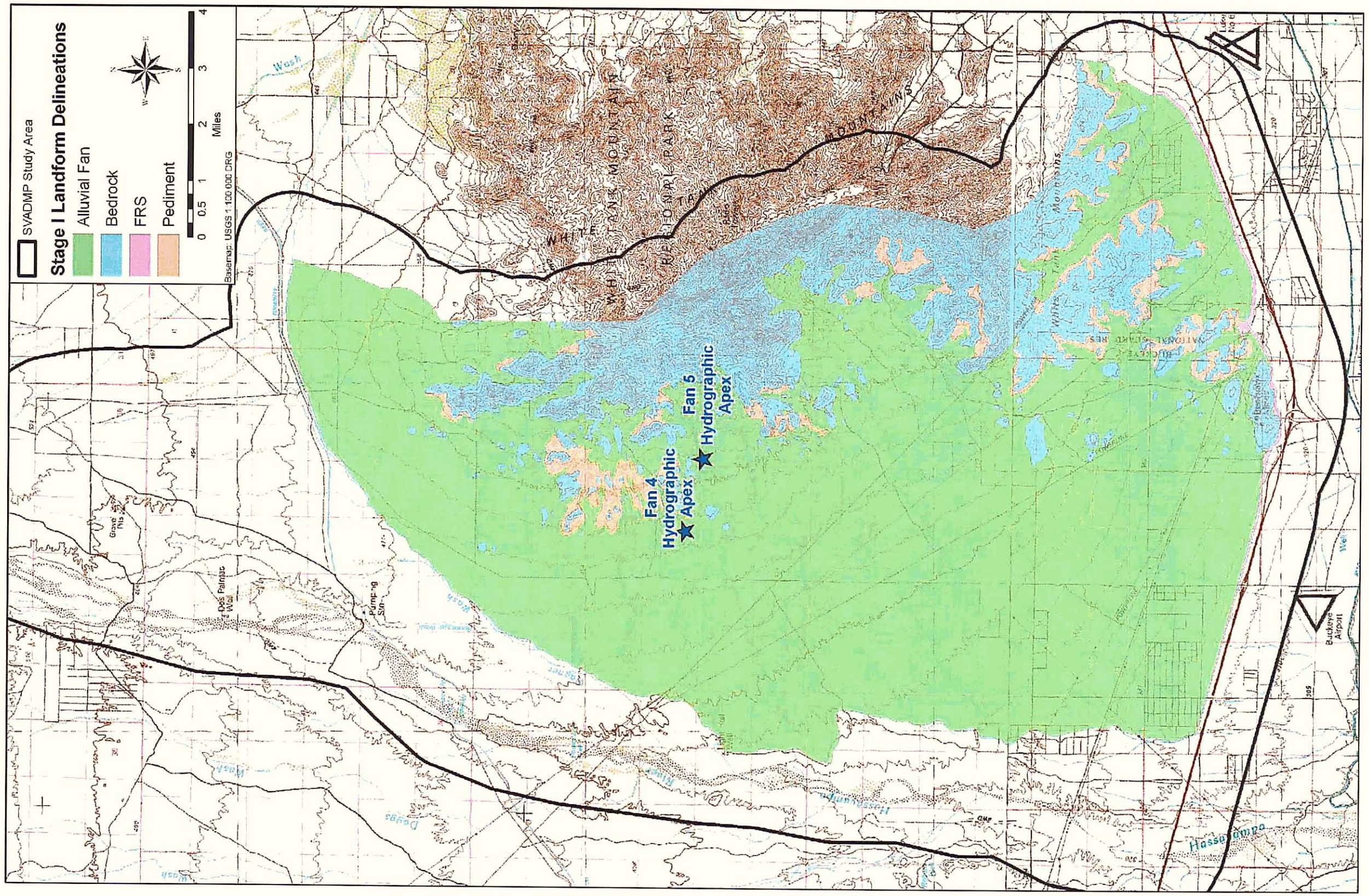


Figure 6.9. Stage I delineations

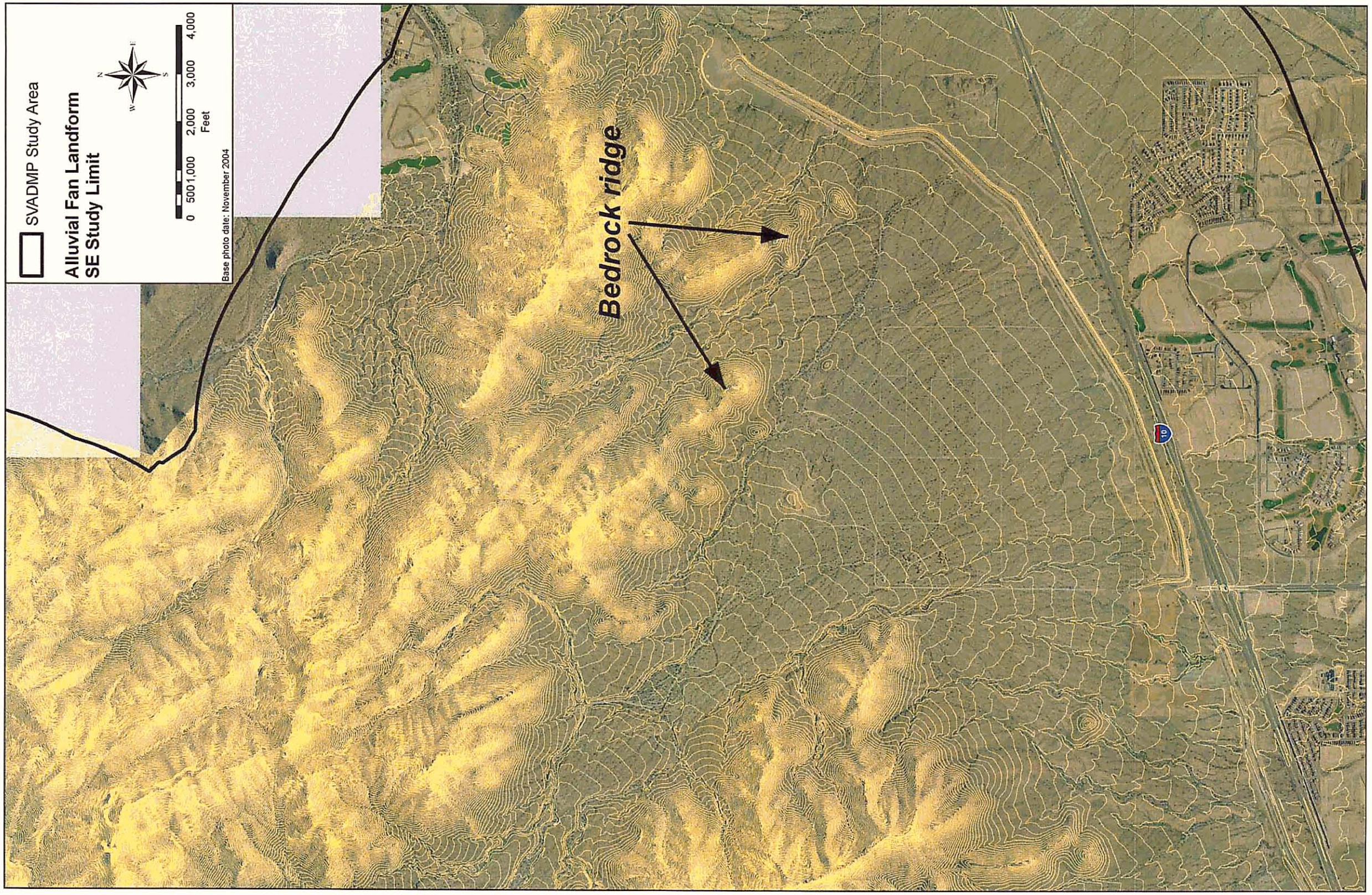


Figure 6.10. Close-up of SE study limit

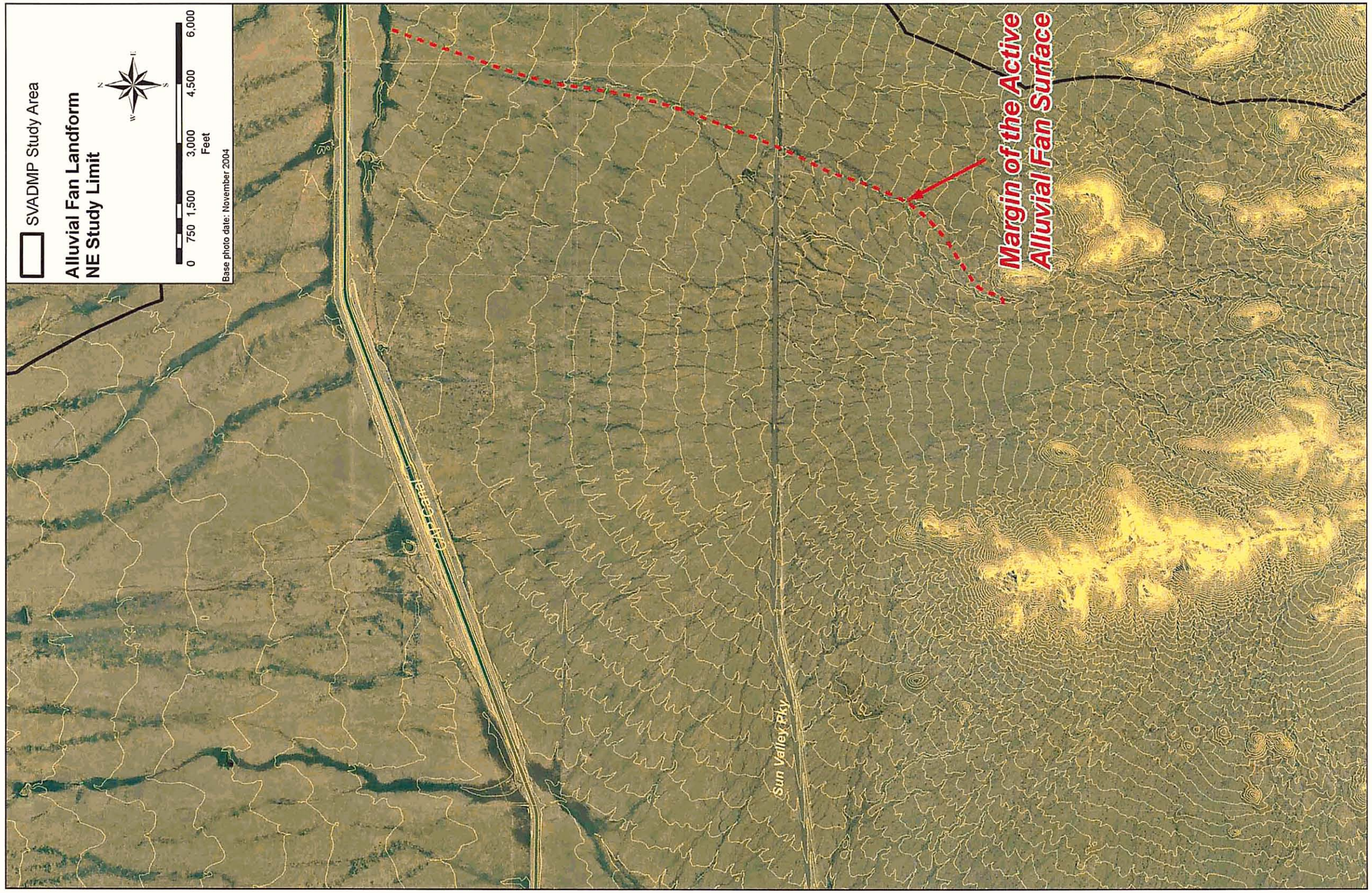


Figure 6.11. Close-up of NE study limit

6B.5.1 Overview of Stage 2 Methodology Concepts

The physical characteristics of a landform provide clues as to its depositional history, existing level of stability, and future flood potential. If a portion of the landform becomes isolated from its original watershed and watercourse, it ceases to receive new deposits and its surface will begin to age and develop specific physical characteristics indicative of its age. These physical characteristics include soil profile development, an integrated tributary drainage network, desert varnish, desert pavement, topographic relief, color, and distinctive vegetative suites.

In a semi-arid environment like that of the White Tank Piedmont, the degree of soil development is directly proportional to surface age. As the surface ages, a soil profile develops, and its structure, color and content changes. Clay and calcium carbonate accumulate in the soil from aeolian sources and chemical weathering of the parent material, forming distinct soil horizons (Figure 6.12). The degree of soil profile development, particularly in the clay and carbonate horizons, can be used as a proxy for surface age. The soil surface also tends to become reddish in color with time due to oxidation of iron (rubification) as well as accumulation and weathering of clay. Young, active surfaces lack soil profile development, and on active alluvial fans consist of stream bed alluvium (Figure 6.13).

Geomorphic surfaces may also develop an accumulation of pebbles and cobbles at the surface as they age. These gravel coverings are known as desert pavement, which form as a byproduct of windblown silt and clay accumulation in the soil column. Repeated wetting by precipitation causes the fine-grained materials to swell, lifting the larger gravels to the surface. Repeated surface drying creates cracks into which more fine windblown material may accumulate. Over thousands of years these processes form a mantle of closely packed gravels that resembles asphalt pavement (Dohrenwend, 1987; Vanden Dolder, 1992). The pebbles and cobbles that form the pavement surface, if they contain sufficient ferromagnesian minerals, will develop a dark black patina on their tops and an orange coating underneath that is known as desert varnish (Figure 6.14).

Landform surfaces free from new deposition will also begin to erode due to direct rainfall and the ensuing runoff on the surface. As the surface erodes, new tributary channel networks develop which become more incised and integrated with time. The channels gradually deepen and widen, creating a greater degree of relief between the channel bottoms and the ridges which separate them. The degree of relief can be directly observed in the field or on aerial photographs (Figure 6.15), but can also be detected by the examining the crenulation (curviness) of topographic map contours (Figure 6.16).

The degree of relief of an apparently inactive landform relative to adjacent active, young surfaces is also an important characteristic. Because active alluvial fans are aggrading landforms, it follows that some older surfaces may gradually become buried by sediment deposition derived from the adjacent younger active alluvial fan (Figure 6.17). Therefore, where there is little topographic difference between younger and older

surfaces, the investigator must take care to evaluate the rate of, and potential for, long-term aggradation of the fan (Figure 6.18). Typically, the rate of fan aggradation is greatest near the hydrographic apex, with lower accumulation rates as the distance from the apex increases and/or the active fan widens.

In a semi-arid environment, it takes thousands of years for many of these geomorphic characteristics to develop. Therefore, surfaces that exhibit well developed soils, red color, significant carbonate development, desert pavement composed of strongly varnished gravels, and tributary drainage networks have been relatively free from flooding for thousands of years. These features provide a record of non-inundation that extends back thousands of years. The non-inundation record can be interpreted and used as a historical record of fan behavior in the same way as historical records of flood peaks are used to predict future flood peaks. As such, without external disturbance, it can be reasonably assumed that the flood hazard potential on geomorphically old (stable) surfaces will be low in the future.

The NRCS soils survey data and AZGS surficial geology mapping differentiate surfaces based on the types of geomorphic characteristics discussed above. Therefore, the map data also provide information about surface age, stability, and flood potential. Young surfaces with little soil development are likely to continue to experience flood inundation, sediment deposition, and channel movement. Older surfaces are unlikely to experience such processes. Older surfaces with cemented soils and entrenched channels also tend to be more stable because their soils are more resistant due to the cohesion provided by clay, carbonate, and pavement, as well as due to containment of flow within defined, vegetation-lined channels. That is, the likelihood of the channel changing its location over time is greatly diminished. Conversely, areas with non-cohesive, coarse soil materials and little lateral relief are more susceptible to lateral changes in channel position.

Active alluvial fans are those where the uncertainty associated with flow path location is so great that it cannot be set aside in realistic assessments of the flood risk. Where risk of flow path change is not so great, that portion of the alluvial fan landform is considered inactive. The Stage 2 geomorphic analyses are intended to distinguish active, unstable, young landforms from inactive, stable, or old landforms.

Figure 6.12. Typical Pleistocene-Aged (Inactive Surface) Soil Profile With Well-Developed Carbonate and Clay Horizons.

Figure 6.13 Typical Late Holocene-Aged (Active Surface) Soil Profiles With No Soil Development.

Figure 6.14. Varnished Desert Pavement Surface on Inactive Portion of an Alluvial Fan Landform. Note the reddened clay-rich soil excavated from the soil pit.

Figure 6.15. Aerial Photograph Showing Tributary Drainage Network on Old, Inactive Surface Adjacent to Distributary & Sheet Flow Pattern in Active Area.

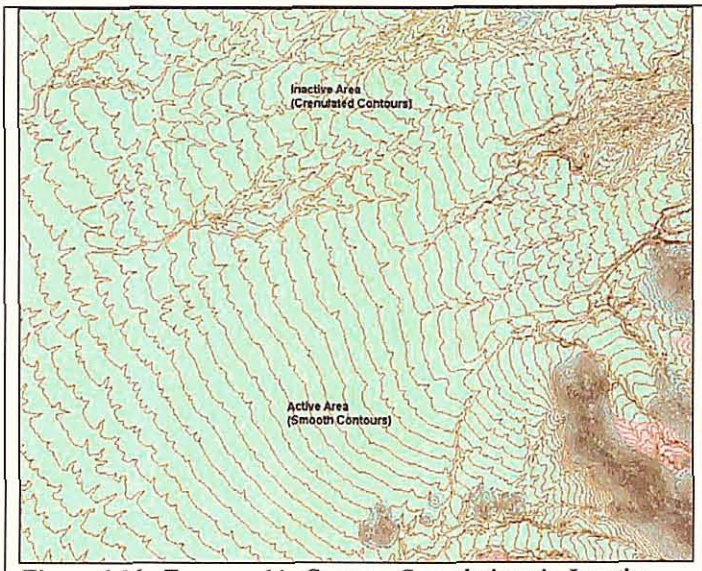


Figure 6.16. Topographic Contour Crenulations in Inactive and Active Areas of an Alluvial Fan Landform.

Figure 6.17. Photograph of Older Varnished Pavement Surface Partially Buried by Recent Flood Deposition (Tiger Wash, Maricopa County, Arizona).

Figure 6.18. Photograph of Active Surface Topographically Confined by Older Surface.

6B.5.2 Overview of Flooding on Fan 4 and 5 Piedmont Areas

Fan 4 and 5 are located within the central portion of White Tank Mountain piedmont, in Township 2 North, Range 4 West, Section 6; Township 2 North, Range 5 West, Sections 1 and 2; Township 3 North, Range 4 West, Sections 19 through 33; and Township 3 North, Range 5 West, Sections 25, 26, 35 and 36. The topographic apex for both fans is located at the mountain front-piedmont boundary in Township 3 North, Range 4 West, Section 25 (Figure 6.8). The hydrographic apex for Fan 5 is located in Township 3 North, Range 4 West, Section 26, approximately two miles downstream from the topographic apex. The

hydrographic apex for Fan 4 is located in Township 3 North, Range 4 West, Section 21; three miles from the topographic apex.

Between the topographic apex at the mountain front and the hydrographic apex, flood flow is conveyed in a well-defined tributary drainage system. Channel depths for Fan 5 range from approximately eight to 10 feet near the topographic apex to five to six feet immediately upstream of the hydrographic apex. Channel depths for Fan 4 range from eight to 10 feet near the topographic apex to three to four feet immediately upstream of the hydrographic apex. Channel slopes above the hydrographic apex are 0.016 feet/feet and 0.028 feet/feet for Fan 4 and 5 respectively; both decreasing in the downstream direction.

At the hydrographic apexes, the drainage networks changes from a well-defined tributary pattern to an unconfined distributary pattern forming active alluvial fans. The drainage area above the Fan 4 hydrographic apex is 2.2 square miles, and above the Fan 5 hydrographic apex is 3.6 square miles. The alluvial fan areas below the hydrographic apexes are 1.0 and 0.9 square miles for Fan 4 and 5 respectively. The active alluvial fan areas downstream of the hydrographic apexes are bounded laterally by older, stable surfaces with tributary drainage patterns. At approximately 1.5miles downstream from the hydrographic apex, Fan 4 transitions into a series of well-confined, single channel flow corridors, some of which combine with Fan 5, and others that merge into a single channel that extends for approximately two miles before transitioning back to an alluvial fan landform immediately upstream of the Hassayampa River confluence. At approximately 1.6 miles downstream of the hydrographic apex, Fan 5 transitions into a series of single channel corridors that return to an alluvial fan landform immediately downstream of Sun Valley Parkway, then transition back to single, confined channel until approximately 2 miles upstream of the Hassayampa River where the single channels transition back to an alluvial fan.

6B.5.3 Identification of Active Areas

Field and Pearthree (1991) suggest that the younger sediments (active areas) on the lower portions of the White Tank Piedmont are eroded primarily from older surfaces in the middle and upper piedmont at or below the hydrographic apex, rather than from the upper mountain watershed. During more the frequent runoff events, flood water and sediment originate from both the middle and lower piedmont. Only the largest, most rare runoff events translate significant flood water and sediment across the entire piedmont downstream of the hydrographic apex to the toe of the piedmont. High infiltration rates in the broad areas of sand and gravel within the active areas transmit the most frequent runoff events into the subsurface before runoff can pass to the lower piedmont. Channel sediment size decreases down piedmont, yielding lower infiltration rates. Therefore, while it is concluded that the Fan 4 and 5 piedmont areas are mostly eroding landforms, [1] some

[11] Note that this statement applies to the whole of the piedmont landform (Stage 1), rather than the active alluvial fan area (Stage2).

level of aggradation and active alluvial fan flooding occurs in the areas immediately downstream of the hydrographic apexes, covering a limited area of the total Fan 4 and 5 landforms (Figure 6.19).

The limits of the active areas of the Fan 4 and 5 alluvial fans are shown in Figure 6.19. These areas were identified through the use of NRCS soils surveys, AZGS surficial geology mapping, historical aerial photographs, interpretation of USGS 7.5 minute contour maps and FCDMC 10-ft contour interval topographic mapping, field observations, surficial characteristics, and other geomorphic features. The relationship of each of these types of evidence to the limits of active and inactive areas is discussed below.

6B.5.3.1 NRCS Soils Data

The active areas Fan 4 and 5 are mapped on the NRCS soils maps (Figure 6.20) as Carrizo-Gunsight complex (15), Momoli-Carrizo complex (92), Sal-Cipriano complex (107), Gunsight-Rillito complex (71), Gilman loams (55), Antho gravelly sandy loams (2), and Brios-Carrizo complex (11). The NRCS describes the Carrizo-Gunsight, Gilman loams, Antho gravelly sandy loams, and Brios-Carrizo soils (Table 6B.4) as young soils located on floodplains, alluvial fans, and active drainageways; consistent with active alluvial fan deposits. The majority of the active areas of Fan 4 and 5 are found within these soil units. The Momoli-Carrizo, Sal-Cipriano, and Gunsight-Rillito soils are described (Table 6B.4) older soils located on the tops of fan terraces. A likely explanation as to why some of the TDN active areas are found within these older soil units is that the mapping scale used by the NRCS was much smaller than used in the SVADMP study. Thus subtle differences near the margins of soil units may have been overlooked. The active area immediately downstream of Fan 5 was mapped entirely as Momoli-Carrizo soils (older soils on fan terraces). The area is clearly active as identified in the aerial photographs and in field verification. The AZGS also mapped the area as young, active deposits (Section 6B5.3.2). It is unclear why the NRCS mapped the area as older soils.

The inactive areas on Fan 4 and 5 bound the active areas laterally and in the upstream direction. The vast majority of the inactive areas adjacent to Fan 4 and 5 are underlain by the Sal-Cipriano and Gunsight-Rillito soils.

6B.5.3.2 AZGS Surficial Geology

The AZGS surficial geology mapping (Figure 6.21) shows three alluvial units (Qy2, Qy1, and Qi) in the vicinity of the Fan 4 and 5 active areas. Qy2 is the youngest unit, and is described as late Holocene, with active stream channel and alluvial fan deposits composed of sand, pebbles, and cobbles. Soil and desert pavement development on Qy2 surfaces is weak to nonexistent and channel patterns vary from anastamosing to distributary, with channel incision of up to 1.5 meters (4.9 feet).

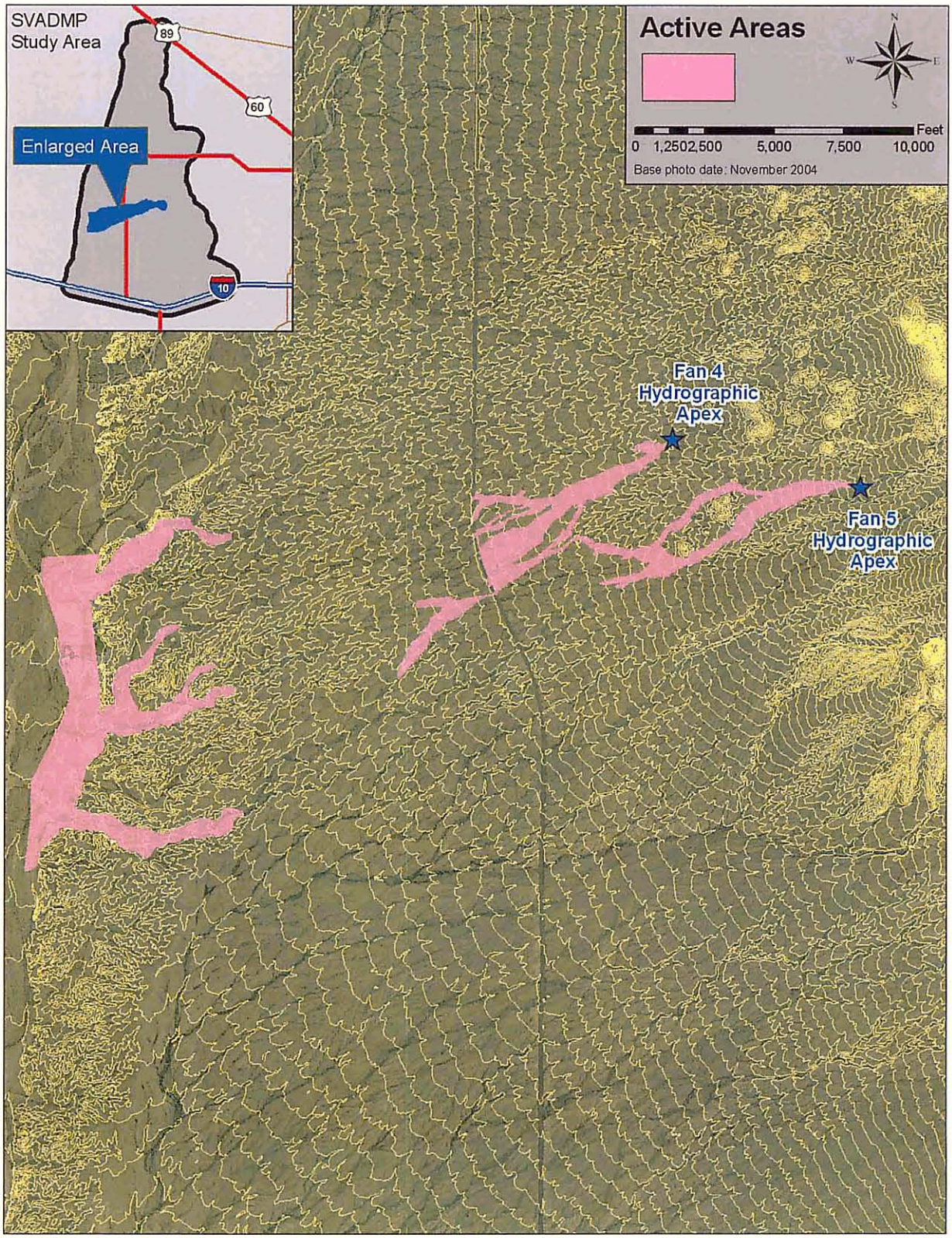


Figure 6.19. Fan 4 and 5 active areas

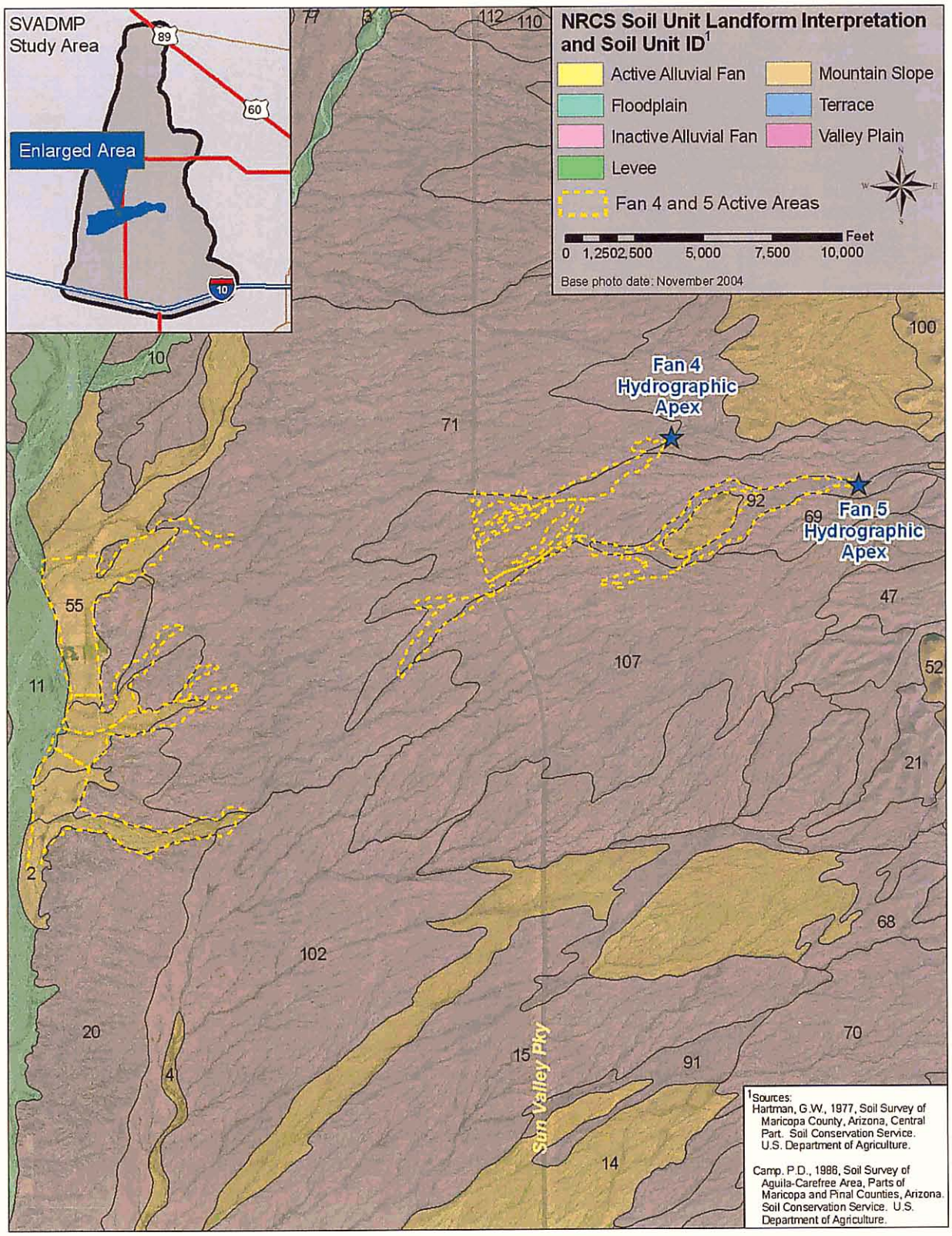
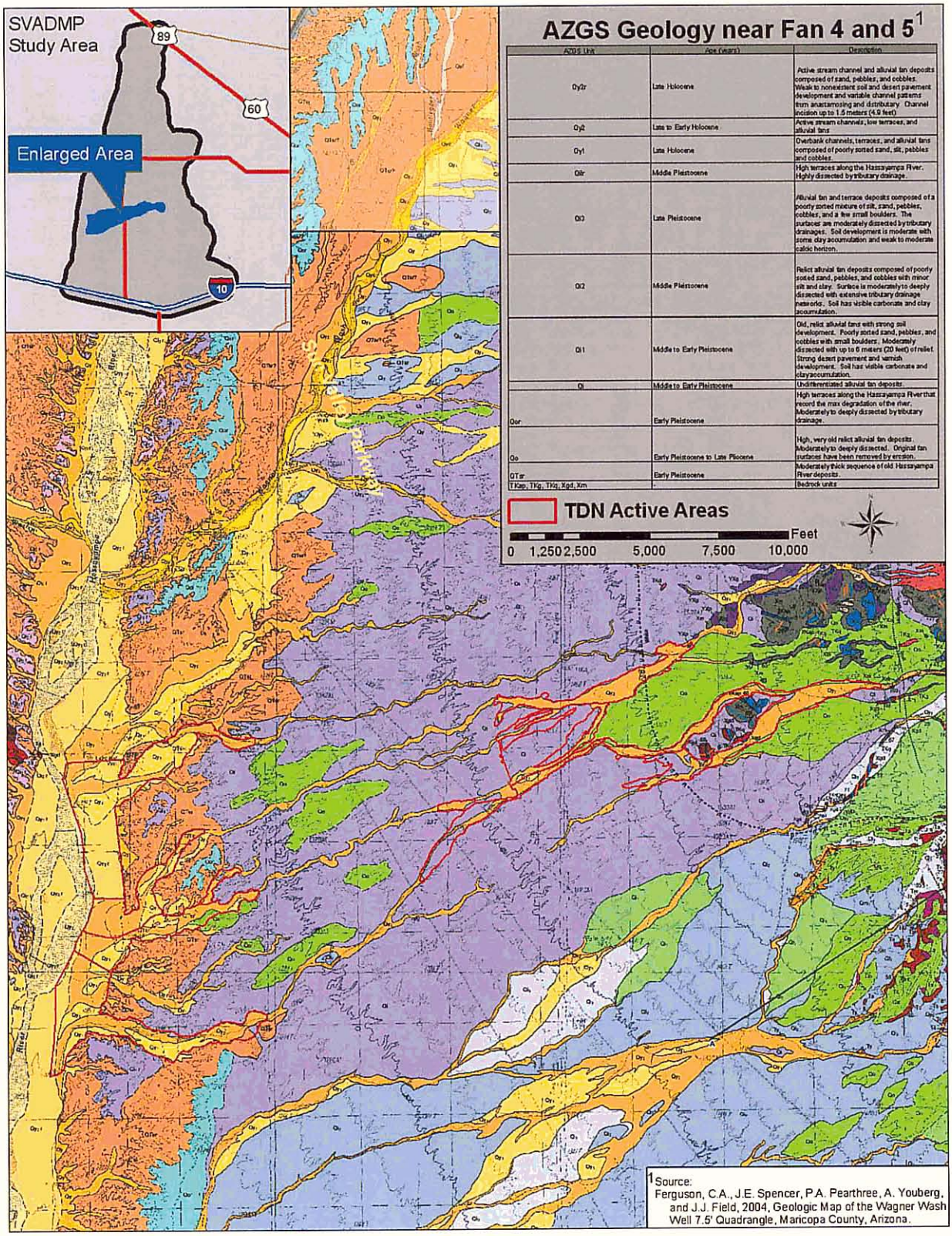


Figure 6.20. NRCS soils mapping for Fan 4 and 5



AZGS Unit	Age (years)	Description
Qy2r	Late Holocene	Active stream channel and alluvial fan deposits composed of sand, pebbles, and cobbles. Weak to nonexistent soil and desert pavement development and variable channel patterns from anastamosing and distributary. Channel incision up to 1.5 meters (4.9 feet)
Qy2	Late to Early Holocene	Active stream channels, low terraces, and alluvial fans
Qy1	Late Holocene	Overbank channels, terraces, and alluvial fans composed of poorly sorted sand, silt, pebbles and cobbles.
Qlr	Middle Pleistocene	High terraces along the Hassayampa River. Highly dissected by tributary drainage.
Ql3	Late Pleistocene	Alluvial fan and terrace deposits composed of a poorly sorted mixture of silt, sand, pebbles, cobbles, and a few small boulders. The surfaces are moderately dissected by tributary drainages. Soil development is moderate with some clay accumulation and weak to moderate calcic horizon.
Ql2	Middle Pleistocene	Relict alluvial fan deposits composed of poorly sorted sand, pebbles, and cobbles with minor silt and clay. Surface is moderately to deeply dissected with extensive tributary drainage networks. Soil has visible carbonate and clay accumulation.
Ql1	Middle to Early Pleistocene	Old, relict alluvial fans with strong soil development. Poorly sorted sand, pebbles, and cobbles with small boulders. Moderately dissected with up to 6 meters (20 feet) of relief. Strong desert pavement and varnish development. Soil has visible carbonate and clay accumulation.
Ql	Middle to Early Pleistocene	Undifferentiated alluvial fan deposits.
Qor	Early Pleistocene	High terraces along the Hassayampa River that record the max degradation of the river. Moderately to deeply dissected by tributary drainage.
Qo	Early Pleistocene to Late Pliocene	High, very old relict alluvial fan deposits. Moderately to deeply dissected. Original fan surfaces have been removed by erosion.
QTsr	Early Pleistocene	Moderately thick sequence of old Hassayampa River deposits.
TKap, TKg, TKq, Xgd, Xm	-	Bedrock units

Figure 6.21. AZGS surficial geology for Fan 4 and 5

The Qy1 surface represents overbank channels and terraces of late to early Holocene age, and is composed of poorly sorted sand, slit, pebbles and cobbles. The Qi unit is described as undifferentiated middle to late Pleistocene alluvial fan and terrace deposits. Similar to the NRCS mapping, the AZGS mapping was conducted on a much smaller scale than the SVADMP, thus subtle differences in AZGS surficial unit boundaries may have been missed.

The AZGS also prepared flood hazard mapping (Figure 6.22) for the White Tank Piedmont, including the area near Fan 4 and 5 in which three flood hazard zones were delineated. The majority of the active area of Fan 5 above Sun Valley Parkway was mapped as high hazard (H1), however the entire Fan 4 active area above Sun Valley Parkway was mapped as low hazard (L2). Again, this was likely due to the scale of mapping that was conducted. The active areas near the Hassayampa River confluence were mapped as high hazard for both Fan 4 and 5.

The NRCS and AZGS mapping, and the stable/unstable area delineations performed for this study are compared in Figure 6.23. The NRCS, AZGS, and TDN mapping are broadly similar. The minor differences are attributed to the lower resolution, small scale mapping performed by the NRCS and AZGS, as well as rectification issues associated with converting paper maps to digital coverages.

6B.5.3.3 Interpretation of Topography

Topographic data were available from USGS 7.5-minute quadrangle maps and from FCDMC 10-foot contour interval mapping (Figure 6.24). Topographic data can be used in the following ways to identify stable and unstable (active/inactive) portions of alluvial fan landforms:

- Contour crenulation. Contour crenulations are "wiggles" in topographic contour lines. Since older, stable surfaces tend to have greater internal relief, better developed drainage networks, and are largely erosive landforms, the contours over such surfaces are more crenulated. Contours over younger, active, unstable surfaces tend to be smoother, reflecting the more uniform, less incised topography.
- Contour shape. Contours on active, unstable alluvial fan surfaces tend to bend downstream (convex) in a smooth radial pattern. Contours on inactive or relict fans tend to be more parallel (or concave) to the mountain front.
- Contour direction. A marked change in the contour orientation occurs at the toe of the alluvial fan, where it enters the floodplain of the axial stream, which is frequently orthogonal to the fan contour orientation.
- Relief. The boundaries of active fan areas are typically confined by older, higher inactive surfaces which constrain alluvial fan flooding to topographically lower unstable surfaces. Topographic relief is addressed more directly in the Stage 3 analysis.

- Longitudinal profile. A longitudinal profile is a plot of elevation versus distance. A profile of an actively aggrading alluvial fan usually in convex (steepens downstream), whereas inactive alluvial fans typically have concave profiles (flattens downstream).
- Map symbols. Symbols on the USGS topographic maps useful for fan identification include stream channel bifurcation, stippling of depositional areas, termination of stream symbols in the downstream direction,

The topographic contours within the active, unstable area of Fan 4 and 5 are less crenulated than the adjacent, stable portions of the piedmont, indicating that the most active surfaces are not incised and that the flow paths are shallow with significant overland and sheet flow components. The topographic data indicate that the inactive portions of the piedmont are incised up to 10 feet in the upper piedmont and in excess of 30 feet in the lower-post piedmont. In addition, the topographic contours bend slightly downstream within the active portions of fans.

The topographic data for the fan also helps define the fan boundaries. The degree of relief at the margins of the active portions of Fans 4 and Fan 5 generally decreases in the downstream direction until the area immediately upstream of the Hassayampa River in which local relief dramatically increases.

The longitudinal profile for Fan 4 (Figure 6.25) has slight concave up profile, which is not a classic indicator of an active alluvial fan, although there are several bulges in the profile including upstream of Sun Valley Parkway, and again upstream of the Hassayampa River confluence. The longitudinal profile for Fan 5 (Figure 6.25) has a stronger concave up profile, with a few slight bulges near the downstream end. The USGS topographic maps do not have any map symbols indicative of active alluvial fans in the vicinity of Fan 4 and 5.

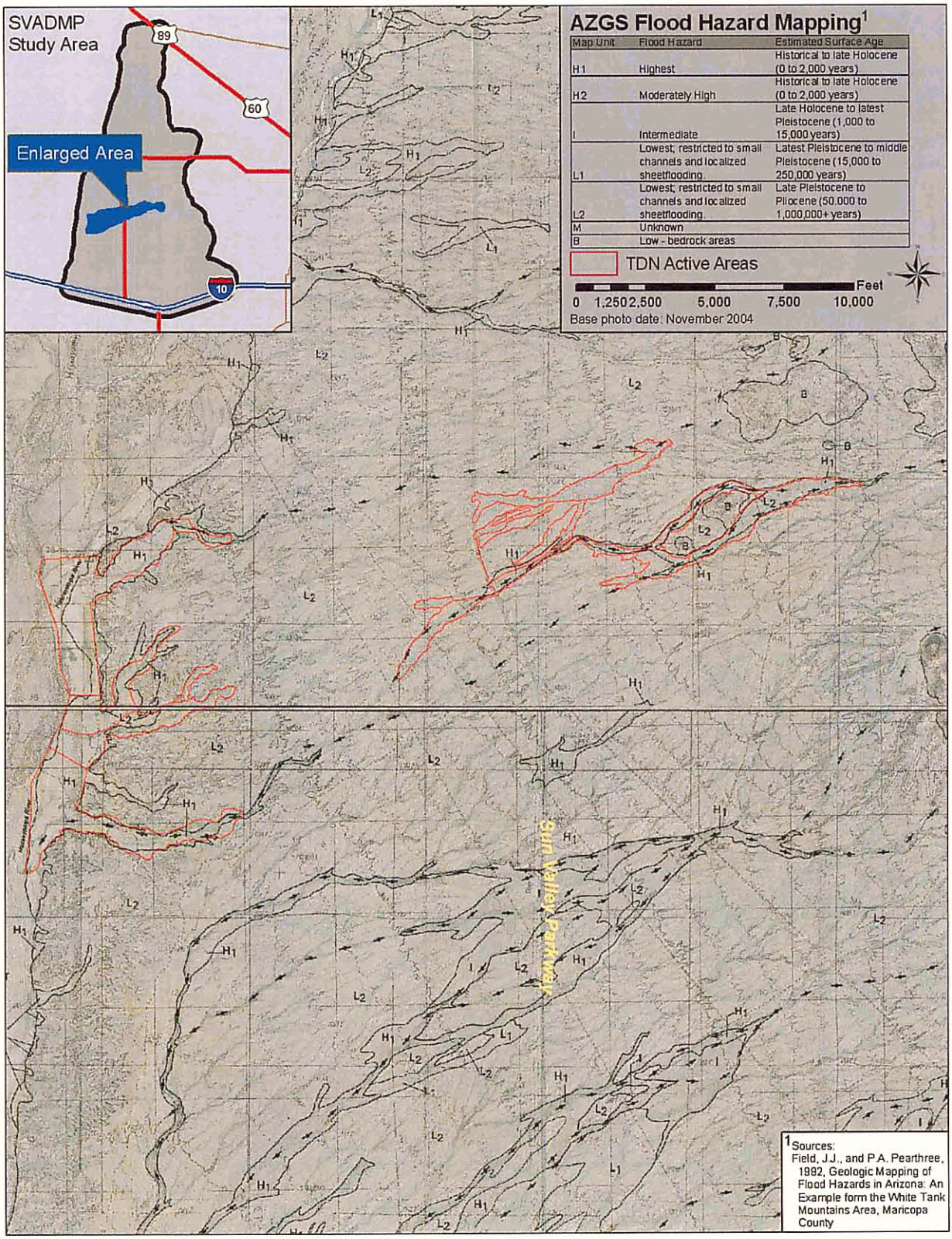


Figure 6.22. AZGS flood hazard mapping near Fan 4 and 5

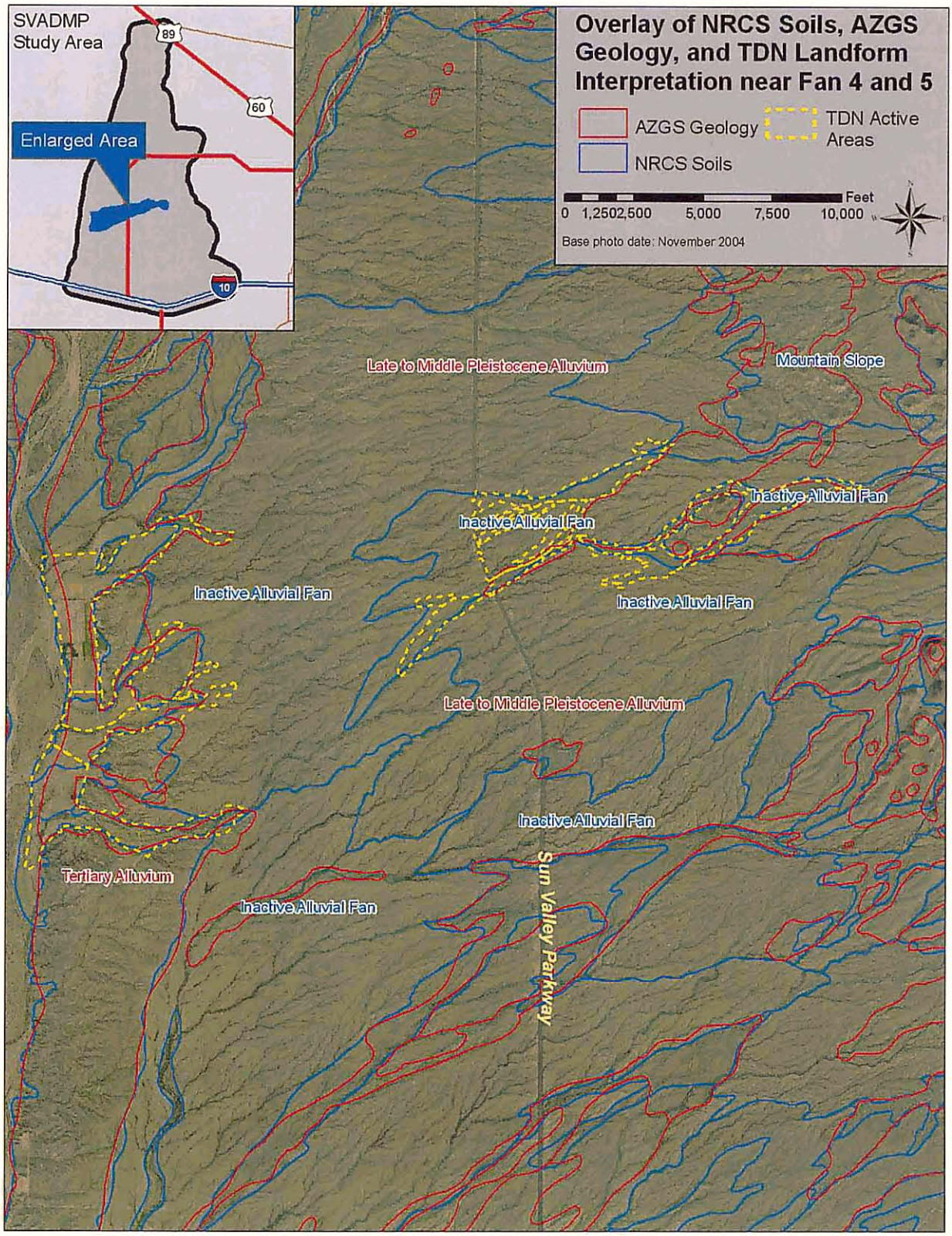


Figure 6.23. NRCS, AZGS and unstable area mapping overlay

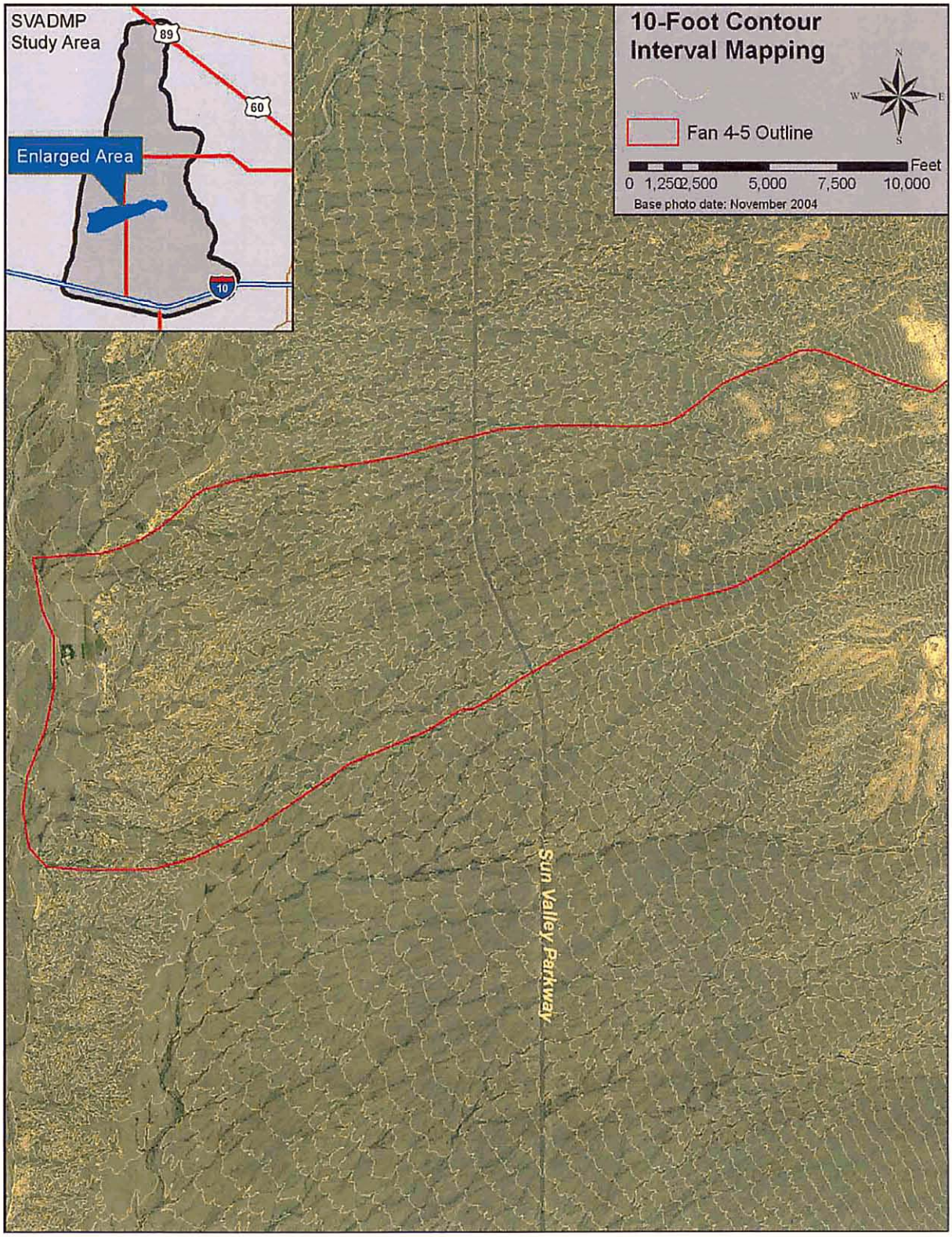
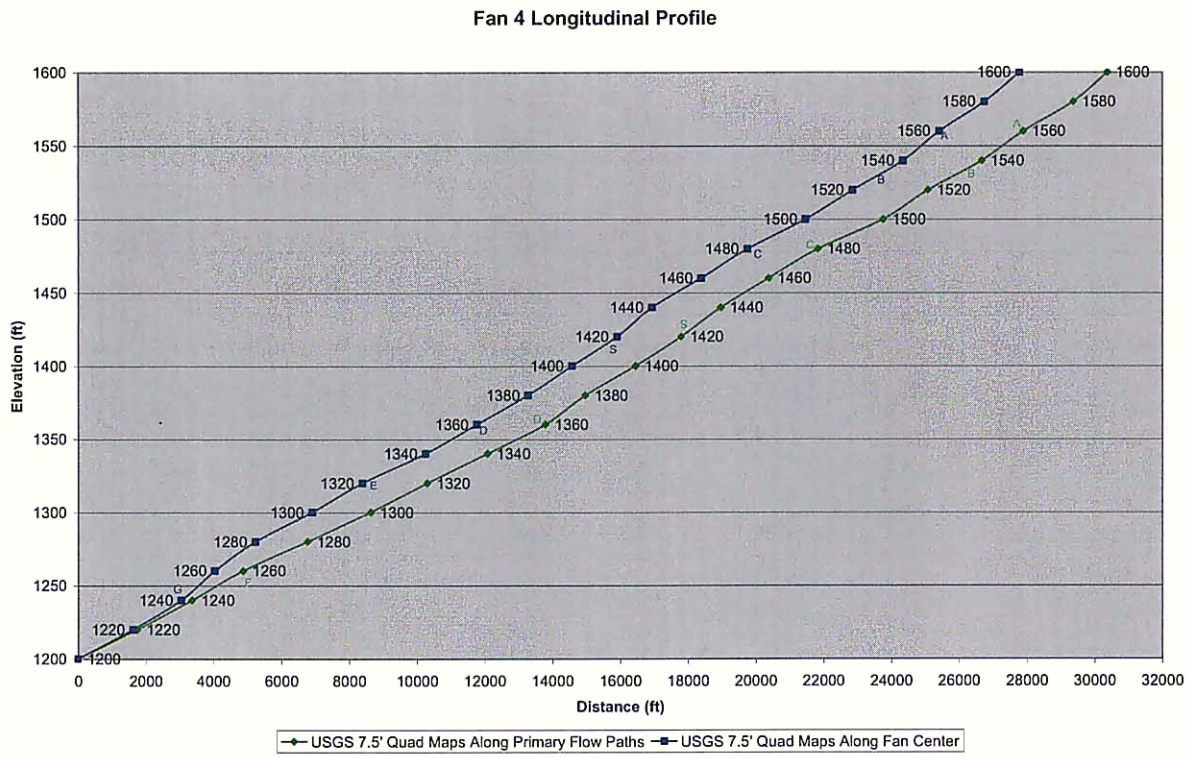


Figure 6.24. 10-foot contour topographic mapping for the Fan 4 and 5 areas



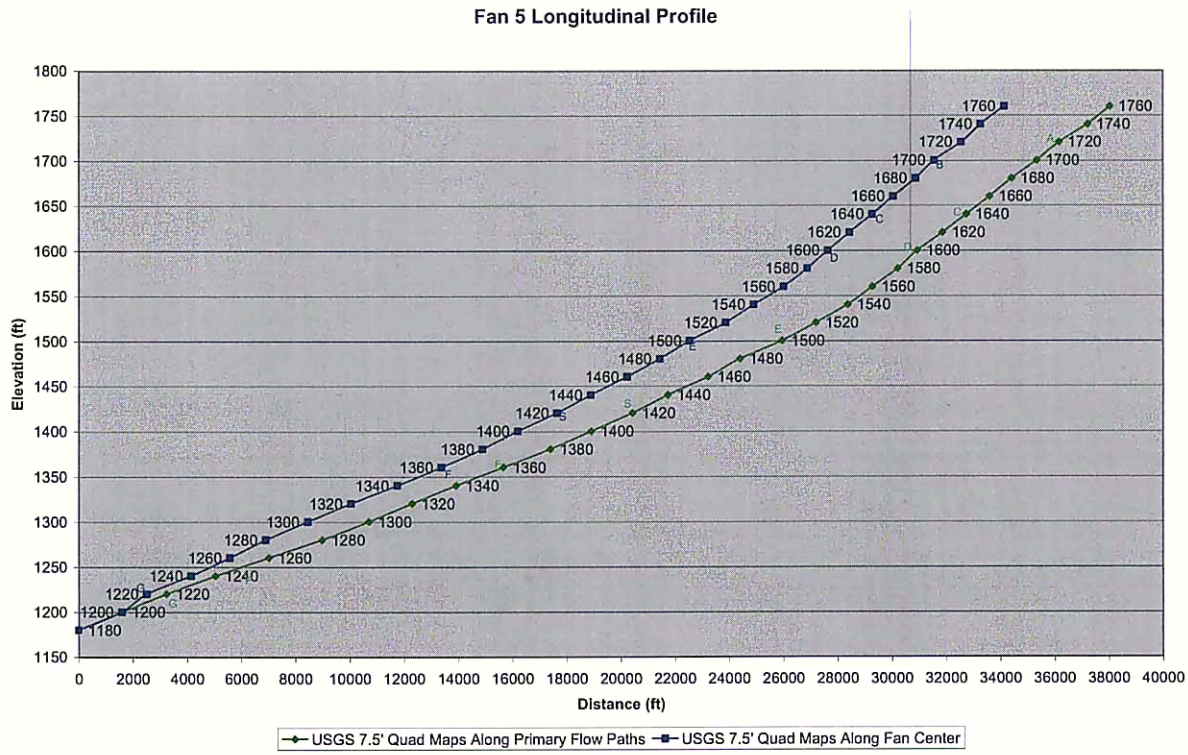


Figure 6.25 Longitudinal Profiles for Fan 4 and 5.

6B.5.3.4 Historical Aerial Photography

Historical aerial photographic coverage from 1953 and 2005 were available for the Fan 4 and 5 areas (Figure 6.26) as sited in Table 6B.5. The 1953 aerial photographs were scanned and semi-rectified using geographic features on the 2005 digital aerial photographs provided by the FCDMC. Channel thalweg locations were plotted on the 1953 and 2005 aerials to identify channel movement, channel avulsions, or other changes in channel characteristics (Figure 6.27). Unfortunately, aerial photographs pre-dating the August 1951 flood documented in the Site 36 Alluvial Fan Floodplain Delineation Technical Documentation Notebook (JEF, 1999), were not available for Fans 4 and 5. The general appearance of the 1953 aerials indicates that the 1951 event may not have been significant in the Fans 4 and 5 study area.

Table 6B.5 List of Historical Aerial Photographs of White Tank Fan Study Area

Source	Photo Date	Scale	Type	Digital
FCDMC Archives (US AMS, 1953)	1953	~ 1:14,400	Black & white prints	Scanned
FCDMC	2004	1:32,000	Color orthophotos	Yes

The comparison of thalweg locations shown in Figure 6.27 indicates that there has been definite channel movement within the active fan areas during 56 year period of record, with almost no discernable channel change in the stable areas. New channels have formed within the most active portions of the alluvial fans, and formerly active channels have been abandoned. There were no significant changes in vegetative cover, distribution or density that could be discerned at the scale of the aerial photographs. The primary human impact on Fans 4 and 5 was construction of Sun Valley Parkway.

6B.5.3.5 Drainage Pattern

Drainage pattern is indicative of alluvial fan stability. Inactive, stable alluvial fans typically have a tributary, well-defined drainage pattern, with channels that generally increase in size with distance downstream. Active, unstable alluvial fans typically have poorly defined distributary or sheet flow drainage patterns, which have channels that often decrease (or disappear) in the downstream direction. The drainage pattern can be readily identified from aerial photographs (Figure 6.19) by the light-toned sandy channel bed materials and/or the bank vegetation which is usually denser and with different species than floodplain and terrace areas.

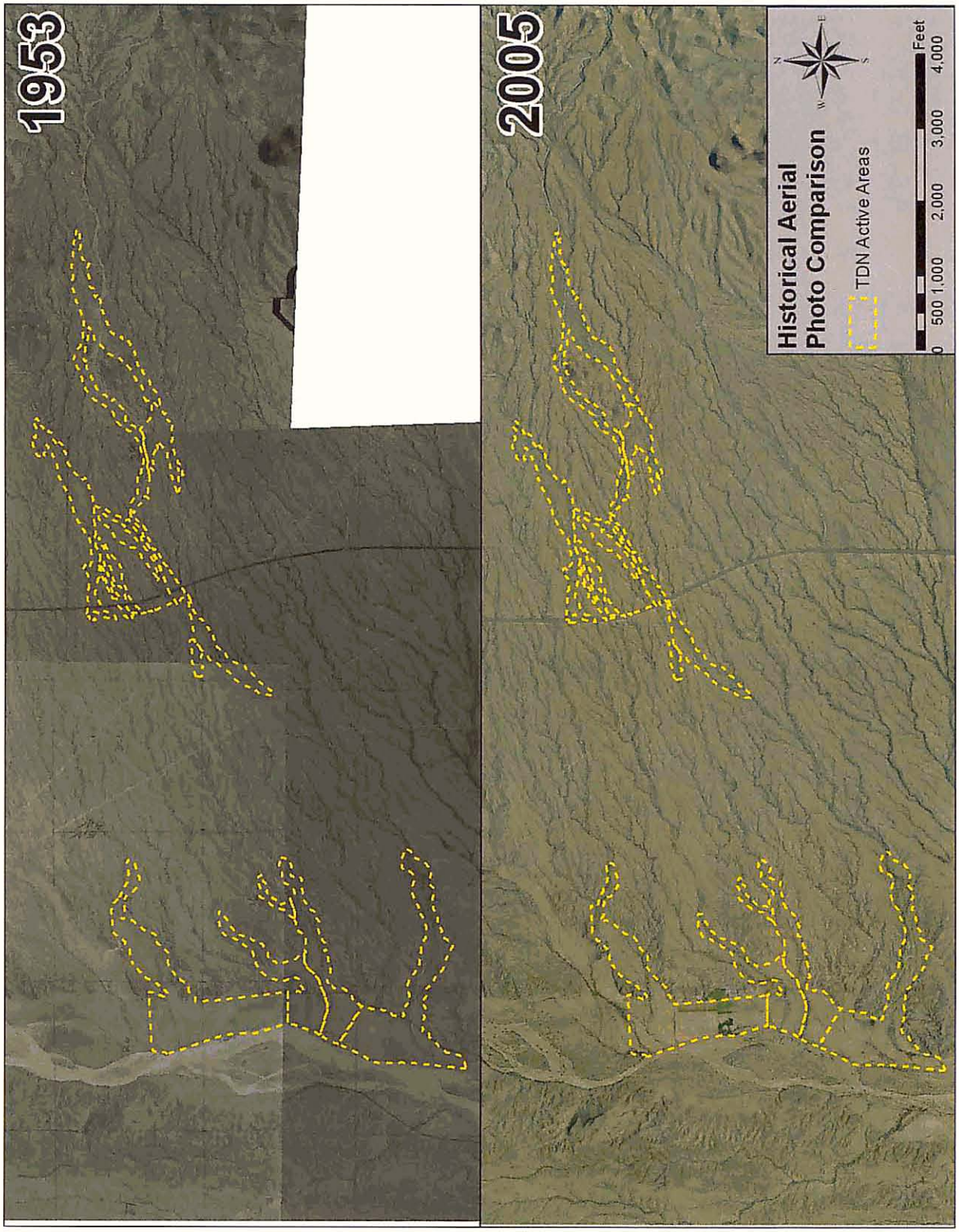


Figure 6.26. Historical and recent aerial photograph comparison

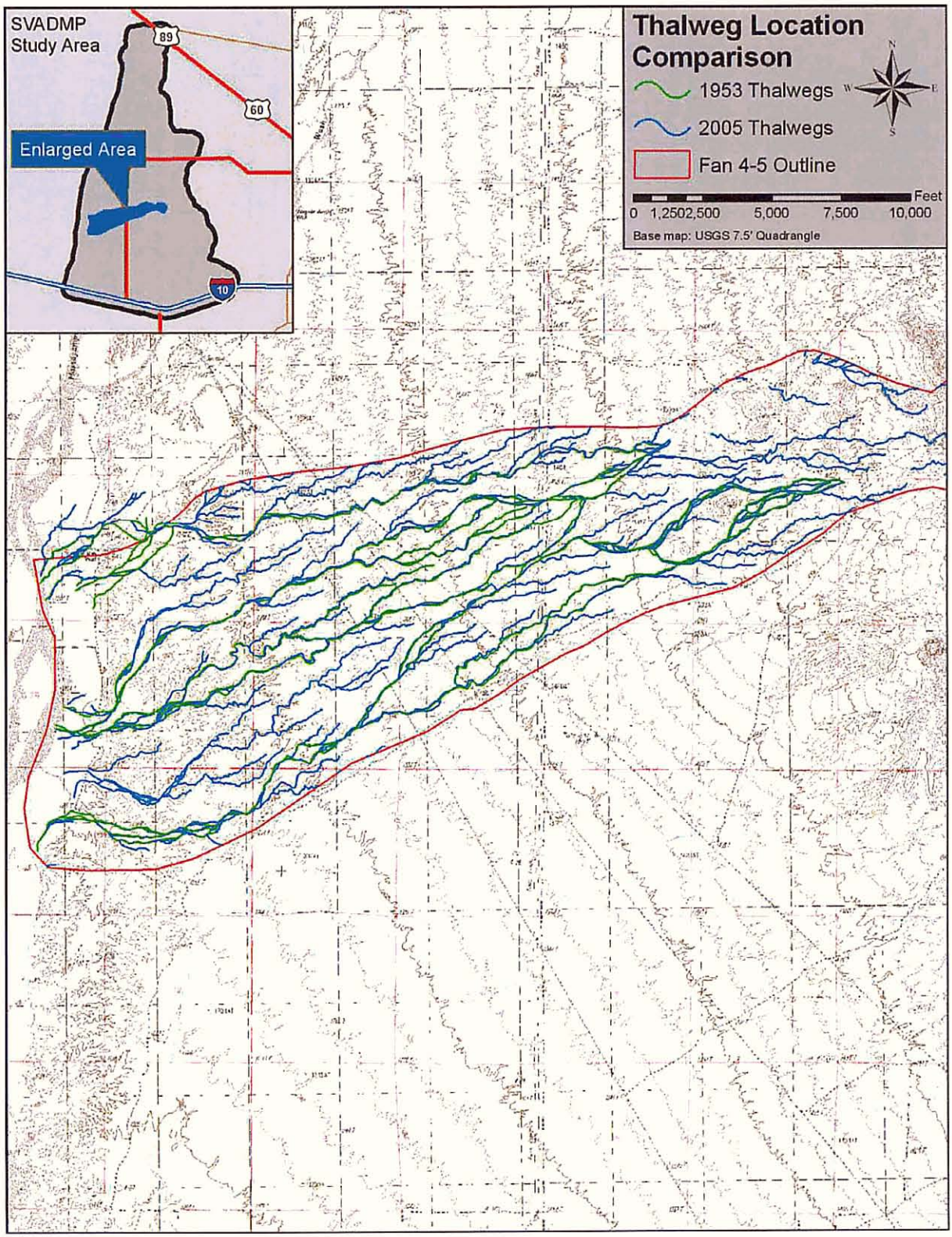


Figure 6.27. Historical thalweg location comparison (1953-2005)

The drainage pattern in the unstable portions of Fans 4 and 5 is distributary with strong components of unconfined and sheet flow and multiple-flow paths. Field observations suggest that large percentages of the active areas are inundated during significant floods. The stable portions of the piedmont have a well-defined tributary drainage pattern. The drainage pattern changes from tributary to distributary at the hydrographic apexes. For Fan 4, the distributary pattern persists from the hydrographic apexes to immediately upstream of Sun Valley Parkway, after which it transitions into a tributary pattern. For a portion of Fan 5 the distributary pattern transitions to a tributary pattern nearly one mile upstream of Sun Valley Parkway. The remaining portion of Fan 5 continues a distributary pattern until about one mile downstream of Sun Valley Parkway where in transitions into a tributary pattern. Both fans then transition back into a distributary pattern between 1.5 and two miles upstream of the Hassayampa River confluence.

6B.5.3.6 Surficial Characteristics

Surficial landform characteristics can be used to identify stable and unstable alluvial fan surfaces, as described in Section 6B.5.1 and the PFHAM. Landform characteristics were identified during field visits, by interpretation of aerial photographs, and from NRCS soils and AZGS geologic maps. Key surficial characteristics considered in the Fan 4 and 5 floodplain delineation included the following:

- Surface Texture
- Surface Color
- Desert Varnish
- Desert Pavement

The active, unstable fan areas shown in Figure 6.19 generally lacked surface reddening, desert varnish and desert pavement, and had relatively uniform surface texture. Inactive, stable surfaces had distinct surface texture, soil reddening, and desert varnish and pavement areas. Areas of apparent geologic age that were surrounded by either active areas or tributary corridors (islands), but were less than five (5) acres in area were included in the floodplain delineation areas.

Surface texture and color were identified primarily from the 2005 color aerial photographs (Figures 1.2 and 6.4). Areas with significant desert pavement accumulation could also be identified on the 2005 aerial photographs, but were also identified during field visits.

6B.5.3.7 Vegetation

Vegetation was used in the following ways to distinguish stable and unstable alluvial fan surfaces on the Fan 4 and 5:

- Vegetative Suites. The types of vegetation on any geomorphic surface are a function of the micro-climate (aspect, elevation, etc.), soil substrate, frequency and concentration of runoff, soil permeability, and soil chemistry. Because adjacent geomorphic surfaces on alluvial fan landforms differ in degree of clay and carbonate accumulation (substrate, chemistry, permeability), incision (runoff characteristics), and frequency of inundation, the vegetation suites on each surface are likely to vary slightly, either by species type and/or by species density or robustness.
- Marker Species. Certain species are almost always found in specific geomorphic and fluvial environments. For example: (1) ocotillo thrive in carbonate rich soils, and often indicate that a caliche layer underlies the surface, (2) saguaro, barrel, and cholla cacti grow well in rocky, well-drained soils are usually found outside the active floodplain, (3) ironwood, palo verde, and mesquite trees typically are found on channel banks or where runoff concentrates frequently.
- Species Age. The apparent age of vegetation is used to distinguish geomorphic surface age. The age of vegetation is directly proportional to overall plant size, as well as trunk diameter (woody trees), presence or number of branches (saguaro cacti branch after about 70 to 100 years), or other factors (creosote clone ring diameter). Old vegetation is indicative of stability or at least non-erosion.
- Burial or Exposure. Burial of the plant base by sediment deposition may indicate aggradation or active alluvial fan flooding. Exposure of a plant's roots by erosion indicates scour or lateral erosion which may be associated with either stable or unstable surfaces, depending on other geomorphic characteristics.

Vegetation characteristics for Fan 4 and 5 were identified in the field and on aerial photographs (Figure 6.28). Active areas were readily identified in the field and on aerial photographs by the diverse vegetative suites, with denser plant concentrations along the more prominent flow paths. Differences in vegetation between stable and unstable portions of the piedmont near Fan 4 and 5 include vegetative density, distribution, size, and type. Active fan areas had denser vegetative cover, with larger plant sizes, especially on the interfluve areas than the inactive surfaces. Channel bank vegetation in the active fans areas was similar is size and density to the bank vegetation in the stable tributary flow corridors. Stable, inactive surfaces tended to have smaller, less dense vegetation with higher concentrations of cholla and saguaro cacti than active surfaces.

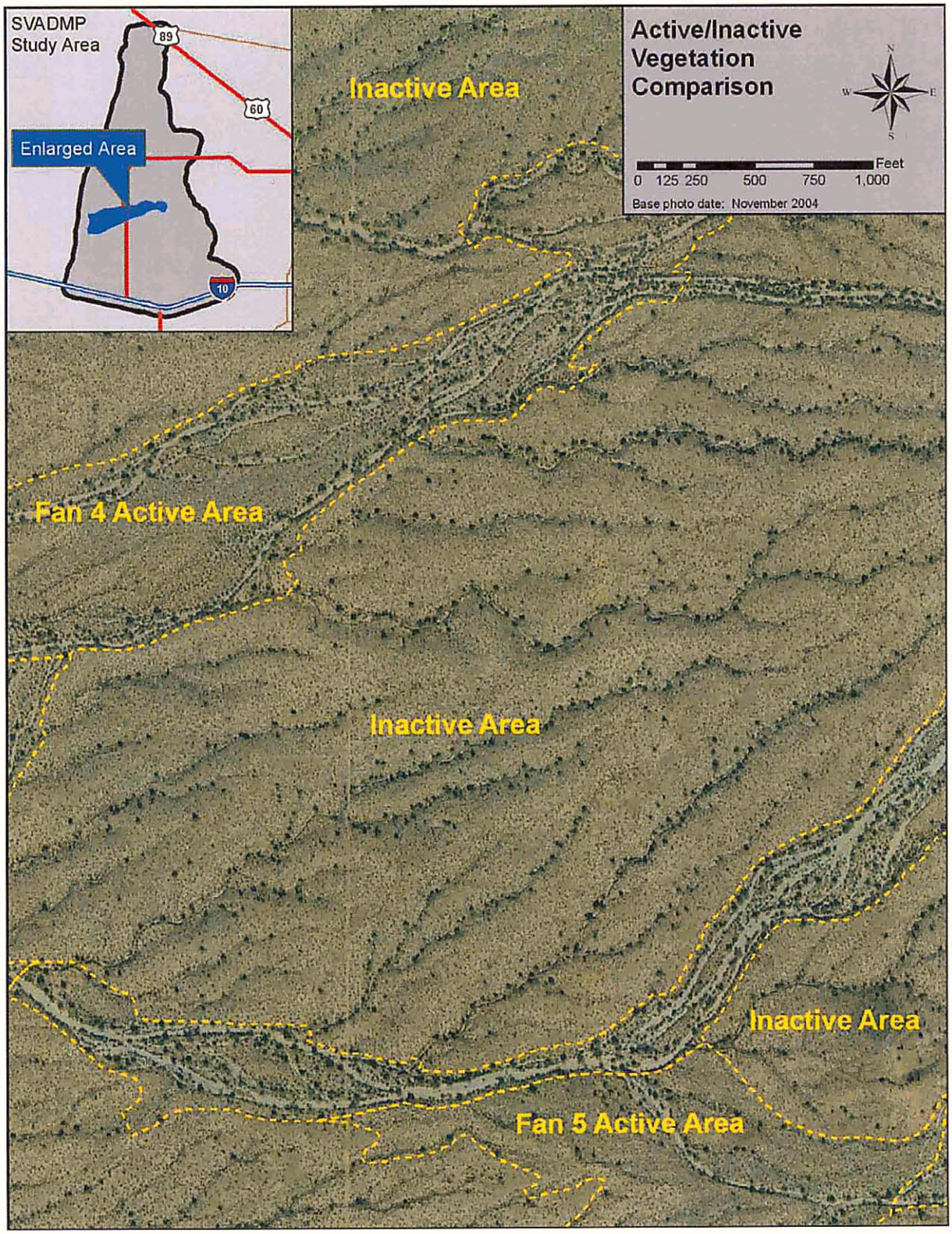


Figure 6.28. Active/Inactive surface vegetation characteristics

6B.5.3.8 Sediment Delivery Potential

Sediment yield was estimated by Ayres (2005) for the Buckeye Sun Valley ADMP for Area 3 using the Revised Universal Soil Loss Equation (RUSLE). The Ayres results indicated 100-year sediment yield rates ranging from 0.48 to 3.61 acre-feet/square mile, and average annual sediment yield ranging from 0.35 to 1.05 acre-feet/square mile/year. Using the most conservative value computed by Ayres, the sediment yield at Fan 4 and 5 hydrographic apexes is shown in Table 6B.6, and which would result in very low rates of aggradation if distributed over the entire active, unstable portion of the fans. The sediment yield data indicate that most avulsions in the active areas are probably due to local phenomena (stream capture, debris clogging, local deposition) rather than overall fan aggradation. The sediment data also suggest that minimal topographic relief is required to contain flooding within the active surfaces. The low sediment yield rates suggest minimal potential for system-wide channel clogging, as well as high probability for water runoff to flow around depositional areas without leaving the active portions of the alluvial fan.

Table 6B.6. Sediment Yield Estimates Based on Ayres (2005)

Value	Fan 4	Fan 5
Average Annual Sediment Yield (AF/yr)	0.8	1.3
100-Year Sediment Yield (AF)	1.0	1.7
Average Annual Depth of Deposition in Active Fan Area (ft)	0.001	0.002
100-Year Average Depth of Deposition in Active Fan Area (ft)	0.002	0.003

6B.5.3.9 Summary

Active and inactive portions of the Fan 4 and 5 landforms were identified using the geomorphic characteristics described above. The characteristics are best used in conjunction with each other, since no single characteristic is universally diagnostic of the level of stability. The stable/unstable landform delineation for Fan 4 and 5 are shown in Figure 6.19.

6B.5.4 Alluvial Fan Floodplains Downstream of Active Unstable Areas

The active unstable alluvial fan areas on the White Tank Piedmont that experience alluvial fan flooding with flow path uncertainty, are located immediately downstream of a hydrographic apex, either the primary hydrographic apex, or a secondary inset hydrographic apex located further downstream. Runoff that passes through the entire active unstable portion of the alluvial fan before reaching the toe of the alluvial fan landform is conveyed downstream through one or more of the following types of drainage networks:

- Stable Distributary Systems

- Stable Tributary Systems
- Sheet Flow Areas

Because they are interpreted as stable, both distributary and tributary throughflow channels were mapped as inactive portions of Fan 4 and 5. The same geomorphic characteristics described in Section 6B.5.3 were used to identify stable throughflow channels downstream of the unstable active alluvial fan areas. Note that significant flood hazards exist along the throughflow channels, as delineated in the Stage 3 analyses below, and that flow along the throughflow channels is still considered a form of alluvial fan flooding because of uncertainty associated with the flow rate in any given corridor. The stable tributary and distributary flow areas are located on the margins of the main active fan area, and consist of channels that convey flow to adjacent drainages or to secondary hydrographic apexes.

6B.5.5 Identification of Inactive Areas

Along with the active alluvial fan areas at Fan 4 and 5, Figure 6.19 also shows the inactive alluvial fan areas. Basically, the inactive areas are those portions of the alluvial fan landform that are not active, as described in the Section 6B.5.3. As shown in Figure 6.19, the majority of the Fan 4 and 5 landforms consist of inactive, stable surfaces.

6B.5.6 Types of Flooding on the Piedmont

Based on the evaluation of active and inactive areas on the Fan 4 and 5 piedmont areas, the following locations and types of flood hazards were defined.

6B.5.6.1 Flooding Along Stable Channels: Upstream of the Hydrographic Apex

Riverine flooding upstream of the hydrographic apex was delineated using approximate method riverine delineation techniques, as described in Section 5. The riverine reach upstream of the hydrographic apex is considered stable surface flooding, and was delineated using approximate method riverine techniques.

6B.5.6.2 Unstable Flow Path Flooding

Active alluvial fan flooding on Fan 4 occurs in the broader areas between the primary hydrographic apexes and Sun Valley Parkway. Active alluvial fan flooding on Fan 5 occurs on the broader areas between the primary hydrographic apex and the area where Fan 4 and 5 converge upstream of Sun Valley Parkway. Additional active alluvial flan flooding occurs within a limited area on Fan 5 downstream of Sun Valley Parkway. Both Fan 4 and 5 contain active alluvial fan flooding areas near the confluence with the Hassayampa River.

6B.5.6.3 Flooding Along Stable Channels: Downstream of the Hydrographic Apex

Downstream of the active fan areas some of the flooding is conveyed in a series of parallel channels that cut through older stable geomorphic surfaces. These channels have been stable over the past 50 years as indicated by the historical aerial photographs and possibly the past few thousand to tens of thousands of years as indicated by the surficial geology. Flood hazards along these corridors can be expected to be confined to the existing channel network. However, uncertainties in the discharges delivered to each channel make detailed quantitative evaluation of these hazards difficult. Until the discharge distribution uncertainty created by the active area upstream can be resolved, this study suggests that an approximate method relying on geomorphic surface interpretation can adequately and realistically evaluate the location and lateral extent of these hazards.

Both Fan 4 and 5 contain stable, tributary channels downstream of the active areas. Fan 4 has a stable, tributary channel that occurs at the hydrographic apex and travels the entire length of the piedmont to the Hassayampa River. Fan 5 has several stable, tributary channels that extend from the downstream end of the active fan areas to the active areas near the Hassayampa River confluence.

6B.5.6.4 Sheetflow Areas

No sheetflow evidence was observed in the field, on topographic maps, or on aerial photographs.

6B.5.6.5 Debris Flow Areas

No evidence of debris flows was observed in the field, on topographic maps, or on aerial photographs. The NRCS soils mapping and AZGS geologic mapping do not mention debris flow hazards or deposits within the study area. The hydrographic apexes are located too far from the mountain front for debris flows to be of concern for the flood hazard inundation areas mapped in this study.

6B.5.7 Summary of Stage 2 Delineation

Figure 6.19 shows the limits of the active and inactive areas within the Fan 4 and 5 piedmont. The Stage 2 active/inactive area delineation is the foundation for the Stage 3 floodplain delineation. The most active areas of Fan 4 and 5 are about 1.0 and 0.9 square miles in extent, respectively, downstream of the hydrographic apexes.

6B.6 *Stage 3: Defining the Approximate 100-Year Floodplain*

The 100-year flood hazard assessment is an outgrowth of the information and results identified and generated in Stages 1 and 2. In Stage 1, Fan 4 and 5 were identified as part of an alluvial fan landform. In Stage 2, the unstable (active) and stable (inactive) portions of the alluvial fan landform were identified. According to the FEMA Guidelines, "the delineated floodprone areas of Stage 2 should approximate the largest possible extent of the 100-year flood." In Stage 3, floodplain limits for the 100-year (1%) flood are delineated for each of the types of the following types of flooding identified in Section 6B.5:

- Flooding Along Stable Channels: Upstream of the Hydrographic Apex. The floodplain along the main channel upstream of the hydrographic apex was delineated using riverine approximate method techniques, as described in Section 5.0.
- Unstable Flow Path Flooding. The floodplain in the areas with unstable flow path flooding (active alluvial fan flooding) downstream of the hydrographic apexes were delineated using geomorphic data. In general, the 100-year floodplain delineated in the active alluvial fan areas is coincident with the Stage 2 unstable area delineation.
- Flooding Along Stable Channels: Downstream of the Hydrographic Apexes. The floodplain along stable distributary and tributary channels located downstream of the active alluvial fan areas were delineated using geomorphic data.

Flood hazards for all portions of the alluvial fan downstream of the hydrographic apexes were delineated using geomorphic techniques. Application of geomorphic mapping techniques to the unstable portions of the alluvial fan is the preferred delineation method in Maricopa County. Application of geomorphic techniques to the remaining portions of the alluvial fan downstream of the hydrographic apexes is required by the site conditions and the available information. The stable distributary and tributary channels systems downstream of the hydrographic apexes are referred to as throughflow channel corridors. Within some of the throughflow channel corridors, channel changes were observed in the historical aerial photo record or in the field, although the changes were confined within the corridors. The corridors are bounded by higher, older, stable geomorphic surfaces. Channel changes along the throughflow corridors are analogous to minor channel changes in a braided riverine system that do not affect the flood limits or overall stream morphology. That is, there is only minimal flow path uncertainty which can be "set aside in a realistic assessment of flood risk." There is, however, significant flow *rate* uncertainty due to the uncertain flow *path* distribution in the active unstable area upstream. This flow rate uncertainty invalidates traditional riverine floodplain delineation techniques for the throughflow channels because the 100-year discharge is unknown.

Flooding along the throughflow channels downstream of active unstable alluvial fan areas has the following characteristics of alluvial fan flooding, as defined by FEMA: (1) it occurs on an alluvial fan

landform, (2) it originates at a hydrographic apex, (3) it is characterized by high velocity flow, (4) it is characterized by processes of erosion, sediment transport, and deposition, (5) and it is hydraulically connected to areas that experience unpredictable flow paths. According to Table G-1 in the FEMA Guidelines, floodplain delineation using geomorphic data is acceptable for alluvial fans with little or no urbanization. At the time of this study, the White Tank Piedmont has little or no urbanization. Therefore, use of geomorphic data as the basis of the floodplain delineation is acceptable for the areas downstream of the hydrographic apex.

The Stage 3 100-year floodplain delineation for Fan 4 and 5 are shown in Figure 6.29.

6B.6.1 Flood Hazard Zones

Table 6B.7 lists and describes the flood hazard zones identified and shown in Figure 6.29 and the Stage 3 – 100-year Floodplain Map in the Floodplain Delineation Exhibits included in the TDN Appendix. These zones are defined for use in piedmont flood hazard delineation in Maricopa County by the Flood Control District of Maricopa County, and were approved the Maricopa County Board of Supervisors on November 1, 2000. The flood hazard zones shown on Figure 6B.29 are given in Table 6B.7. The resulting flood hazard map is similar in nature to the one shown in Example 4 (Figure G-9) in FEMA Guidelines.

The unstable areas delineated in the Stage 2 analysis were used to identify the location of the Zone A – Administrative Floodway Active Alluvial Fan (Zone AFHH). The AFHH (active alluvial fan) zone lies within the unstable areas nearest the hydrographic apex, in the zones where the greatest risk of flow path uncertainty exists.

Zone A – Administrative Floodway Inactive Alluvial Fan (Local Community Zone AAFF) were intended to be used along stable throughflow channel corridors which traverse the inactive portions of an alluvial fan landform.

Between many of the mapped floodprone areas are large islands of older stable geomorphic surfaces. These were mapped using a shaded Zone X designation. These zones include areas of possible flood hazards from local drainage areas smaller than one square mile as well as stable areas potentially flooded by events less frequent than the 100-year flood (e.g. the 500-year flood). Inselbergs were mapped as unshaded Zone X. Also, because approximate methods were used, islands smaller than five (5) acres were not delineated.

Table 6B.7 Flood Hazard Zones Mapped in White Tank Fan (Site 6) Approximate FDS		
Zone Name	**Local Community Zone Designation**	**Description**
Zone A	Zone A	Approximate 100-year floodplain; riverine reaches upstream of hydrographic apex, and previously mapped ponding area behind Buckeye FRS #1
Zone A – Administrative Floodway Riverine	Zone A	Approximate 100-year floodplain, riverine reaches upstream of hydrographic apex, managed as a floodway district.
Zone A – Administrative Floodway Active Alluvial Fan	AFHH – Administrative Floodway	Alluvial Fan High Hazard, community to treat as a floodway district
Zone A – Administrative Floodway Active Alluvial Fan	AFUFD – Administrative Floodway	Alluvial Fan Uncertain Flow Distribution Area; transitional area downstream of AFHH zone characterized by channelized and sheet flooding generally becoming more stable and less uncertain with increasing downstream distance from the AFHH zone; community to treat as a floodway district
Zone A – Administrative Floodway Inactive Alluvial Fan	AAFF - Administrative Floodway	Approximate Alluvial Fan Floodway; corridors for conveyance of water and sediment on a stable alluvial fan surface downstream of the AFHH and AFUFD; community to treat as a floodway district
Zone A – Inactive Alluvial Fan	AFZA	Alluvial Fan Zone A; areas within the 100-year floodplain on an inactive alluvial fan characterized by shallow channelized flow and sheet flooding in stable channels; zone is considered approximate because no base flood elevations are provided; flood hazards within this zone are not necessarily equal throughout, that is, the frequency and magnitude of flooding with respect to depth and velocity of flow may vary within the AFZA zone; floodplain managers should consult available aerial photographs and topographic maps for more detailed evaluation of site specific flood hazard within this zone; development will be allowed in this zone given demonstration of adequacy of site and/or design which addresses safety from inundation and sedimentation hazards
X (shaded) – Inactive Alluvial Fan	X (shaded)	Areas flooded between 100-yr and 500-yr discharge; or areas of flooding with depth of 100-year flood less than 1 foot; or drainage area less than 1 square mile
X (unshaded)	X (unshaded)	Areas outside the 500-year floodplain; shown only on rocky hills
D	D	Area not studied

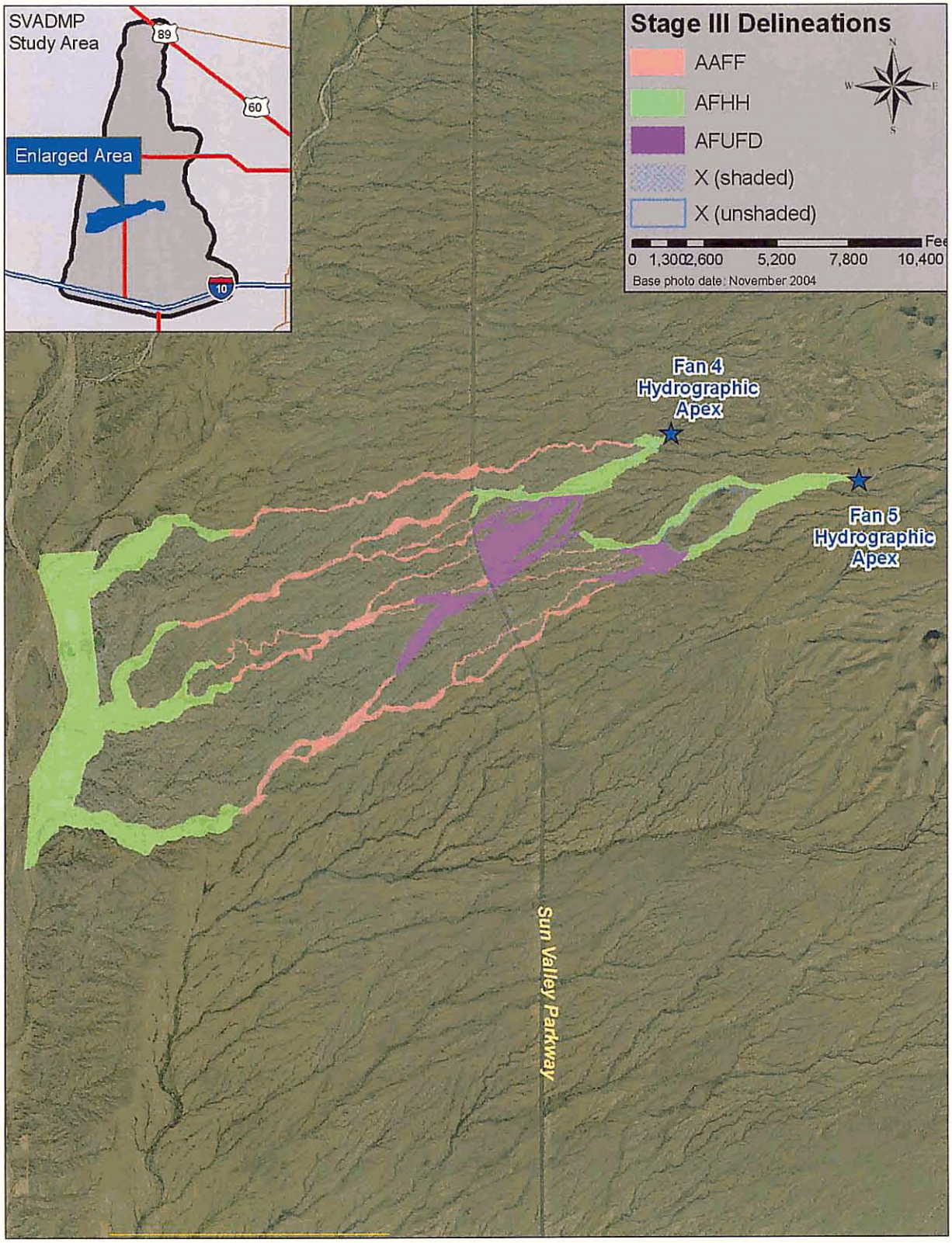


Figure 6.29. Stage III floodplain zone delineations for Fan 4 and 5

6B.6.2 Verification of Results

Figure 6B.15 shows a comparison of the results of the Stage 3 analysis with the flood hazard evaluation by Field and Pearthree (1992). Figure 6B.16 shows the relationship of the Field and Pearthree surficial geology mapping to their flood hazard evaluation.

In general, everything shown by Field and Pearthree as H1and is hydraulically connected to Fan 4 or 5 has been mapped as within one of the various 100-year flood hazard areas. H1 surfaces are characterized as "very high flood potential." H1 surfaces included areas with the "potential for localized, high-velocity, relatively deep, channelized flows and sheet flooding" with "some potential for drastic shifts in channel position." The H1 areas largely correspond with the AFHH zones mapped in this study. H1 zones are also shown within the AAFF zone administrative floodways.

A number of areas identified L2 surfaces by Field and Pearthree have been given a Shaded X designation in this study. The authors of this study made the judgment that these areas, while having some geologic flood potential, lie outside the one percent chance limits. The Shaded X area reasonably represents the fact that while flood prone at some level, the frequency of flooding on those surfaces is less than one percent. Additionally, these areas receive floodwaters from local tributary drainage and as such are not completely flood free. Consequently, designation as Zone X (unshaded) is unwarranted.

Overall, the 100-year flood hazard assessment of the Fan 4 and 5 piedmont areas and alluvial fans are believed to be reasonable, sound, and defensible based on the data presented in this Technical Data Notebook. However, revisions to the mapping presented here could be justified based on more detailed topographic mapping, hydrologic and hydraulic analyses in the future.

6B.6.3 Limitations

Every modeling and mapping methodology has limitations. The limitations of the approximate geomorphic floodplain delineation method used for the Fan 4 and 5 alluvial fans are summarized below.

6B.6.3.1 Scale of mapping

The mapping for this study was compiled onto 1:12000 scale maps. The 2004 aerial photographs used are of excellent resolution that did not limit interpretation at the map scale. Nevertheless, the size of the alluvial fan landforms considered precludes the level of detail possible when mapping at an individual lot basis.

6B.6.3.2 Accuracy of mapping

Map accuracy is also a limitation for some of the data sources used such as NRCS and AZGS soils and flood hazard mapping. These maps were scanned and semi-rectified, but some horizontal

displacement remained. Additionally, in the process of transferring field and photo interpretations to the orthophotos, the accuracy is limited to one's ability to identify precisely identical locations on each photograph. Through the use of landmarks, distinctive channel features and patterns, large trees, etc. it is believed that these errors have been minimized.

6B.6.3.3 Time period of historical photo record

Period of record for historical aerial photos spans 52 years. While this is a reasonably long period, it does not ensure that a 100-year event occurred during this time period, or that the full range of expected alluvial fan processes has been observed. However, use of geomorphic data extends the period of record significantly.

6B.7 Work Study Maps

This study includes geomorphic mapping and floodplain delineation of parts of the Fan 4 -5 alluvial fans. The figures for Section 6B, including a cover sheet showing the project location and 11" x 17" versions of the Stage 1 Landform map, Stage 2 Stability map, and Stage 3 Floodplain map, are located at the end of Section 6B of the Technical Data Notebook.

6B.8 References

1. Aerial Mapping Company, 1999, Color stereographic aerial photographs of White Tank fan approximate delineation study area, flight date 9-25-99, scale 1:9,600 and flight date 10-6-99, scale 1:32,000.

2. Alpha Engineering Group, Inc., 1994, White Tanks Wash Flood Insurance Study, FCD No. 90-64: for FCDMC, Phoenix, Arizona.

3. Camp, P.D., 1986, Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona: U.S. Soil Conservation Service Report, 306 p., 53 maps, scale 1:24,000.

4. CH2M Hill, 1992, Alluvial Fan Data Collection and Monitoring Study: Tempe, Arizona, CH2M Hill and R.H. French, Ph.D., P.E. Consulting Engineer for the Flood Control District of Maricopa County, 204 p.

5. Dohrenwend, J.C., 1987, Basin and Range, *in* Graf, W.L., ed., Geomorphic systems in North America: Geological Society of America, Centennial Special Volume 2, p. 303-342.

6. FCDMC, 1996, Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics: Phoenix, Arizona, Flood Control District of Maricopa County.

7. FCDMC, 1996 and 1998. Black and white semi-rectified aerial photographs from FCDMC image database. Original photography from which digital versions were created 1:7,200 scale.

8. FEMA, 2002, Guidelines and Specifications for Flood Hazard Mapping Partners – Appendix G: Guidance for Alluvial Fan Flooding Analyses and Mapping, February, 2002. Available on-line at http://www.fema.gov/mit/tsd/FT_alfan.htm.

9. Field, John J., 1994, Processes of Channel Migration on Fluvially Dominated Alluvial Fans in Arizona. Arizona Geological Survey OFR 94-13, 40 p.

10. Field, John J. and Pearthree, Philip P., 1992, Geologic Mapping of Flood Hazards in Arizona: An Example from the White Tank Mountains Area, Maricopa County. Arizona Geological Survey OFR 91-10, 16 p., 4 maps, scale 1:24,000.

11. Field, John J. and Pearthree, Philip P., 1991, Surficial Geology Around the White Tank Mountains, Central Arizona: Arizona Geological Survey OFR 91-8, 7 p., 9 maps, scale 1:24,000.

12. Hartman, G.W., 1977, Soil Survey of Maricopa County, Central Part: Soil Conservation Service, USDA, 117 p., 128 maps, scale 1:20,000.

13. Hjalmarson, H.W., 2003, Piedmont flood hazard assessment for flood plain management for Maricopa County, Arizona: Flood Control District of Maricopa County, 362 p.

14. Hjalmarson, H.W., 1994, Potential flood hazards and hydraulic characteristics of distributary-flow areas in Maricopa County, Arizona: U.S. Geological Survey Water Resources Investigations Report 93-4169, 56 p.

15. Hjalmarson, H.W., and Kemna, S.P., 1991, Flood hazards of distributary-flow areas in southwestern Arizona: U.S. Geological Survey Water Resources Investigations Report 91-4171, 68 p.

16. JE Fuller/Hydrology & Geomorphology, Inc., 2000, Inundation Mapping of the September 1997 Flood, Surficial Geologic Mapping and Evaluation of the Piedmont Flood Hazard Assessment Manual for Portions of the Tiger Wash Piedmont. Report to the Flood Control District of Maricopa County, FCD Contract No. 98-4, Assignment #2.

17. Kangieser, P.C., 1969, Major rainstorms and snowstorms in Arizona 1897-1969 [unpublished report]: Tempe, Arizona, Arizona Weather Bureau, 25 p.

18. National Archive, 1954, Black and white aerial photographs, scale 1:20,000.

19. National Archive, 1949, Black and white aerial photographs, scale 1:20,000.

20. National Research Council, 1996, Alluvial Fan Flooding: Washington, D.C., National Academy Press, 172 p.

21. Pearthree, Phil, 1999, Personal communication, November 16, 1999.

22. P.A. Pearthree, K.A. Demsey, Jill Onken, K.R. Vincent, and P.K. House, 1992, Geomorphic Assessment of Flood-Prone Areas on the Southern Piedmont of the Tortolita Mountains, Pima County, Arizona, AZGS Open File Report 91-11, 31 p., scale 1:12,000 and 1:24,000, 4 sheets

23. Sabol, G.V., Rumann, J.M., Khalili, D., Waters, S.D., Lehman, T.W., 1995, Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology: Flood Control District of Maricopa County, Phoenix, Arizona.

24. Thomas, Blakemore E., Hjalmarson, H.W., and Waltemeyer, S.D., 1997, Methods for Estimating Magnitude and Frequency of Floods in the Southwest United States: U.S. Geological Survey, Water Supply Paper 2433, 195 p.

25. U.S. Army Mapping Service, 1953, Large format black and white aerial photography. From FCDMC archives. Scale = approximately 1:14,400.

26. U.S. Geological Survey, 1988, Wagner Wash Well, Ariz. Quadrangle, 7.5 minute series, Provisional Edition, 1:24,000 (photo date 1984).

27. U.S. Geological Survey, 1982, Buckeye NW, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (photo date 1955, originally published 1958; photo revised in 1982 using 1978 photography).

28. U.S. Geological Survey, 1982, Valencia, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, originally published 1958; photo revised in 1982 using 1978 photography).

29. U.S. Geological Survey, 1978, White Tank Mtns NE, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, published 1957; photo revised 1971, and photo inspected with no changes made in 1978).

30. U.S. Geological Survey, 1997, White Tank Mountains, AZ, SW, Digital Orthographic Quarter Quadrangle, GeoTIFF format, 1 meter resolution, UTM, NAD83 projection.

31. U.S. Geological Survey, 1997, Wagner Wash Well, AZ, SE, Digital Orthographic Quarter Quadrangle, GeoTIFF format, 1 meter resolution, UTM, NAD83 projection.

32. U.S. Geological Survey, 1992, Buckeye NW, AZ, NE, Digital Orthographic Quarter Quadrangle, GeoTIFF format, 1 meter resolution, UTM, NAD83 projection.

33. Vanden Dolder, E.M., 1992, Rock varnish and desert pavement provide geological and archaeological records: Arizona Geology, v. 22, no. 1, p. 1, 4-7.

34. Waters, Stephen D., 1991, Hydrologic analysis for White Tanks Distributary Flow Area: Phoenix, Arizona, Flood Control District of Maricopa County, 29 p.

Appendix G
(Separate Volume)

Geomorphology Analyses Supporting Documentation

SECTION 7: DRAFT FIS

7.1 Summary of Dischages

See Section 4 and Table 4.2 for detail regarding the origin of the discharges presented below.

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-year	100-Year	500-Year
White Tank Fan 4 – Section 500 (S400)	1.54			998	
White Tank Fan 5 – Section 600 (S500)	3.64			1981	

**Area estimated based on unit discharge from*

7.2 Floodway Data

Floodway data tables are not presented in this TDN.

7.3 Annotated Flood Insurance Rate Maps

See C. Maps of this TDN.

7.4 Flood Profiles

Flood profiles are not presented in this TDN.

Appendix A

References

1. Aerial Mapping Company, 1999, Color stereographic aerial photographs of White Tank fan approximate delineation study area, flight date 9-25-99, scale 1:9,600 and flight date 10-6-99, scale 1:32,000.

2. Alpha Engineering Group, Inc., 1994, White Tanks Wash Flood Insurance Study, FCD No. 90-64: for FCDMC, Phoenix, Arizona.

3. Camp, P.D., 1986, Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona: U.S. Soil Conservation Service Report, 306 p., 53 maps, scale 1:24,000.

4. CH2M Hill, 1992, Alluvial Fan Data Collection and Monitoring Study: Tempe, Arizona, CH2M Hill and R.H. French, Ph.D., P.E. Consulting Engineer for the Flood Control District of Maricopa County, 204 p.

5. Dohrenwend, J.C., 1987, Basin and Range, in Graf, W.L., ed., Geomorphic systems in North America: Geological Society of America, Centennial Special Volume 2, p. 303-342.

6. FCDMC, 1991, A Hydrologic Analysis of Wagner Wash Watershed, a report prepared by the Flood Control District of Maricopa County, Hydrology Division, Watershed Management Branch, dated April 1990, revised Jan. 1991.

7. FCDMC, 1995, Drainage Design Manual, Volume I, Hydrology, as revised January 1, 1995.

8. FCDMC, 1996 and 1998. Black and white semi-rectified aerial photographs from FCDMC image database. Original photography from which digital versions were created 1:7,200 scale.

9. FCDMC, 1996, Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics: Phoenix, Arizona, Flood Control District of Maricopa County.

10. FEMA, 2002, Guidelines and Specifications for Flood Hazard Mapping Partners – Appendix G: Guidance for Alluvial Fan Flooding Analyses and Mapping, February, 2002. Available on-line at http://www.fema.gov/mit/tsd/FT_alfan.htm.

11. Field, John J. and Pearthree, Philip P., 1991, Surficial Geology Around the White Tank Mountains, Central Arizona: Arizona Geological Survey OFR 91-8, 7 p., 9 maps, scale 1:24,000.

12. Field, John J. and Pearthree, Philip P., 1992, Geologic Mapping of Flood Hazards in Arizona: An Example from the White Tank Mountains Area, Maricopa County. Arizona Geological Survey OFR 91-10, 16 p., 4 maps, scale 1:24,000.

13. Field, John J., 1994, Processes of Channel Migration on Fluvially Dominated Alluvial Fans in Arizona. Arizona Geological Survey OFR 94-13, 40 p.

14. Hartman, G.W., 1977, Soil Survey of Maricopa County, Central Part: Soil Conservation Service, USDA, 117 p., 128 maps, scale 1:20,000.

15. Hjalmarson, H.W., 1994, Potential flood hazards and hydraulic characteristics of distributary-flow areas in Maricopa County, Arizona: U.S. Geological Survey Water Resources Investigations Report 93-4169, 56 p.

16. Hjalmarson, H.W., 2003, Piedmont flood hazard assessment for flood plain management for Maricopa County, Arizona: Flood Control District of Maricopa County, 362 p.

17. Hjalmarson, H.W., and Kemna, S.P., 1992, Flood hazards of distributary-flow areas in southwestern Arizona: U.S. Geological Survey Water Resources Investigations Report 91-4171, 68 p.

18. JE Fuller/Hydrology & Geomorphology, Inc., 2000, Inundation Mapping of the September 1997 Flood, Surficial Geologic Mapping and Evaluation of the Piedmont Flood Hazard Assessment Manual for Portions of the Tiger Wash Piedmont. Report to the Flood Control District of Maricopa County, FCD Contract No. 98-4, Assignment #2.

19. Kangieser, P.C., 1969, Major rainstorms and snowstorms in Arizona 1897-1969 [unpublished report]: Tempe, Arizona, Arizona Weather Bureau, 25 p.

20. National Archive, 1949, Black and white aerial photographs, scale 1:20,000.

21. National Archive, 1954, Black and white aerial photographs, scale 1:20,000.

22. National Research Council, 1996, Alluvial Fan Flooding: Washington, D.C., National Academy Press, 172 p.

23. Pearthree, Phil, 1999, Personal communication, November 16, 1999.

24. Phillips, J. V. and Ingersoll, T.L., 1998, Verification of Roughness Coefficients for Selected Natural and Constructed Stream Channels in Arizona: U.S. Geological Survey Professional Paper 1584, 77 p.

25. Sabol, G.V., Rumann, J.M., Khalili, D., Waters, S.D., Lehman, T.W., 1995, Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology: Flood Control District of Maricopa County, Phoenix, Arizona.

26. Soil Conservation Service, 1963, Buckeye Watershed: Watershed Work Plan: USDA.

27. Thomas, Blakemore E, Hjalmarson, H.W., and Waltemeyer, S.D., 1997, Methods for Estimating Magnitude and Frequency of Floods in the Southwest United States: U.S. Geological Survey, Water Supply Paper 2433, 195 p.

28. Thomsen, B.W. and Hjalmarson, H.W., 1991, Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona. U.S. Geological Survey: Tucson, Arizona, 126 p.

29. U.S. Army Corps of Engineers, 1990, HEC-1 Flood Hydrograph Package, User's Manual, CPD-1A

30. U.S. Army Corps of Engineers, HEC-RAS River Analysis System, Version 3.1.3, May, 2005.

31. U.S. Army Mapping Service, 1953, Large format black and white aerial photography. From FCDMC archives. Scale = approximately 1:14,400.

32. U.S. Geological Survey, 1978, White Tank Mtns NE, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, published 1957; photo revised 1971, and photo inspected with no changes made in 1978).

33. U.S. Geological Survey, 1982, Buckeye NW, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (photo date 1955, originally published 1958; photo revised in 1982 using 1978 photography).

34. U.S. Geological Survey, 1982, Valencia, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, originally published 1958; photo revised in 1982 using 1978 photography).

35. U.S. Geological Survey, 1988, Wagner Wash Well, Ariz. Quadrangle, 7.5 minute series, Provisional Edition, 1:24,000 (photo date 1984).

36. U.S. Geological Survey, 1992, Buckeye NW, AZ, NE, Digital Orthographic Quarter Quadrangle, GeoTIFF format, 1 meter resolution, UTM, NAD83 projection.

37. U.S. Geological Survey, 1997, Wagner Wash Well, AZ, SE, Digital Orthographic Quarter Quadrangle, GeoTIFF format, 1 meter resolution, UTM, NAD83 projection.

38. U.S. Geological Survey, 1978, White Tank Mtns NE, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, published 1957; photo revised 1971, and photo inspected with no changes made in 1978).

39. U.S. Geological Survey, 1997, White Tank Mountains, AZ, SW, Digital Orthographic Quarter Quadrangle, GeoTIFF format, 1 meter resolution, UTM, NAD83 projection.

40. Vanden Dolder, E.M., 1992, Rock varnish and desert pavement provide geological and archaeological records: Arizona Geology, v. 22, no. 1, p. 1, 4-7.

41. Waters, Stephen D., 1991, Hydrologic analysis for White Tanks Distributary Flow Area: Phoenix, Arizona, Flood Control District of Maricopa County, 29 p.

Appendix B

Correspondence

APPENDIX B

B.1 Special Problem Reports

B.2 Contact (telephone) Reports

B.3 Meeting Minutes or Reports

B.4 General Correspondence

B.5 Contract Documents

B.6 Public Notification

B.7 FEMA Correspondence

B.1 Special Problem Reports

Special Problem Report for Administration of Flood Zones

B.2 Contact (telephone) Reports

B.3 Meeting Minutes or Reports

B.4 General Correspondence

Memorandum JE Fuller/ Hydrology & Geomorphology, Inc.

DATE: September 15, 2006

TO: Valerie Swick/FCDMC

FROM: Jon Fuller, PE, RG, CFM

RE: Sun Valley ADMP
Alluvial Fan Floodplain Delineations: Fans 4 & 5
Response to TDN Review Comments

CC: Kathryn Gross/FCDMC
Julie Cox/FCDMC
Mike Kellogg/JEF
Rob Lyons/JEF

This memorandum summarizes JE Fuller/Hydrology & Geomorphology, Inc. (JEF) responses to District review comments. District review comments are enumerated below, using the number from the District review comment letter. JEF responses are shown in 10-point bold italic font immediately below each comment. We appreciate the thoughtful and timely review by the District staff.

Hydrology Comments (Julie Cox, Letter of August 24, 2006)

1. Electronic files were not submitted. Please submit CD for comparison purposes.
   JEF Response: Done. DDMSW, HEC-1, GIS, PDF, and all other file types used to develop the TDN are included on the CD.

2. I compared the input parameters and the output from the Fan 4 & 5 models to the Area 4 models for both the 100-yr 24-hr and 100-yr 6-hr events. The sub-basin data and the output in this Fan 4 & 5 study are consistent with the same sub-basins in the Area 4 models.
   JEF Response: No response needed.

3. Based on the isopluvials in the Hydrology Manual, change the 100-yr 6-hr rainfall to 3.4 inches.
   JEF Response: Per meeting with Julie Cox on 9-18-06, and follow email correspondence, JEF will leave the 100-yr, 6-hr point rainfall depth at 3.2 inches based on the following findings:
   - ***NOAA 2 has the isopluvial value at 3.2 inches, as does the most current draft of the District's Manual***
   - ***The effective District Manual has the isopluvial value at 3.4 inches, but there is no explanation of why it was changed from the NOAA 2 value. We can make an educated guess as to what the isopluvial value might be, but the fact is that we cannot say with certainty that NOAA didn't intend to use 3.2 inches.***
   - ***Regardless of which isopluvial value we choose, we can be criticized (didn't use NOAA 2, the official source of rainfall data vs. didn't use effective FCD Manual)***
   - ***PBSJ (ADMS) and Alpha (White Tank Wash FDS) both used the 3.2 inch value. There is continuity in using the 3.2 in value***
   - ***The District is moving towards adopting the NOAA 14 rainfall. NOAA 14 has a 6hr, 100yr value of 3.16 inches***

- ***Using 3.4 in instead of 3.2 in results in about a 10% increase in Q100 peak discharge for about half the apexes. The other half are controlled by the 24 hr storm. Accuracy of hydrology is probably no better than +/- 25% anyway***
- ***For the TDN, the discharge does not affect the floodplain delineation. On the fan surface, geomorphic methods were used (Q is not a factor). For the upstream riverine delineations (approx. methods), there are no BFE's and the washes are in well defined canyons, so the difference in Q results in no observable difference in floodplain extent***
- ***For the ADMP, recommended capital improvement basin design is controlled by the 24 hr (volume) and once the piedmont drainage area kicks in, the 24 hr controls anyway***

4. Add copies of the 100-yr 24-hr and 100-yr 6-hr isopluvials from the Hydrology Manual to Appendix D.
   JEF Response: Done.

5. The Summary of Results page is missing from Appendix D.1. Please include in the next submittal.
   JEF Response: Done.

6. Land Use. The RTIMP used in the HEC-1 models differs from that in DDMSW. Please change to be consistent.
   JEF Response: The RTIMP in the HEC-1 model is a result of the % rock outcrops in the soil map units. Therefore, the RTIMP values for input land use categories may not reflect final values used in the HEC-1 models depending on whether any rock outcrops are found in soil units within the watershed.

7. Plate 1 – Add title Watershed Map, add intermittent elevations to contours, add the ft symbol to the top and bottom elevations, recommend changing to black and white map due to reproduction issues.
   JEF Response: Done. The symbology has been revised so all features will be discernable when reproduced in black and white.

8. Plate 2 – Add title Soils Map, add intermittent elevations to contours, add the ft symbol to the top and bottom elevations, recommend changing to black and white map due to reproduction issues. Cannot distinguish soil types from each other. Please use more contrast for the different soil types.
   JEF Response: Done. The symbology has been revised so all features will be discernable when reproduced in black and white.

9. Plate 3 – Add title Land Use Map, add intermittent elevations to contours, add the ft symbol to the top and bottom elevations, recommend changing to black and white map due to reproduction issues. Cannot distinguish land use types from each other. Please use more contrast for the different land use types.
   JEF Response: Done. The symbology has been revised so all features will be discernable when reproduced in black and white.

10. Plate 3 – To be consistent with the other Fan TDNs, please show only the existing land use types modeled, i.e. Hillslopes and Mountain Terrain. Remove Desert Rangeland (NDR) < 5% slopes from the legend since this land use type was not used.
    JEF Response: Done.

11. Report, Page 1-1, Section 1.1. Change "Sites 4 and 5 n the White Tank Piedmont" to "Sites 4 and 5 on the White Tank Piedmont".
    JEF Response: Done.

12. Report, Page 4-3, last sentence. Change "PI records" to "PC records".
    JEF Response: Done.

13. Report, Page 4-4, Figure 4.1. Remove the 2-yr 6-hr and 2-yr 24-hr isopluvials. They are not related to this report.
    JEF Response: Both the 2-year and 100-year point rainfall is input into the PREFRE programs to develop the rainfall statistics for the HEC-1 model. Per verbal comment from Julie, the Figure will remain as is.

14. Report, Page 4-5, Land Use, last sentence. Insert "Natural" before "Mountain Terrain".
    JEF Response: Done

15. Report, Page 4-5, Land Use, last sentence. Change "Fan 10 and 11" to "Fan 4 and 5".
    JEF Response: Done

16. Report, Page 4-7, 2 locations. Change "Table 1" to "Table 4.1".
    JEF Response: Done

17. Report, Page 4-7, Unit Hydrograph. Change "Fan 10 and 11" to "Fan 4 and 5".
    JEF Response: Done

18. Report, Page 4-12, Table 4.3. Show units, i.e. cfs and cfs/sq mi.
    JEF Response: Done

19. I did not find where the report spells out the names of the soil types. Please include a table that identifies the name for each soil type (645100, 645123, etc.).
    JEF Response: Done.

20. Report references. Please add references from the Buckeye/Sun Valley ADMS, Sun Valley ADMP, Piedmont Manual, Hydrology Manual, Hydraulics Manual, SCS Soil Surveys, etc. as appropriate.
    JEF Response: No citations to the Sun Valley ADMS or ADMP reports were made in Section 4. References to appropriate ADMS and ADMP documents are provided in other sections of the TDN where ADMS or ADMP documents were cited. A reference to the District's Hydrology Manual was added to the citations list.

    Julie Cox provided the following comment during a meeting on 9-18-06: Review the unit hydrograph for Sub-basin S500, something seems off.
    JEF Response: Due to the MCUHP2 program's limitation of 50 ordinates, the total unit hydrograph could not be captured. Therefore, the unit hydrograph was redeveloped for a 10 minute time-step. The peak flow rates were reduced slightly and all documentation and maps were updated accordingly. A paragraph was added to Section 4.3.1 that discusses this problem in more detail.

Geomorphology Comments (Kathryn Gross, Letter dated August 11, 2006)

I have reviewed the above submittal and have the following comments. Overall the delineation limits appear reasonable; however, there are some designation concerns and modifications that are needed prior to approval.
JEF Response: See responses to specific comments below.

Technical Summary

1. Hydrology – Make sure all supporting documentation is provided. Full comments forthcoming from Julie Cox.
   JEF Response: Comments were received from Julie and are listed above.

2. Hydraulics – Upstream modeling appears reasonable. Please run checkras on the upstream delineation. Upstream of the apex the delineation should be an administrative floodway. If the Consultant prefers the water surface elevations for each cross-section location can be determined using FlowMaster or a similar product. If left in RAS the Consultant needs to provide a baseline in the delineation and be prepared to answer any FEMA questions, as they will review it as a RAS product.
   JEF Response: Done. Check-RAS was run, output is included in Appendix E, a baseline has been included on the workmaps.

3. Geomorphology – TDN appendix G supporting documentation needs to be provided. A master Appendix G for all fan delineations is recommended.
   JEF Response: An Appendix G has been created.

4. Floodplain Delineations - Some potential modifications to the delineation limits are recommended. This will require updates on the workmaps and annotated FIRM panels as well. This is discussed later in the comments.
   JEF Response: Specific responses are provided below.

5. Delineation should be called out as White Tank Fans 4 and 5.
   JEF Response: Done

Delineation

1. Locations where there are concerns regarding the delineation have been identified in the shape file fan45quest.shp. This file will be included with this comment submittal. Some points require no action, as they are just field visit points for myself.
   JEF Response: File was received and considered. See specific responses below.

2. At present the delineation appears reasonable. However, there are two locations where modifications may be discussed further.
   a. The first location is the AFHH zone that contains points 3 and 10. The surface does not appear to support the active fan condition.
      JEF Response: Zone has been changed to AFUFD designation.

b. The second location possibly needed designation modification would be the Hassayampa Fans. If management is concerned about the floodway designation further discussions may be necessary.
JEF Response: It is our professional opinion that our delineation correctly identifies small, but active alluvial fans at the toe of the piedmont where the fans confluence with the Hassayampa River. The active fans are delineated as such. In some places, slight modifications to the fan limits were made based on further consideration.

Report Comments

1. Page 2-1, Abstract section 2.1.3. Craig Kennedy is no longer the official contact at Baker. If a new contact is identified prior to FEMA submittal the name should be updated.
JEF Response: Done

2. Page 2-1 section 2.1.7 Reach Description. Should we list only the fan associated with this report?
JEF Response: Done

3. Page 2-1 section 2.1.10 Coordination of Peak Discharges. Since the hydrology is not finalized yet, this date will need to be updated.
JEF Response: Done

4. FEMA O&C Form
   a. Part D – The form should be updated to reflect my name.
   JEF Response: Done

5. FEMA RH&H Form
   b. Two sets of RH&H forms were submitted. For each set all the fans are listed under Flooding Source. Was one set to be for Fan 4 and one set to be Fan 5?
   JEF Response: Changed to list only one fan per form.
   c. Part B
      i. Number 3 - The yes box should be checked here instead of no if the use of RAS is continued.
      JEF Response: Done
      ii. Number 4 – Could the model name reflect a Fan 4 and 5 identifier?
      JEF Response: Done

6. Section 4 – Review comments will be provided by Julie Cox.
JEF Response: Déjà vu. Comments were received from Julie and are listed above.

7. Section 5, the upstream floodplain should be delineated as an administrative floodway and its designation should be discussed in this section.
JEF Response: A discussion of riverine administrative floodways was added to Section 5.

8. Section 5, the alluvial fan delineation will supercede portions of the existing Hassayampa River delineation. This should be discussed in the text in either this section or section 6.
JEF Response: This comment was discussed with the District reviewer. Because the alluvial fan floodplain delineation includes administrative floodways, the limits were drawn to the floodway

limit, rather than the floodway fringe. The latter would leave a gap between floodways that potentially could be developed. A discussion of this was added to Sections 5 and 6.

9. Page 5-8. Make sure to include the RAS summary table in the final report.
   JEF Response: Done.

10. Page 6-60, 6B.6.2 consider rewording third paragraph. My interpretation of the text is that there was a difference in flood hazard between the delineation and the AZGS flood hazard classification, L2. In my opinion it looks like a reasonable match. L2 states that flows are confined in channels. The AAFF zones are essentially occurring in the channels as described by the AZGS report.
    JEF Response: The paragraph was reworded.

Appendix Comments

1. For Appendix A, B, C, and E - no comments. Update references as needed.
   JEF Response: No response needed.

2. Appendix D - Consider placing a separate copy of the Rainfall figure in the appendix. Organize data following State Standard.
   JEF Response: Done.

3. Appendix F – consider providing information from the sediment yield analysis here.
   JEF Response: The Ayres Sediment Report was added to Appendix G.

4. Appendix G – no supporting documentation of the geomorphic analysis was provided. Perhaps a master Appendix G could be developed for use with all the Fan reports.
   JEF Response: An Appendix G has been created.

5. Appendix H- no digital information was provided in this submittal. Please make sure to include a cd with the next submittal including digital line work for hydrology as well as floodplain delineation.
   JEF Response: Done. DDMSW, HEC-1, GIS, PDF, and all other file types used to develop the TDN are included on the CD.

6. A-Maps Hydrology. No concerns.
   JEF Response: No response needed.

7. B-Maps Geomorphology. No concerns.
   JEF Response: No response needed.

8. C-Maps Hydraulics/Floodplain.
   a. Consider removing the smaller Shaded X zones.
      JEF Response: Small zones less than 5 acres were not delineated.

   b. Floodway symbology is needed on the delineations shown.
      JEF Response: Done.

   c. Consider adding a legend of the FCD fan delineation categories.

JEF Response: Done.

d. Consider revising the title to "Approximate Zone A Floodplain Delineation Study of White Tank Fans 4 and 5."
JEF Response: Done.

e. Consider labeling the Fans as White Tank Fan 4 and White Tank Fan 5 on the workmaps.
JEF Response: Done.

f. Consider adding labels identifying where the White Tank Fan 4 and 5 delineation will tie into the existing Hassayampa River delineation.
JEF Response: Done.

9. Annotated Panels. Please consider the following:
   a. Somewhat hard to read the red line work and text.
   JEF Response: Increased font size, added white background behind text where necessary.

   b. Designations need to be modified. Please use FEMA designations on panels:
   JEF Response: Done.

   c. Upstream of Apex: Zone A Administrative Floodway – Inactive Fan Flooding
   JEF Response: Done.

   d. Downstream of Apex: Zone A Administrative Floodway – Active Fan Flooding and Zone A Inactive Fan Flooding.
   JEF Response: Done.

   e. Add a note stating administrative floodways are regulated by the local regulatory authority.
   JEF Response: Done.

   f. Add floodway shading of the corridors.
   JEF Response: Done.

   g. Consider naming the corridor.
   JEF Response: Done.

   h. FEMA will only allow one designation for any given location. If the proposed delineation is going to overlap the effective delineation a note with a leader line showing where we want to remove the effective delineation from the FIRM panel should be added.
   JEF Response: Done.

Text Comments

1. Page 5-1 section 5.1. Please correct "apeces" with either "apexes" or "apices".
   JEF Response: Done

2. Page 6-4. Update the study list so that 16 is added to 3-13

JEF Response: Done

3. Page 6-9. Update the text in the 2nd paragraph. It states Fan 6 instead of Fans 4 and 5.
   JEF Response: Done

4. Page 6-26, 6B.4.4 last sentence. Please update the text to reflect that there were 5 new fans identified (16-20).
   JEF Response: Done

5. Page 6-42 second paragraph second to last sentence. Please replace "excel" with "excess."
   JEF Response: Done

6. Page 6-54 section 6B.5.6.3. Please add "and" before Sun Valley Parkway in the first sentence and replace "of" with "on" in the second sentence.
   JEF Response: Done

7. Section 6B.5.6 Please revisit numbering of subsections.
   JEF Response: Done

Memorandum JE Fuller/ Hydrology & Geomorphology, Inc.

DATE: November 3, 2006

TO: Valerie Swick/FCDMC

FROM: Jon Fuller, PE, RG, CFM

RE: Sun Valley ADMP
Alluvial Fan Floodplain Delineations: Fan 4-5
Response to TDN Review Comments

CC: Kathryn Gross/FCDMC
Julie Cox/FCDMC
Mike Kellogg/JEF
Rob Lyons/JEF

This memorandum summarizes JE Fuller/Hydrology & Geomorphology, Inc. (JEF) responses to District review comments. District review comments are enumerated below, using the number from the District review comment letter. JEF responses are shown in 10-point bold italic font immediately below each comment. We appreciate the thoughtful and timely review by the District staff.

Hydrology Comments (Julie Cox, Email on October 5, 2006)

Per above-referenced email from Julie Cox/FCDMC, all hydrology comments have been addressed.

JEF Response: No response needed.

Geomorphology Comments (Kathryn Gross, Letter dated October 6, 2006)
The TDN has been reviewed and is considered approved once the minor corrections listed below are addressed.

JEF Response: The minor corrections have been made. Therefore, the TDNs should be considered as approved.

1. Section 2.
   - Section 2.1 – In the abstract under Coordination of Peak Discharges, could the reference for Sun Valley be updated to read Sun Valley ADMP instead of ADMS?

     JEF Response: Done.

   - Section 2.2 FEMA forms
     - Form 1 – Section B, add the Town of Buckeye Community Number (040039) for each panel listed in the table.

JEF Response: Done.

- H&H Form
  1. 2 sets of H&H forms were submitted for Fan 5
     JEF Response: Done.

  2. For Fan 5, Section B, number 4, the model name still reads zone_a instead of the updated name zone_a45.

     JEF Response: Done.

2. Section 6. Section number updates. Please update the section numbers listed below.
   - Page 6-5 – Subsections under 6B.2 are listed as 6.1.1-6.1.5 instead of 6B.2.1-6B.2.5

     JEF Response: Done.

   - Page 6-19 – Summary should be 6B.4.1.3 (sorry for oversight in last review)

     JEF Response: Done.

   - Page 6-53 – Summary should be 6B.5.3.9 (sorry for oversight in last review)

     JEF Response: Done.

3. Section 6. Figure 6.8. Fan 20's apex is not included.

   JEF Response: Done.

4. Section 6. "Renegade" threes. On the top of pages 6-36 and 6-41 there are some renegade number 3s included.

   JEF Response: Done.

5. Section 6, page 6-36, first sentence. Please correct "apex for Fan 4 is location in…"

   JEF Response: Done.

6. Appendix B – Please make sure District provides a copy of the public meeting brochure and mailing list for inclusion prior to FEMA submittal.

JEF Response: District will provide following November Submittal per phone conversation with KAG on 10-31-06.

7. Appendix E. Noticed that the discharges listed in the model notes do not match the discharges used in the model (hard copy and digital). Consider correcting the notes and re-running the model. (Sorry for the oversight in the last review)

   JEF Response: Done.

8. Appendix G – Please include a placeholder in the TDN for appendix G that directs individuals to the stand-alone binder.

   JEF Response: Done.

9. CD. There is an additional 24-hour hydrology model called "test.dat" included with the digital hydrology models. Is there a reason for its inclusion? Please provide an updated cd with the file removed if it is not necessary.

   JEF Response: Done.

10. C Maps.
    - On Sheets 3, 5, and 6, at the jurisdiction limits, please change the "City of Buckeye" to "Town of Buckeye". (Sorry for the oversight in the last review)

      JEF Response: Done.

    - For all Sheets, in the legend please change "Effective 100-year Administrative Floodway" to "Effective 100-year Floodway". (Sorry for the oversight in the last review)

      JEF Response: Done.

    - On Sheet 4, there is a doubled Zone X label in Section 27.

      JEF Response: Done.

    - On Sheet 5, regarding the text "Match White Tank Fan 19 FDS". Since there is no true White Tank Fan 19 FDS, please consider revising this text.

      JEF Response: Done.

11. Annotated Panels. For all panels, consider updating the Administrative Floodway note. Replace "Administrative Flooding" with "Administrative Floodway."

    JEF Response: Done.

12. Annotated Panels. Consider creating a panel 1575 to show the rest of the delineation. This can be discussed further.

JEF Response: This is a non-printed map as stated in FEMA form 1 Section B. We looked on the FEMA website again and as of 10-31-06 there is still no printed panel for this section.

B.5 Contract Documents

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

Flood Control District
of Maricopa County

w.fcd.maricopa.gov
1 West Durango Street
enix, Arizona 85009
ne: 602-506-1501
: 602-506-4601
602-505-5897

June 30, 2005

Jonathan Fuller
President
JE Fuller/Hydrology & Geomorphology, Inc.
8400 S. Kyrene Road, Suite 201
Tempe, Arizona 85284

RE: Contract FCD 2004C049, Sun Valley Area Drainage Master Plan

Dear Jon:

Congratulations on the award of the above referenced contract. Enclosed is an original of the fully executed contract document for your files. This letter is the official Notice to Proceed effective June 22, 2005. The work under the contract is to be completed within three hundred eighty-nine (389) calendar days. The contract completion date is July 16, 2006.

The District welcomes your participation on this project. We want to remind you of the importance we at the District place upon the contract completion date. Maintaining schedules are imperative in meeting the District's planning and future funding goals. Your contract completion date is not only a contractual requirement, but is also a commitment on the part of your firm. Throughout the term of the contract it must be treated with a high degree of importance. We expect and anticipate that this will be the case.

Again, we welcome your participation as a District consultant and look forward to an enjoyable and profitable relationship. Should you have any questions regarding the contract, please call me at (602) 506-8378.

Yours truly,

Sharon McGuire

Sharon McGuire
Contracts Specialist

Enclosure: Contract FCD 2004C049

cc: Central File FCD 2004C049

EXHIBIT A

SCOPE OF WORK

FCD 2004C049

SUN VALLEY AREA DRAINAGE MASTER PLAN

TABLE OF CONTENTS

1.0 GENERAL PROVISIONS 4
- 1.1 GENERAL REQUIREMENTS 4
- 1.2 DEFINITIONS 4
- 1.3 TERMS AND CONDITIONS 4
- 1.4 CONSULTANT FEE 4
- 1.5 EVALUATION FORMS 4
- 1.6 OPTIONAL TASKS 4
- 1.7 LOCATION 4
- 1.8 PURPOSE AND NEED 4
- 1.9 AGENCIES 5
- 1.10 DATA PROVIDED TO THE CONSULTANT 6
- 1.11 PROJECT FORMAT 6

2.0 SCHEDULE AND PROJECT COORDINATION 6
- 2.1 SCHEDULE 6
- 2.2 PROJECT COORDINATION 8
- 2.3 SCOPING SESSION 9
- 2.4 MEETINGS 10

3.0 SURVEY, PHOTOGRAMMETRY, AND MAPPING 12
- 3.1 FIELD SURVEY 12

4.0 DATA DELIVERY STANDARDS 12

5.0 PUBLIC/ STAKEHOLDER INVOLVEMENT 12
- 5.1 PUBLIC INFORMATION GUIDELINES 12
- 5.2 PUBLIC INVOLVEMENT PLAN 13
- 5.3 PIO COORDINATION 15
- 5.4 STAKEHOLDER INVOLVEMENT 15

6.0 RIGHTS-OF-WAY AND EASEMENTS 16
- 6.1 EXISTING RIGHTS-OF-WAY 16
- 6.2 AFFECTED PROPERTIES 16

7.0 ENVIRONMENTAL EVALUATION 16
- 7.1 ENVIRONMENTAL OVERVIEW 16
- 7.2 404 JURISDICTIONAL DELINEATION (OPTIONAL) 18
- 7.3 TITLE VI ENVIRONMENTAL JUSTICE ASSESSMENT 18

8.0 GEOTECHNICAL INVESTIGATION 18

9.0 HYDROLOGY 19
- 9.1 STANDARDS 19
- 9.2 REVIEW EXISTING AND PREPARE NEW HYDROLOGY 19
- 9.3 REVIEW OTHER EXISTING HYDROLOGIC MODELS AND FAN METHODOLOGIES 19
- 9.4 MODELING DISCREPANCIES 20
- 9.5 HYDROLOGIC ALTERNATIVE ANALYSIS 20
- 9.6 HYDROLOGIC ANALYSIS SUBMITTALS 20

10.0 HYDRAULICS 21
- 10.1 STANDARDS 21
- 10.2 REVIEW AND UPDATE EXISTING HYDRAULIC ANALYSES 21

10.3 EXISTING CAPACITY OF DRAINAGE FACILITIES 21
10.4 ALTERNATIVE ANALYSIS 22
10.5 OPEN CHANNEL HYDRAULICS FOR MAJOR WATERCOURSES .. 22
10.6 STRUCTURES HYDRAULICS 23
10.7 SEDIMENT TRANSPORT, SCOUR, CHANNEL AND RIVER MECHANICS 23
10.8 CHANNEL STABILIZATION DESIGN 26
10.9 HYDRAULIC ANALYSIS SUBMITTALS 26
11.0 FLOODPLAIN DELINEATION STUDIES 26
11.1 APPROXIMATE FLOODPLAIN DELINEATIONS 26
11.2 DETAILED FLOODPLAIN DELINEATIONS (OPTIONAL) 27
11.3 GENERAL FLOODPLAIN DELINEATION TASKS 28
11.4 SUBMITTALS 29
12.0 PLANNING STUDIES 30
12.1 PROJECT PHASING 30
12.2 PHASE II 31
12.3 PROJECT COORDINATION 31
12.4 PLANNING/REGULATORY COORDINATION 31
12.5 PROJECT INFORMATION SUBMITTAL 32
12.6 STEP 1: PRELIMINARY ALTERNATIVES FORMULATIONS AND ANALYSIS 32
12.7 STEP 2: PROPOSED ALTERNATIVES ANALYSIS 33
12.8 STEP 3: RECOMMENDED ALTERNATIVE ANAYLSIS 35
12.9 IMPLEMENTATION PLAN (OPTIONAL) 37
12.10 SITE VISITS 37
12.11 MEETINGS 37
12.12 REPORTS 38
12.13 DELIVERABLES FOR PLANNING STUDIES 38
13.0 PRE-DESIGN 39
14.0 FINAL DESIGN AND CONSTRUCTION DOCUMENTS 39
15.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC) 39
16.0 MAINTENANCE PLAN (OPTIONAL) 40
17.0 CADD/DRAFTING STANDARDS 40
18.0 DIGITAL ORTHOPHOTOS 40
19.0 DESIGN REFERENCES, SPECIFICATIONS AND STANDARDS 40
19.1 STANDARD DETAILS AND SPECIFICATIONS 40
19.2 DESIGN MANUALS, POLICIES, GUIDES, AND PROCEDURES 40
20.0 LANDSCAPE PLANNING AND DESIGN 41
20.1 SCENERY RESOURCE ASSESSMENTS FOR PLANNING STUDIES 41
21.0 RECREATION MULTIPLE-USE ASSESSMENTS FOR PLANNING STUDIES 55

10.8 CHANNEL STABILIZATION DESIGN

10.8.1 Step 1 – Preliminary Alternatives

Qualitative determinations of anticipated erosion and deposition trends shall be used to identify locations requiring channel stabilization measures for the preliminary alternatives.

10.8.2 Step 2 – Proposed Alternatives

The channel stabilization analysis for the proposed alternatives shall include evaluation of various stabilization techniques and investigation of spacing and character of the grade control structures. Types of materials for horizontal and vertical stabilization shall be examined. Minimal channel stabilization design analysis shall be conducted for the purpose of feasibility assessment.

10.8.3 Step 3 – Recommended Alternatives

Channel stability calculations shall be performed at critical design locations of no more than 168 locations.

10.8.3.1 Channel stability for unlined channels shall be based on permissible velocity.

10.8.3.2 Channel stability for lined channels using riprap or loose material shall be based upon tractive shear design. Provide calculations to show that the type of bank protection (riprap, gabions, concrete, etc.) is suitably sized to resist hydraulic forces (tractive shear, impingement, buoyancy, etc.) at the design frequency peak flow.

10.8.3.3 All hydraulics and structural calculations shall be provided for DISTRICT review.

10.8.3.4 Minimum factors of safety applied to hydraulic forces on structural components shall be 1.5 based on the 100-year frequency peak flow.

10.9 HYDRAULIC ANALYSIS SUBMITTALS

The Hydraulic Analysis submittals for Steps 1, 2, and 3 will be prepared as a separate section of the alternatives reports as described in Section 12.12.2.

10.9.1 The CONSULTANT shall provide a draft submittal at each Step for review by the DISTRICT.

10.9.2 The CONSULTANT shall provide the final submittal at each Step as part of the final alternatives report.

11.0 FLOODPLAIN DELINEATION STUDIES

Delete this section in its entirety and replace with the following:

11.1 APPROXIMATE FLOODPLAIN DELINEATIONS

Approximate floodplain delineations will be performed using appropriate riverine and alluvial fan methodologies acceptable to the DISTRICT and FEMA. The CONSULTANT shall conduct the study using the guidelines established in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, *February 2002*, FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, *December 1993*, Arizona Department of Water Resources' State Standard for Floodplain Hydraulic Modeling (SS9-02), and the project SOW. The models for each study

area will need to include textual descriptions regarding the name of the study contractor and their location, DISTRICT FCD contract number, DISTRICT project manager, study-related topographic mapping, and other items determined pertinent to obtain full study documentation.

11.1.1 Approximate Alluvial Fan Floodplain Delineations will be performed for Area 4 and presented in the TDN. The delineation of the alluvial fan floodplain delineation is based on a three stage process where landforms are first identified (Stage 1), then the stability of the landforms are determined (Stage 2), and the formal floodplain delineation is delineated based on hydraulic indicators and the results of Stage 1 and Stage 2 (Stage 3).

11.1.1.1 The CONSULTANT shall bring any concerns or discrepancies concerning the Stage 1 and Stage 2 findings to the DISTRICT's attention in the Initial Approximate Floodplain Delineation Technical Memorandum. The Stage 1 and 2 concerns will then be addressed by the DISTRICT and resolved with the CONSULTANT prior to completing the Stage 3 floodplain delineation (Task 11.1.1.5). The DISTRICT shall address concern and discrepancies identified in the Initial Approximate Floodplain Delineation Technical Memorandum. The revised findings shall be provided to the CONSULTANT.

11.1.1.2 **(OPTIONAL)** - The CONSULTANT shall make any necessary adjustments to the Stage 1 and Stage 2 findings to address concern and discrepancies identified in the Initial Approximate Floodplain Delineation Technical Memorandum. The revised findings shall be provided to the DISTRICT. **This optional task is not authorized with the Notice to Proceed; it may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period.**

11.1.1.3 Using the information from the Technical Memorandum Buckeye Sun Valley ADMS Piedmont Landform Delineations (T2.6.2), present the Stage 1 information in TDN format.

11.1.1.4 Using the information from the Technical Memorandum Buckeye Sun Valley ADMS Piedmont Landform Stability Assessment (T2.6.3), present the Stage 2 information in TDN format.

11.1.1.5 Using the methodologies described in the Piedmont Flood Hazard Assessment Manual (draft May 2003) perform the Stage 3 floodplain Delineation.

11.1.2 Approximate Riverine Floodplain Delineations will be performed for the areas upstream of the alluvial fan apices to prove flow containment. The approximate delineation methodology may use HECRAS or other approved approximate hydraulic delineation method. The CONSULTANT shall perform flow containment hydraulic evaluation of the areas upstream of the alluvial fan apices only for those apices not being so evaluated by others. The number of fan apices for which the CONSULTANT shall evaluate flow containment shall not exceed sixteen (16).

11.2 DETAILED FLOODPLAIN DELINEATIONS (OPTIONAL)

Detailed floodplain delineation will be performed on no more than four (4) miles of the White Tank Wash and Tributaries if the hydraulic analysis warrants the delineation be revisited. The delineations may be accomplished using the U.S. Army Corps of Engineers' most recent version of the HEC-RAS computer model. Other modeling methodologies acceptable to FEMA shall be considered on a case-by-case basis, and will be specified in the SOW. The CONSULTANT shall

conduct the study using the guidelines established in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, *February 2002*, FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, *December 1993*, Arizona Department of Water Resources' State Standard for Floodplain Hydraulic Modeling (SS9-02), the DISTRICT's Consultant Guidelines (*Third Edition – December 1, 2003 – Revision 1*). and the project SOW. The models for each study area will need to include textual descriptions regarding the name of the study contractor and their location, DISTRICT FCD contract number, DISTRICT project manager, study-related topographic mapping, and other items determined pertinent to obtain full study documentation. **This optional task is not authorized with the Notice to Proceed; it may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period.**

11.3 GENERAL FLOODPLAIN DELINEATION TASKS

11.3.1 The delineation work shall meet requirements for floodplain and floodway delineations as prescribed by the FEMA and the ADWR. The delineation work may also require review and acceptance by other cities, towns, or local agencies as identified in the contract SOW.

11.3.2 The delineation study shall be based on the final results of the hydrologic study as summarized in Section 9.0 of this document, or existing hydrology data supplied by the DISTRICT at the beginning of the project.

11.3.3 The CONSULTANT is to make refinements to the approximate delineation analysis based on review of the results by the DISTRICT, ADWR, FEMA, and the FEMA Flood Map Production Coordination Contractor. The CONSULTANT shall also review the delineation and/or modeling results for reasonableness. Work normal to the scope shall include all adjustments to the input parameters required for obtaining the most realistic results.

11.3.4 Administrative Floodways are to be determined using the methods outlined in the Piedmont Flood Hazard Assessment Manual (draft May 2003).

11.3.5 REVIEW AND APPROVAL

The CONSULTANT must obtain DISTRICT approval at each of the following steps:

a. Proposed location and alignment of the cross sections and channel centerline for approximate riverine analysis upstream of the alluvial fan apices.
b. Floodplain (natural) delineation and Administrative Floodway delineation
c. Finalized reporting in Technical Data Notebook.
d. Final FEMA submittal package (with all documentation).

11.3.6. CROSS SECTIONS

11.3.6.1 Flood zones must be determined according to FEMA criteria and clearly labeled on the final work-study drawings.

11.3.6.2 A Technical Data Notebook (TDN) shall be prepared in accordance with the ADWR State Standards Attachment 1-97 (SSA1-97) to present the findings of the floodplain/floodway delineations. The format of the TDN shall follow "ADWR/FEMA Submittals" as outlined in SSA1-97 unless otherwise specified in the SOW. Pertinent information from other sections of these guidelines shall also be documented as necessary to fully complete the TDN for a FEMA

submittal and review. The TDN shall include profile plots and complete printouts of the HEC-RAS and HEC-1 models.

11.3.7 WORK STUDY MAPS

11.3.7.1 The CONSULTANT shall provide permanent non-erasable mylars of the work study drawings. A cover sheet will be provided with the project title, date of topographic mapping, and a location map showing geographic range covered by each specific mapping sheet. Each drawing shall include contours, spot elevations, the floodplain and floodway delineations, and a minimum of a north arrow, scale, section corners and quarter corners, current and proposed streets and highway names, NAD83 Central Zone State Plane Coordinate System grid marks, major drainage features, corporate boundaries, cross section lines, channel station center line, index map, and description and elevation of elevation reference marks (ERMs). The DISTRICT will supply a template of map and drawing formats.

11.3.7.2 The final mylar drawings shall be sealed by each qualified registrant according to the work performed. The work of each SUBCONSULTANT and/or sub-contractor shall be performed in accordance with the SOW and these Guidelines. The CONSULTANT shall check all work prior to each submittal to the DISTRICT. All drawings shall be initialed and dated by the person who performed the work and the checker.

11.3.8 QUALITY ASSURANCE

11.3.8.1 A qualified registrant shall seal the final submittal of mylar drawings.

11.3.8.2 The work of each SUBCONSULTANT shall be performed in accordance with the SOW and these Guidelines. The CONSULTANT shall check all work prior to each submittal to the DISTRICT. All drawings shall be initialed and dated by both the person who did the work and the checker.

11.3.8.3 The work of any subcontractors utilized by the prime CONSULTANT for this contract shall be reviewed by the prime CONSULTANT for compliance with the SOW and these Guidelines prior to submittal for review by the DISTRICT.

11.3.9 HIS DATA

Delivery of digital study data shall follow the DISTRICT's format as stated in the Consultant's Guidelines.

11.4 SUBMITTALS

The CONSULTANT shall submit the following items to the DISTRICT for review by Federal Emergency Management Agency (FEMA) and any other appropriate governmental agency. All of the following products, unless otherwise specified, are considered deliverables for the FEMA submittal:

11.4.1 Original Affidavits of Publication.

11.4.2 Two (2) complete sets of blueline topographic base maps with the floodplain/floodway delineations shown. All drawings shall be signed and sealed by persons of appropriate professional registration(s). Each registrant shall provide a specific statement as to what service they performed.

11.4.3 Two (2) copies of the Technical Data Notebook, including complete HEC-1 and HEC-RAS digital input/output files on diskettes or CDs. The Technical Data Notebook shall be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA1-97) using the ADWR/FEMA Submittals outline, unless otherwise specified by the DISTRICT.

11.4.4 Three (3) sets of the project survey report.

11.4.5 Final Submittal - The following products are considered deliverables for the final submittal to the DISTRICT after FEMA approval is issued.

11.4.5.1 One (1) complete set of mylars and four (4) complete sets of sealed blueline topographic base maps with the floodplain/floodway delineations shown. All drawings shall be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

11.4.5.2 Four (4) complete copies of the Technical Data Notebook including HEC-1 and/or HEC-RAS input/output files on diskettes. The Technical Data Notebook shall be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA1-97) using the ADWR/FEMA Submittals outline, unless otherwise specified by the DISTRICT. This submittal of the Technical Data Notebook shall include any correspondence and/or meeting minutes with the reviewing agencies, and shall reflect any revisions required by those reviewing agencies. Revisions may include, but are not limited to, modifications to the delineation maps, the HEC-1 model, the HEC-RAS model, and/or the final Technical Data Notebook.

12.0 PLANNING STUDIES

Delete this section in its entirety and replace with the following:

12.1 PROJECT PHASING

12.1.1 Area Drainage Master Plan (ADMP) projects will generally be completed in two Phases, each with a separate Notice to Proceed (NTP). The Phase I was completed as the Buckeye/Sun Valley Area Drainage Master Study (ADMS). The second phase will separate the Buckeye and Sun Valley Area because of their distinct differences in hydrologic characteristics. This project will be known as the Sun Valley Area Drainage Master Plan (ADMP).

12.1.2 Phase I consisted mainly of data collection including analyses of existing facilities, identification of past drainage and flooding problems, collection of existing flood photos, completion of existing conditions analyses, identification of flood hazard limits, and formulation of flood protection alternatives. Phase I primarily addressed Area 3; however, the Stage 1 Landform Delineation and Stage 2 Landform Stability Assessment were performed for both Areas 3 and 4. A Data Collection Report and Phase I Report were prepared and available to the CONSULTANT.

12.1.3 For Phase II, the CONSULTANT shall conduct the preliminary alternatives and then conduct a detailed analysis of the proposed alternatives (structural and non-structural). Proposed alternatives may include floodplain delineation work to be conducted during Phase II. Phase II work shall address Areas 3 and 4. Procedures for implementation of structural and non-structural plan features will be evaluated and recommended and, if

required by the project SOW, development guidelines and erosion hazard non-encroachment areas will be refined. An ADMP report and Phase II Technical Data Notebook (TDN) will be prepared at this time. The ADMP report shall include cost estimates and an implementation plan of the recommended alternatives.

12.2 PHASE II

12.2.1 DATA COLLECTION AND EXISTING CONDITIONS UPDATE

12.2.1.1 The CONSULTANT shall review the Data Collection Report prepared for Phase I of the project and update/refine the existing conditions analysis to reflect any new information, as appropriate.

12.2.1.2 The CONSULTANT shall identify permanent and temporary right-of-way (ROW) and easement requirements necessary for the proposed alternatives. The DISTRICT will provide all available GIS ROW information to the CONSULTANT. The remaining ROW will be researched and drawn on the proposed alternatives project area base sheets by the CONSULTANT. Only areas of additional ROW or easements necessary to construct the proposed alternatives will be identified.

12.2.1.3 The CONSULTANT shall identify zoning and land ownership for properties potentially impacted by the proposed alternatives.

12.2.1.4 The CONSULTANT shall obtain supplemental field surveys as necessary to aid in the development of the proposed alternatives.

12.2.1.5 For survey purposes, the CONSULTANT shall identify and obtain any necessary rights-of-entry (ROE) within the project area. Before distribution, the CONSULTANT shall provide any ROE letters to the DISTRICT for approval.

12.3 PROJECT COORDINATION

The CONSULTANT shall coordinate with other DISTRCT projects in the area such as, but not limited to the Buckeye FRS #1 Rehabilitation Project and the Hassayampa Watercourse Master Plan. A total of five (5) coordination meetings will be held for this purpose.

12.4 PLANNING/REGULATORY COORDINATION

12.4.1 The CONSULTANT shall complete an inventory and determine the status and relevance of any planning studies conducted by Maricopa County, partner Towns and Cities, and any other agencies working within the project area.

12.4.2 The CONSULTANT shall identify significant conditional development approvals by the Maricopa County Board of Supervisors; partner Towns and/or Cities' Councils, and any other agencies.

12.4.3 The CONSULTANT shall meet with planning staff from identified agencies to determine current policy thinking concerning land use, development standards, flood control, and environmental protection for the project area.

12.4.4 The CONSULTANT shall assess opportunities and obstacles created by adopted codes, ordinances, and development conditions.

B.6 Public Notification

Sun Valley

Area Drainage Master Plan

October 2006

Introduction

Since its inception in 1959, the Flood Control District of Maricopa County (District) has provided flood control services to County residents in order to ensure public safety and to protect property from flooding. As commercial and residential development in the West Valley forges beyond the White Tank Mountains, the District is working to ensure proper floodplain management and coordination of flood control infrastructure improvements is accomplished.

The Dis is nearing completion of Step of a three-step process to develop a drainage master plan for the Sun Valley area, located within western Maricopa County The District will also identify tential multi-use and recreational facilities that will complement and enhance the proposed project area as part of the plan.

Open House

6:00–8:00PM
Presentation: 6:30–7:00PM
Thursday, October 18, 2006
Buckeye Community Center
201 E. Centre, 623-349-6600

The purpose of the Open House is to present the recommended alternative, allow the public the opportunity to talk informally with project team members, and provide input about the Sun Valley ADMP. Public comment will also be sought following the presentation of the floodplain delineations

Looking south from near Wagner Wash and Sun Val Parkway; the western piedmont of the White Tank Mountains.

About the Study

The purpose of the Sun Valley Area Drainage Master Plan (ADMP) is to develop a conceptual drainage plan to serve as a roadmap that jurisdictional authorities and developers can use in planning flood control measures to mitigate flood hazards up to the 100-year event. The ADMP incorporates development plans for the area and jurisdictional drainage policies to develop a preferred regional flood control solution.

The study area has numerous alluvial fans downstream of the White Tank Mountains. Alluvial fans are fan-shaped sediment deposits located at the topographic break, such as a mountain front, that are made up of streamflow and/or debris flow sediment. Alluvial fans are hazardous because their flood flow path is unpredictable, and because of the potential for extreme erosion and sedimentation. Alluvial fans cover large areas of the White Tank Mountains and in order to develop private property within the fans developers have incorporated structural and non-structural solutions to address the hazards associated with them.

During the initial Step 2 Proposed Alternatives Analysis, multiple stakeholder meetings and a public meeting were held to discuss the alternatives development. The plan was developed with input from developers and their engineers to comprise whole-fan solutions by controlling runoff from the fan's apex (the point where the flows start to split) down to the outfall.

Structural and non-structural alternatives were developed and

About the Study
–continued

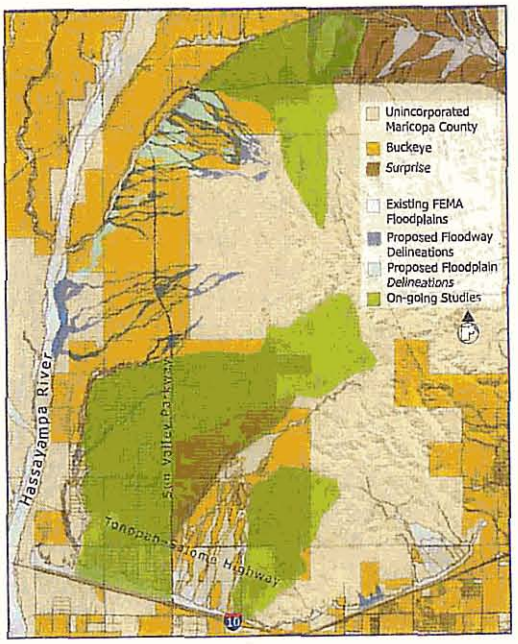
evaluated as part of Step 2 of the Sun Valley ADMP. The refined alternatives include both non-structural and environmentally friendly, aesthetically compatible structural flood control measures. For example, structural alternatives include an on-line basin at the fan's apex and restricted natural corridors to take the flows downstream in a controlled manner, while non-structural methods include floodplain delineations, which will not allow homes and buildings within the high hazard areas.

The proposed alternatives were evaluated for their flood control function, economic costs, environmental impacts, permitting issues, visual and aesthetic characteristics, and recreation and multiple-use opportunities.

In Step 3, the recommended alternative was further refined with consideration given to engir ring elements and the cost est. .es. Special attention was given to maximizing non-structural, floodplain management approaches along the preferred corridor alignments.

The Town of Buckeye, Arizona was a project participant. The ADMP was performed by JE Fuller/ Hydrology & Geomorphology, Inc., with sub-consultants C.L. Williams Consulting, Inc., Logan Simpson Design, Inc., AMEC Earth & Environmental, EDAW Inc., and Richard H. French, Ph.D., P.E.

Floodplain/Floodway Delineations

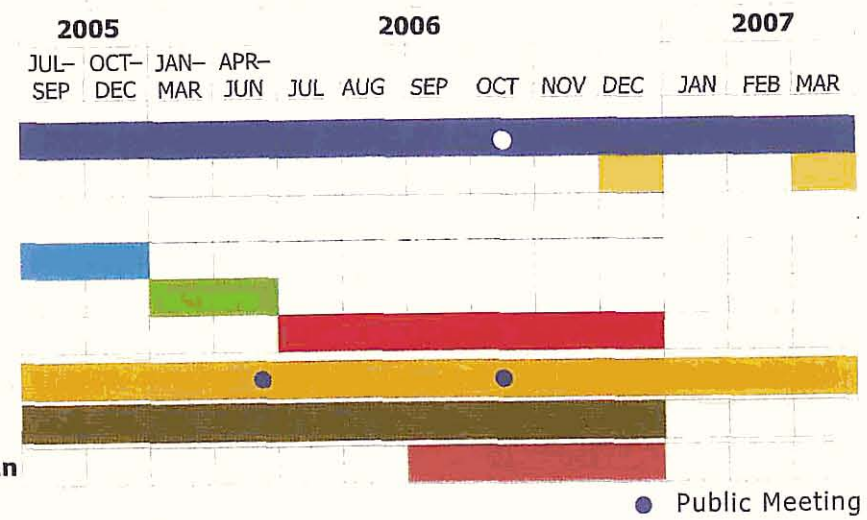


As part of the Sun Valley ADMP the District performed floodplain/ floodway delineations of resulting in approximately nine square miles of alluvial fan approximate floodplain delineations. These included Alluvial Fan Approximate Zone A designations as well as Alluvial Fan Approximate Zone A Administrative Floodway designations. Alluvial fan flooding is a special flood hazard characterized by unstable channel positions and unknown flow distributions at and downstream of the apex (most upstream portion of an alluvial fan landform).

The delineation study area is generally bounded by the Central Arizona Project Canal on the North, Wagner Wash and the Hassayampa River on the West, White Tank Mountains on the East, and the Buckeye Flood Retarding Structures 1 and 2 on the South.

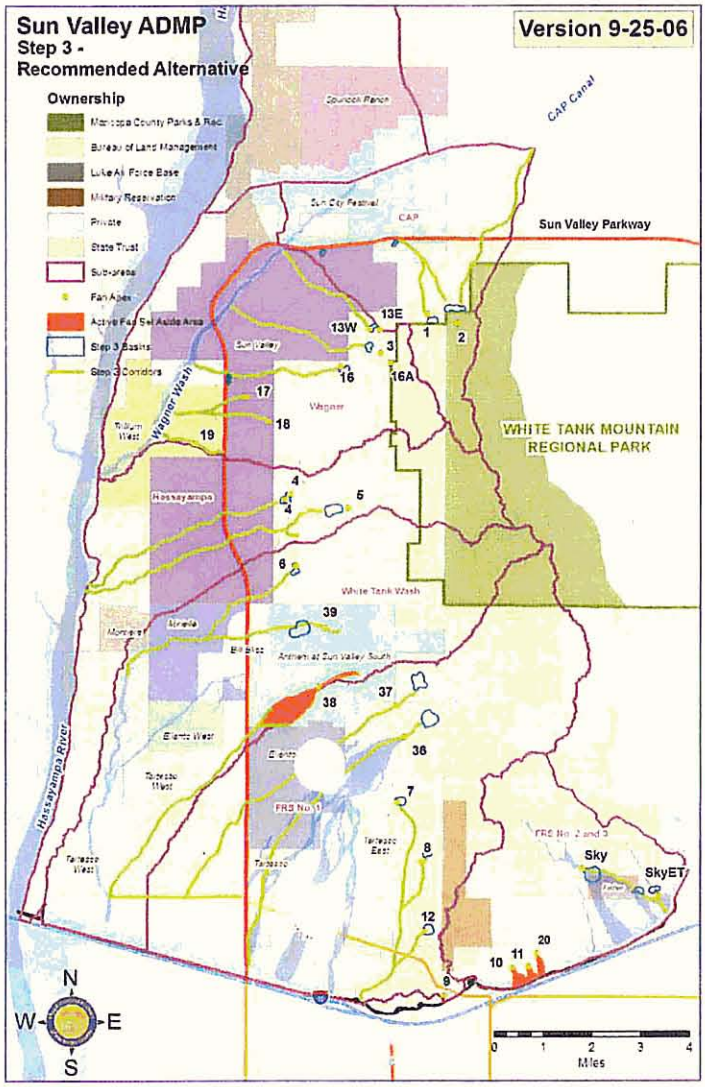
After the delineations are submitted to the Federal Emergency Management Agency (FEMA), the approval process can take one year or longer. Flood insurance will not be required for affected homeowners until it is adopted and the Flood Insurance Rate Map panels are updated. However, the delineation maps will be used as best technical information to guide adjacent development. A detailed fact sheet outlining the floodplain/floodway delineations will be available at the October 18 public meeting and on the project Web site at www.fcd.maricopa.gov.

Projected Schedule



Study Area

The study area, approximately 183-square miles, is bounded by the White Tank Mountains and Trilby Wash on the east, the Hassayampa River on the west, the Buckeye Flood Retarding Structures on the south and Gates Road to the north. The watercourses within the study area are all tributaries to the Hassayampa River or the Buckeye Flood Retarding Structures, except Fan 2 which is a tributary to Trilby Wash.



Next Steps

The Recommended Alternative (Plan) will be described at the public meeting. After the public meeting, comments about the Plan will be reviewed and incorporated if appropriate. The Plan and associated reports will be completed by the end of December 2006.

The first group of floodplain delineations will be submitted to FEMA for review in December 2006. A second public meeting will be held in the spring 2007 to provide information about the second group of floodplain delineations. After comments have been addressed, they will be sent to FEMA for review. The District will use the information as Best Available Technical Data to regulate the floodplains in the area while FEMA is completing their review. As the master planned communities are built and incorporate elements of the recommended plan, the floodplains will be revised to reflect flood control features and sent toFEMA to be incorporated on the Flood Insurance Rate Maps (FIRM).

As the Master Plan Developments move through the Buckeye Planning Process, the District will continue to be involved to ensure incorporation of the Plan. The District will also identify areas needed to complete the Plan that are not within a Master Plan Development and will take the necessary steps to ensure continuity of the Plan.

Related Project

Buckeye FRS No. 1 is the western most dam of a system of three dams that parallels the north side of Interstate 10 for 7.1 miles west to the Hassayampa River. The dam is operated and maintained by the District and is regulated under the jurisdiction of the Arizona Department of Water Resources (ADWR).

The District is conducting a planning study intended to develop project alternatives to address dam safety issues and to maintain flood control benefits to downstream properties for the long-term. The District is seeking federal funding assistance for this project from the Natural Resources Conservation Service. Alternatives may include a modified dam, floodways, or basins, which will provide a minimum of 100-year flood protection.

The District will be coordinating with local stakeholders and with the public to select an implementable alternative that meets project requirements and objectives.

Contact

Valerie Swick, EIT PH CFM
Project Manager
602-506-2929
vas@mail.maricopa.gov

Nicole Kelley
Public Information Officer
602-506-6762
nkk@mail.maricopa.gov

The District will distribute newsletters and other informational materials at key milestones in the project.

Sun Valley
Area Drainage Master Plan

October 2006

Supervisor Max Wilson, District 4

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

PUBLIC MEETING/OPEN HOUSE ANNOUNCEMENT

Floodplain/Floodway Delineations Studies

The Flood Control District of Maricopa County (District) identifies flood hazards by conducting Floodplain Delineation Studies. Floodplain/ floodway delineations identify special hazard areas that are subject to inundation by a 100-year flood (one percent chance of occurring each year). The studies allow for sound floodplain management so that future development will not impede, divert, or retard the movement of floodwaters.

There are two types of delineation studies the District uses to identify flood hazard zones: detailed and approximate.

Detailed studies are conducted in developed areas and identify the floodplain limits using detailed technical information. Base flood elevations within the floodplain are determined.

Approximate studies are conducted in areas with limited or no development. As the name of the study suggests, these studies provide approximate floodplain boundaries.

Along with the delineations contracted by the District, developers in the area were required to perform delineations on eight other alluvial fans occurring within the Sun Valley ADMP study area. Those delineations will include Alluvial Fan Approximate Zone A designations as well as Alluvial Fan Approximate Zone A Administrative Floodway designations.

The District manages floodplains located within both Unincorporated Maricopa County and the Town of Buckeye which are being delineated under this study.

After the delineations are submitted to the Federal Emergency Management Agency (FEMA), the approval process can take a year or more. Flood insurance will not be required for affected homeowners until it is adopted and the FIRM panels updated. However, the delineation maps will be used as best technical information to guide adjacent development.

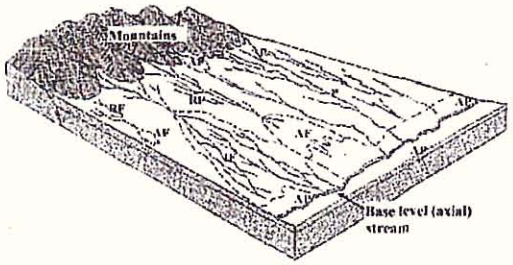
There are many areas of the county that haven't been studied and although floodplains exist, they are not documented yet. It is also important to note that if your property wasn't located in a floodplain when you moved in, that could change in the future. As development increases, the floodplain has the potential to change. In addition, new technology allows the District to create more accurate delineations.

Many of these issues, as well as the construction of new structures and flood control facilities, can remove people from the floodplain in the future.

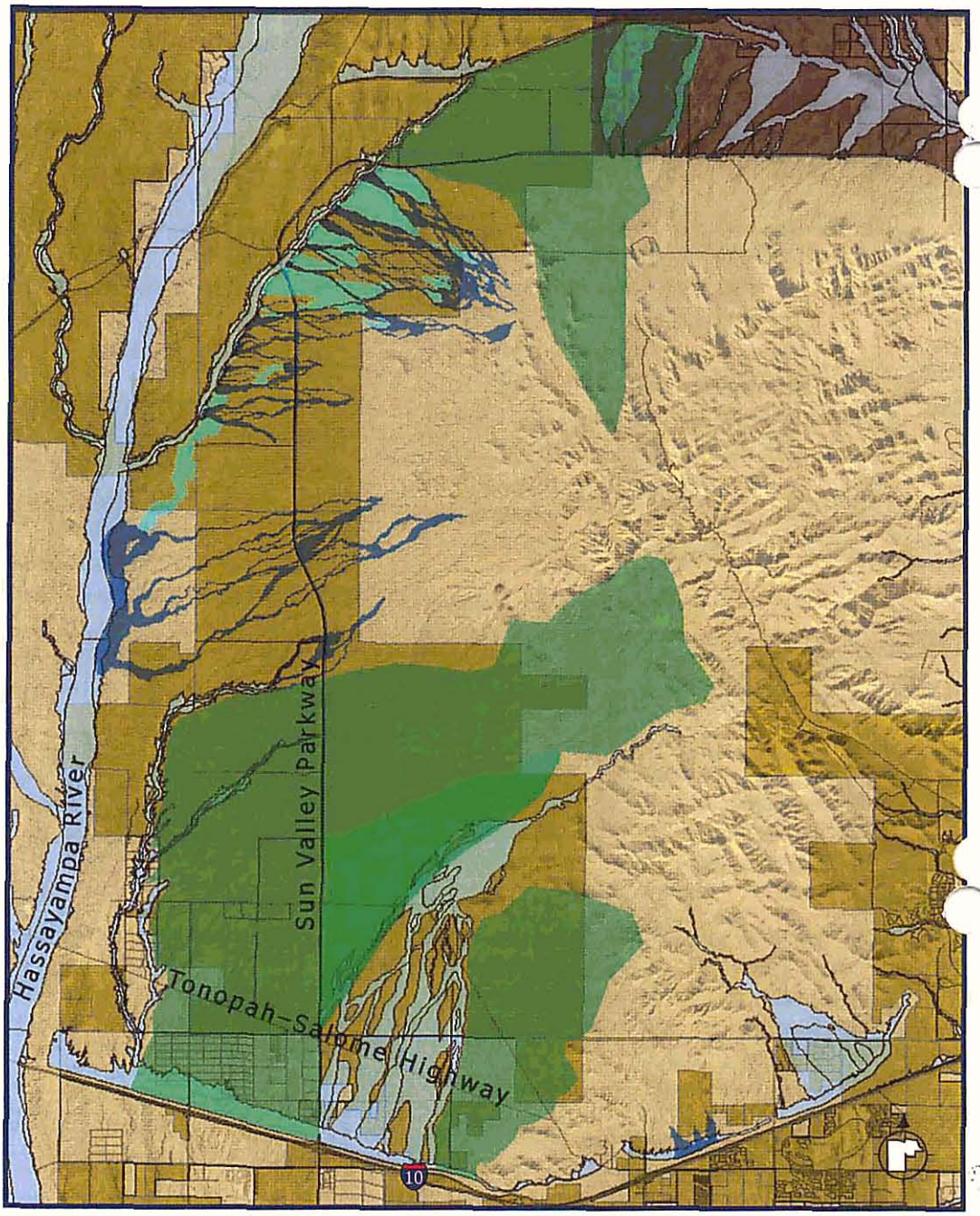
A **floodplain** is the area adjoining a watercourse that may be covered by water during a flood.

An **apex** is the most upstream portion of an alluvial fan landform where flow is no longer contained in a single channel.

Alluvial fan flooding is a special flood hazard that is characterized by unstable channel positions and unknown flow distributions at and downstream of the apex.



- Unincorporated Maricopa County
- Buckeye
- Surprise
- Existing FEMA Floodplains
- Proposed Floodway Delineations
- Proposed Floodplain Delineations
- On-going Studies



Map not to Scale.

As part of the Sun Valley Area Drainage Master Plan (ADMP) the District performed floodplain/floodway delineations resulting in approximately nine square miles of alluvial fan floodplain delineations. These included Alluvial Fan Approximate Zone A designations, as well as Alluvial Fan Approximate Zone A Administrative Floodway designations.

The delineation study area is generally bounded by the Central Arizona Project Canal on the North, Wagner Wash and the Hassayampa River on the West, White Tank Mountains on the East, and the Buckeye Flood Retarding Structures 1 and 2 on the South.

Count	TAX_OWNER	Address	Address 2	City	State	Zip
1	DUDAS SUZAN B/E JOAN TURBETT	836 S PARK AVE		LINDEN	NJ	07036
2	CHILSON ALTON R/ALEXANDRA	PO BOX 8927		SURPRISE	AZ	85374
1	LONIGRO NOLA J	RR 7 BOX 361		MT PLEASANT	PA	15666
1	MENTZER PHILLIP W/JEANNE	510 HOWARD RD		WEST CHESTER	PA	19380
1	MISAGHI IRAJ J	794 CENTER ST		HERNDON	VA	20170
1	PERRY WILLIAM A	26885 YOWAISKI RD		MECHANICSVILLE	MO	20659
1	BAYVIEW FINANCIAL TRADING GROUP LP	ATTN: JACK SILVER	2665 S BAYSHORE DR, Ste. 301	MIAMI	FL	33133
1	ALTER BARRY	3312 SW 57TH PL		FT LAUDERDALE	FL	33312
1	RUBIN MARK S	1703 NE 38TH AVE		OCALA	FL	34470
1	BAGGETT NATHAN D	1512 PAVILLION DR		HOOVER	AL	35226
1	ROBBINS ME/MAXWELL SJ/CARTER JJ/RJ	C/O SUSAN J MAXWELL	8284 BLAIR LN	GERMANTOWN	TN	38139
2	ANDERSON MARVIN L & MARGARET JEANELLEN	PO BOX 1022		LUCASVILLE	OH	45648
1	WANNEMACHER EDITH K	1024 PLAZA ST		FINDLAY	OH	45840
1	MOON FRANCES B/ETAL	205 S FOREST DR		KOKOMO	IN	46901
1	RAHMAN OLIUR	8080 RITTER		CENTERLINE	MI	48015
1	WITTE EVA MAE/SWINDLE DORENE MAE/RYAN	22140 SIBLEY RD		WYANDOTTE	MI	48193
1	WADLE LITA M/GRABOW VIOLET	4665 DOVER RD		BLOOMFIELD	MI	48304
1	CHRISTIANSEN DUANE D/PEGGY A	919 6TH AVE N		GLADSTONE	MI	49837
1	DESENS DONALD J & DIANE K	1713 TAYLOR LN		WEST BEND	WI	53090
1	BRODIE JOHN A & MARY E	132 RIVERVIEW DR		THIENSVILLE	WI	53092
1	SMARSLIK JOHN W/MARY K	W2830 KRUEGER RD		LAKE GENEVA	WI	53147
1	METZGER OSCAR & ANNE	1821 PARAMOUNT DR #B		WAUKESHA	WI	53186
3	WERDIN MARY J	8183 W HIGHWAY 12		WHITE WATER	WI	53190
1	STENNER MARCELLA G	575 WASHINGTON ST		FENNIMORE	WI	53809
1	BUSS VICTOR W & ROSE MARIE E	708 GROVE ST		BEAVER DAM	WI	53916
1	WRYCHA-SIKORSKI SANDRA L	3014 COUNTRY RD # C		MOSINEE	WI	54455
1	PRELOZNI HENRY P	2584 HIGH POINT RD		EAGLE RIVER	WI	54521
1	HEIM DONNA	W25844 STATE ROAD 35 54		TREMPEALEAU	WI	54661
1	MROTEK HELEN L	12386 W STATE ROAD 77		HAYWARD	WI	54843
1	SERGEANT ARMOND C	709 MENASHA AVE E		LADYSMITH	WI	54848
1	SCHRADER ELIZABETH M	1654 JEFFERSON AVE		SAINT PAUL	MN	55105
1	ROKER RICHARD D & PHYLLIS E	39566 780TH AVE		BIRD ISLAND	MN	55310
2	ELFERING GREGORY G	40304 870TH AVE		BIRD ISLAND	MN	55310
1	KRUEGER DAVID	16769 200TH ST		HUTCHINSON	MN	55350
1	PADILLA MARIA	19350 PARK AVE		WAYZATA	MN	55391
1	SIMMERING RICHARD A & CATHERINE	1800 HAYES ST NE APT 1		MINNEAPOLIS	MN	55418
1	BAUMANN WALTER L ETAL	84579 490TH AVE		LAKEFIELD	MN	56150
1	SCHNELL SHIRLEY TRUST	129 MAPLE ST		TYLER	MN	56178
1	LIEN KERMIT H & BERDELLA T	165 JORDAN DR APT 19		GRANITE FALLS	MN	56241
1	FINSTROM DOUGLAS	1060 160TH AVE SE		KERKHOVEN	MN	56252
1	WITTMAN HENRY/IONA	11 LAKEVIEW ST		LAKE LILLIAN	MN	56253
1	ENESTVEDT ALAN & VERLA M	78454 COUNTY ROAD 9		SACRED HEART	MN	56285
1	MAVIS M. MCPHEETENS	29570 436TH PL		AITKIN	MN	56431
2	REZNECHEK DELORIS	14735 150TH ST		WADENA	MN	56482
1	BAUMBERGER T E TR/BAUMBERGER DOROTHY A T	24533 461ST AVE		COLTON	SD	57018
2	MARDIAN FAMILY LIVING TRUST	MARY MARDIAN TTE OR PAUL MARDIAN TTE	1112 N 4TH ST	ABERDEEN	SD	57401
1	WILSON LESTER L	723 15TH AVE NE APT 6		ABERDEEN	SD	57401
1	HIRCHERT CLIFFORD F & ETHEL L	PO BOX 66		PIEDMONT	SD	57769
1	WOJCIK KATHRYN	319 7TH AVE SE		JAMESTOWN	ND	58401
1	JACOBSON FLORENCE	710 JOSLYN ST		HELENA	MT	59601
1	SCOVILLE DIANE	PO BOX 121		BASIN	MT	59631
3	ANDERSON BRUCE A/TIMOTHY B	2110 GREENOUGH DR W		MISSOULA	MT	59802
1	ODEGARD PETER B/ELIZABETH	7385 BERYL LN		MISSOULA	MT	59804
1	MAYS HERESCHEL R/CLARA F	2346 HIGHWAY 93 S		ARLEE	MT	59821
2	MAYS HERSCHEL R/CLARA F	23460 US HIGHWAY 93 N		ARLEE	MT	59821
1	SCHEYTT GREGORY /JERRILYN K	16350 FALCON LN		FLORENCE	MT	59833

1	JONASSON STEVEN	1194 E IDAHO ST STE B		KALISPELL	MT	59901
1	LAUTERBACH VIRGINIA C/EDWARD G TR	1500 E EVERGREEN TERRACE		GLENVIEW	IL	60714
1	KANDO ELLIA D/NAJIBA K	26698 LONG MEADOW CIR		MUNDELEIN	IL	60060
1	FRANCES COX	431 CENTRAL AVE		WILMETTE	IL	60091
1	HIRSBRUNNER ALEX	139 N MAPLE AVE		BLOOMINGDALE	IL	60108
1	GALICA ROBERT A/LINDA S	30910 S ROUTE 45		PEOTONE	IL	60468
1	POOCHIGIAN ERNEST/DIAN	955 DEERPATH RD # TD		AURORA	IL	60506
1	PEARL SYDNEY N TR	222 E PEARSON ST APT 101		CHICAGO	IL	60611
1	DOBRA CHARLES W & MARY JEAN	2846 N NATCHEZ AVE		CHICAGO	IL	60634
1	POCHELSKI LEONARD C / LENORE / LUCILLE B	4833 N LEONARD DR		NORRIDGE	IL	60706
1	SMITH JOHN H/NORMA J	1 BROOK LN		RIVERTON	IL	62561
1	RUSNIAK MARK G TR	632 BROADMOOR DR		CHESTERFIELD	MO	63017
1	MEYER MILTON L & JUDITH	PO BOX 1274		ARKANSAS CITY	KS	67005
2	MCMICHAEL LLOYD J/ESTHER E	PO BOX 1766		GARDEN CITY	KS	67846
1	SIEBARTH GEORGIA J	1628 PARISH BARN RD		IOWA	LA	70647
1	MCFATRIDGE VIRGINIA	C/O PAT WEAVER	7304 NIBLICK WAY	EDMOND	OK	73003
1	BLOCK WILLIAM E JR	3325 W 83RD ST		TULSA	OK	74132
3	HANSON AGGREGATES CENTRAL	8505 FREEPORT PKWY STE 500		IRVING	TX	75063
1	DICKSON THARIEL	PO BOX 459		WEATHERFORD	TX	76086
1	BROWN JOHN DOUGLAS	5943 BEAUDRY DR		HOUSTON	TX	77035
1	D BRANCHAW	8573 GRAY CT		ARVADA	CO	80003
1	MAHAFFY & CO	14799 W 72ND AVE		ARVADA	CO	80005
1	ACHENBACH ALLEN	12205 PERRY ST LOT 129		BROOMFIELD	CO	80020
1	RAYMOND & CLARA B SHEPHARD FAMILY IRREVO	% JEANNE WEBER	705 KIMBARK ST	LAFAYETTE	CO	80026
1	HOLOUBEK POLLY S	7777 S WILLOW WAY		ENGLEWOOD	CO	80112
1	CLERKIN PAUL V & ELIZABETH A	PO BOX 11487		DENVER	CO	80211
1	VORWALD LINDA M	11027 W ARIZONA AVE		LAKEWOOD	CO	80232
15	TRILLIUM WEST LLC	9145 E KENYON AVE STE 102		DENVER	CO	80237
1	PIXLER LORI A/SESSIONS P E/HAIDER MARTIN	13395 GAYLORD ST		THORNTON	CO	80241
1	ROUSH GERALD RAYMOND & VIRGINIA ELAINE	PO BOX 73		DILLON	CO	80435
1	HAIGES HOWARD JR & MARY ELLEN	28797 BUFFALO PARK RD		EVERGREEN	CO	80439
1	BRANDT CONRAD C	2300 BLUE MOUNTAIN AVE		BERTHOUD	CO	80513
1	MINNESOTA TITLE CO	KNOTT ED/LINDA/SPARKS R K ETAL TR CONTO	HOUSE 19395 RD 46	CHEYENNE WELLS	CO	80810
1	FRIGON MERLIN/LORRAINE	7865 MONTHNE DR		COLO SPRINGS	CO	80920
1	RUDD NORMAN	390 MIDDLE MOUNTAIN RD		BAYFIELD	CO	81122
1	BOYD JOANN/STANCATO EVANGELINE/JOSEPH E	8875 COUNTY RD UNIT 150		SALIDA	CO	81201
2	JUNIOR RUTHERFORD FAMILY TRUST/ETAL	115 IRWIN ST		GUNNISON	CO	81230
1	VAN ACKEREN MARY C	2035 E LIBERTY CT		GRAND JUNCTION	CO	81503
1	TIMPTE MARY R TR	1620 HERMOSA AVE UNIT 64		GRAND JUNCTION	CO	81506
1	ARNOLD GLORIA H	2542 EMMA RD		BASALT	CO	81621
1	PITTSER DOUGLAS ALLEN	20 MAROON PL		CARBONDALE	CO	81623
1	RIESER STEVEN W/SANDRA S	554 VALLEY RD		CARBONDALE	CO	81623
1	PULHAM DON MARVIN TR	89 BUCKHORN FLATS RD		RIVERTON	WY	82501
1	ROUSH ROBERT RONALD & JERRILYN KAY	2297 S 1475 W		SYRACUSE	UT	84075
1	SCHOENERBERGER NEIL	PO BOX 3285		OGDEN	UT	84409
8	UNITED STATES OF AMERICA	135 N 2ND AVE		PHOENIX	AZ	85003
7	UNITED STATES OF AMERICA BUREAU OF RECLA	201 N CENTRAL AVE		PHOENIX	AZ	85004
9	MARICOPA COUNTY PARKS & RECREATION	411 N CENTRAL AVE STE 470		PHOENIX	AZ	85004
2	CAMBRIDGE BUSINESS INSURANCE LTD/SMT INV	625 S 5TH ST STE E2		PHOENIX	AZ	85004
2	MT BALDY LIMITED PARTNERSHIP	625 S 5TH ST STE E2		PHOENIX	AZ	85004
5	SMT INVESTORS LIMITED PART/BOA SORTE LTD	625 S 5TH ST STE E2		PHOENIX	AZ	85004
1	DEPT OF HOUSING AND URBAN DEVELOPMENT	1 N CENTRAL AVE STE 600		PHOENIX	AZ	85004
1	LOFTIN MARK C	PO BOX 6590		PHOENIX	AZ	85005
1	HARTONO HO JOSEPH FREDERIC/MARY YULIA TR	2042 N 16TH ST		PHOENIX	AZ	85006
2	SPANN JOHN Q	1209 E ALMERIA RD		PHOENIX	AZ	85006
1	ARIZONA STATE LAND DEPT	1624 W ADAMS ST		PHOENIX	AZ	85007
10	ARIZONA STATE OF	1700 W WASHINGTON ST		PHOENIX	AZ	85007

2	ARIZONA STATE DEPT OF TRANSPORTATION	205 S 17TH AVE		PHOENIX	AZ	85007
1	STATE OF ARIZONA	1701 W JACKSON ST		PHOENIX	AZ	85007
1	DOZAL ALBERTO	1120 N 34TH ST		PHOENIX	AZ	85008
2	UNITED METRO MATERIALS INC	701 N 44TH ST		PHOENIX	AZ	85008
2	ADAMS CHARLES W & JOYCE A	4636 E FILLMORE ST		PHOENIX	AZ	85008
5	FIRST AMERICAN TITLE INS CO TR 857 CONTO	1216 S JEAN ELIZABETH		BUCKEYE	AZ	85009
9	BAYVIEW FINANCIAL PROPERTY TRUST CONTO	1963 E KENTUCKY LN		BUCKEYE	AZ	85009
1	DOMINGUEZ JOSE LUIS/RENE KAY	4000 W GRANT ST		PHOENIX	AZ	85009
4	WATER UTILITY OF GREATER BUCKEYE INC	3800 N CENTRAL AVE STE 770		PHOENIX	AZ	85012
1	MEREDITH HERMAN TR #7732	77 E MISSOURI AVE UNIT 42		PHOENIX	AZ	85012
1	HORAN ADNAN/ LISA	1 E CAMELBACK RD STE 650		PHOENIX	AZ	85012
1	BURNS INTERNATIONAL INC	4520 N CENTRAL AVE STE 500		PHOENIX	AZ	85012
14	SC WEST LLC	C/O JAMES H PATTERSON	2901 N CENTRAL AVE STE 200	PHOENIX	AZ	85012
2	LAIDLAW RONALD W/BONNIE J	1533 E MONTEBELLO AVE		PHOENIX	AZ	85014
3	DEEPHAVEN INVESTMENTS CORPORATION	3338 E MITCHELL DR		PHOENIX	AZ	85015
1	C DENNIS GREEN FAMILY LLC	DAVID L HAGA	2575 E CAMELBACK RD	PHOENIX	AZ	85016
2	CAMPO GRANDE LAND AND CATTLE LLC	2202 E BETHANY HOME RD		PHOENIX	AZ	85016
7	SONORAN WEST PROPERTIES LLC	2400 E ARIZONA BILTMORE CIR STE 1270		PHOENIX	AZ	85016
1	HARLO LLC	3104 E CAMELBACK RD STE 706		PHOENIX	AZ	85016
1	FIDELITY NATIONAL TITLE COMPANY TR B176	3131 E CAMELBACK RD STE 115		PHOENIX	AZ	85016
4	GODERICH INVESTMENTS LLC	4531 N 16TH ST 103		PHOENIX	AZ	85016
73	50 SUN VALLEY PARKWAY LLC	4531 N 16TH ST STE 103		PHOENIX	AZ	85016
1	AKISAKU INDUSTRIES L L C	4531 N 16TH ST STE 103		PHOENIX	AZ	85016
3	ELLICE INVESTMENTS LTD	4531 N 16TH ST STE 103		PHOENIX	AZ	85016
1	HIGH COUNTRY LAND & CATTLE LLC	4531 N 16TH ST STE 103		PHOENIX	AZ	85016
14	LEPORIDAE INVESTMENTS LLC	4531 N 16TH ST STE 103		PHOENIX	AZ	85016
1	MILLBANK INVESTMENTS LLC	4531 N 16TH ST STE 103		PHOENIX	AZ	85016
4	WILLOWDALE INVESTMENTS LLC	4531 N 16TH ST STE 103		PHOENIX	AZ	85016
5	WILLOW DALE INVESTMENTS L L C	ATTN: RICHARD JUTZI	4531 N 16TH ST STE 103	PHOENIX	AZ	85016
1	JOHNSON OLIVER G/MARIA A	2601 W CLAREMONT ST APT 1022		PHOENIX	AZ	85017
2	SMITH WANDA ETAL	5508 N MARION WAY		PHOENIX	AZ	85018
1	LONGO MICHAEL A/MARY KAY	5110 N 44TH ST BLDG L		PHOENIX	AZ	85018
1	SILVERMAN RICHARD	5337 N 46TH ST		PHOENIX	AZ	85018
1	AIELLO GROUP LTD PARTNERSHIP	4963 E ROCKRIDGE RD		PHOENIX	AZ	85018
1	GORDON RICK S	4446 E EARLL DR		PHOENIX	AZ	85018
1	FRIE EDDIE A	3618 W MINNEZONA AVE		PHOENIX	AZ	85019
1	GRABIEC JOSEPH DAVID TR/MATREENA	3321 N 40TH AVE		PHOENIX	AZ	85019
2	CSW SUN VALLEY SOUTH HOLDINGS LLC	7720 N 16TH ST STE 310		PHOENIX	AZ	85020
1	STAFFORD DOUGLAS V/OXFORD KAREN	9230 N 8TH ST APT 1		PHOENIX	AZ	85020
1	GORDON WAYNE E	104 E ECHO LN		PHOENIX	AZ	85020
1	MCDONALD THOMAS F/MERCEDES P TR	8120 N 5TH ST		PHOENIX	AZ	85020
1	PURPLE ROCK HOLDINGS LLC	7139 N 11TH PL		PHOENIX	AZ	85020
1	STEELE JOHN	PMB 480	7000 N 16TH ST STE 120	PHOENIX	AZ	85020
1	SHANK ROBERT A/ROBERTA R/C ROBERTS A C I	9828 N 19TH AVE		PHOENIX	AZ	85021
1	TREME LOLA E	10317 N 12TH AVE		PHOENIX	AZ	85021
1	WHITE JOSEPH W & HELENE C	7042 N 23RD AVE		PHOENIX	AZ	85021
1	MINICHELLI RITA	1250 E BELL RD SPACE #46		PHX	AZ	85022
1	BELL MATTHEW P	1101 E VILLA RITA DR		PHOENIX	AZ	85022
3	DUNCAN FAMILY TRUST	14250 N 14TH ST		PHOENIX	AZ	85022
1	CURTIS ALAN J	15625 N 17TH AVE		PHOENIX	AZ	85023
2	K H LAND LLC	318 W BEVERLY LN		PHOENIX	AZ	85023
1	OCCHINO WILLIAM & BETTY ETAL	228 W TIERRA BUENA LN		PHOENIX	AZ	85023
1	CAZACU GEORGE	413 E TOPEKA DR		PHOENIX	AZ	85024
1	NGUYEN HOANG HUY/CHRISTINE THU	1015 E BLACKHAWK DR		PHOENIX	AZ	85024
1	GARZA FRANK J/DEBORAH A	1533 W BEHREND DR		PHOENIX	AZ	85027
1	MALKO TIMOTHY TODD/KATHLEEN ANN	2403 W LONE CACTUS DR APT 152		PHOENIX	AZ	85027
2	WILSON ROBERT D	2629 E MOUNTAIN VIEW RD		PHOENIX	AZ	85028

1	VILLA FELIX	2186 W SHARON AVE		PHOENIX	AZ	85029
1	ROBERSON PHILLIP E/LEAH J	3249 W WETHERSFIELD RD		PHOENIX	AZ	85029
1	AL QASEMY HAIDER	5502 N WOLF		PHOENIX	AZ	85031
2	DALLAS & MARION WHITE REV TRUST THE	4744 N 49TH DR		PHOENIX	AZ	85031
1	PULASKI CHRISTINA/B/T/WHITE E/A L/OWEN J	C/O OWEN JUDITH	18444 N 42ND ST	PHOENIX	AZ	85032
1	ALVAREZ ENRIQUE JR	7007 W INDIAN SCHOOL RD APT 11		PHOENIX	AZ	85033
1	PORTER JOYCE E	8012 W WHITTON AVE		PHOENIX	AZ	85033
1	MARICOPA COUNTY OF	4701 E WASHINGTON ST		PHOENIX	AZ	85034
1	FIRST AMERICAN TITLE INSURANCE CO TR 856	4801 E WASHINGTON ST # 100		PHOENIX	AZ	85034
1	CASTILLO ROBERT D	1202 S 14TH ST		PHOENIX	AZ	85034
1	LEDEZMA ELISA S	5207 W VIRGINIA AVE		PHOENIX	AZ	85035
4	FIRST AMERICAN TITLE INS CO TR 82 CONTO	1647 N 45TH AVE UNIT C102		ALBANY	AZ	85035
1	ARMENDARIZ HECTOR/JAIME ALMA	8905 W SHERIDAN ST		PHOENIX	AZ	85037
1	HEREDIA MARIA C	8527 W VALE DR		PHOENIX	AZ	85037
1	GAREY CHESTER L	3450 N 84TH LN		PHOENIX	AZ	85037
1	CASTILLO CYNTHIA K	8821 W FLOWER ST		PHOENIX	AZ	85037
2	LE TUAN VAN/LAM THAM THI	2610 N 88TH LN		PHOENIX	AZ	85037
1	MALDONADO LUIS ANTONIO	10138 W HIGHLAND AVE		PHOENIX	AZ	85037
1	DE LA RIVA MARIA E	10062 W HIGHLAND AVE		PHOENIX	AZ	85037
1	PRICE ROBERT H	4405 N 106TH AVE		PHOENIX	AZ	85037
1	PELLETIER TERESA/BOSWELL HELEN E	30250 W LATHAM ST		PHOENIX	AZ	85040
1	CDK INVESTMENTS LLC	2320 E BASELINE RD STE 1483		PHOENIX	AZ	85042
1	CASTELLANOS OSCAR/CRUZ NORMA C	1517 E WINSTON DR		PHOENIX	AZ	85042
1	HUGHES DAVID A	2735 E SOUTH MOUNTAIN AVE		PHOENIX	AZ	85042
1	CALDERON INEZ L	2842 E SOUTH MOUNTAIN AVE		PHOENIX	AZ	85042
2	NELSON BRUCE RYDEN/KATHERINE JO AIELLO	4334 E BOULDER RDG		PHOENIX	AZ	85044
2	BOILLOT CHRIS	3144 E DRY CREEK RD		PHOENIX	AZ	85048
1	GUERRA GILBERT JR	3901 E WINDSONG DR		PHOENIX	AZ	85048
1	GLACIER PARK INVESTMENTS LLC	3636 E RENEE DR		PHOENIX	AZ	85050
2	YOUNG RAYMOND A SR/OLIVIA G	3431 E UTOPIA RD		PHOENIX	AZ	85050
1	WHITE TANKS FOOTHILLS GEN PARTNSHIP	4102 W HAYWARD AVE		PHOENIX	AZ	85051
1	RAMSEY JAMES/LINDA	2748 W ORANGEWOOD AVE		PHOENIX	AZ	85051
1	HARVEY JOEL C/SHARON K	3027 W ANDERSON DR		PHOENIX	AZ	85053
1	LINDSAY FAMILY REVOCABLE LIVING TRUST	LINDSAY DOUGLAS R SR/MARJORIE L TRUSTEES	3009 W KELTON LN	PHOENIX	AZ	85053
3	SCI-BERCHEM LLC	3166 W TIERRA BUENA LN		PHOENIX	AZ	85053
1	ILLING M NEAL/VINCENT ELIZABETH	PO BOX 10735		PHOENIX	AZ	85064
2	BABCOCK GRANT M/SUEANN TR	PO BOX 32341		PHOENIX	AZ	85064
1	STEWART TITLE & TRUST OF PHX TR CONTO	PO BOX 32341		PHOENIX	AZ	85064
1	DE BRUM LEANDER/PATRICK	PO BOX 36315		PHOENIX	AZ	85067
3	MCHENRY DAVID J	PO BOX 9356		PHOENIX	AZ	85068
1	ARIZONA PUBLIC SERVICE CO /OPERATIVE/	PO BOX 53999		PHOENIX	AZ	85072
3	TDH ENTERPRISES LTD	PO BOX 54744		PHOENIX	AZ	85078
1	SOTO BLANCA ALCALA	PMB 1134	515 E CAREFREE HWY	PHOENIX	AZ	85085
1	VELLUTATO JULIUS/JULI A	3125 W DESERT VISTA TRL		PHOENIX	AZ	85085
1	LOW MICHAEL W/NIKI	35310 N 27TH LN		PHOENIX	AZ	85086
2	MAYFIELD GARY S & JOYCE A	49226 N 25TH AVE		PHOENIX	AZ	85087
3	CPH ELIANTO WEST LLC	1855 W BASELINE RD STE 101		MESA	AZ	85202
2	TRI-CITY READY MIX INC	745 N STAPLEY DR		MESA	AZ	85203
1	APACHE SPRINGS LLP/AFFARE LLP/ELMAREL LP	1819 E SOUTHERN AVE STE B10		MESA	AZ	85204
2	MADLAD INC	1515 N GREENFIELD RD, Ste. 101		MESA	AZ	85205
1	BESS EULA M	310 N 83RD ST		MESA	AZ	85207
1	BRUCE JERRY W & EULA MAE	310 N 83RD ST		MESA	AZ	85207
1	HELMS STEVE & MAXEEN LYNN	318 N 83RD ST		MESA	AZ	85207
29	LEE MOUNTAIN RANCHES LLC	2160 E KENWOOD ST		MESA	AZ	85213
1	METZGER DOUGLAS/RENA	2927 E ADOBE ST		MESA	AZ	85213
1	KEY GREGORY MICHAEL	PO BOX 8327		MESA	AZ	85214
1	BINGHAM SCOTT D/KAREN D	2537 N MAPLE ST		MESA	AZ	85215

1	GARDNER WESTSIDE PARTNERSHIP II	4301 E MCKELLIPS RD			MESA	AZ	85215
1	GOLDEN WEST INVESTMENTS	6052 E SNOWDON ST			MESA	AZ	85215
1	CARTRIGHT ROBERTA SUE TR	1182 S CORTEZ RD			APACHE JCT	AZ	85219
1	DIFFENDAL JOHN/BENOIT ED	10540 E APACHE TRL LOT 425			APACHE JUNCTION	AZ	85220
1	ADVISORY BOARD OF THE ARIZONA DISTRICT C	3180 N ALMA SCHOOL RD STE 2			CHANDLER	AZ	85224
1	RODRIGUEZ CARRIE CHAVEZ	614 W AVIARY WAY			GILBERT	AZ	85233
1	IQBAL MUHAMMAD Z/NAJMA Z	1153 W WINDHAVEN AVE			GILBERT	AZ	85233
2	PACE KENT J/JAMELA	3336 E HARVARD AVE			GILBERT	AZ	85234
1	CATON CARL ERNEST & CYNTHIA ANNE TR	3538 E PRINCETON CT			GILBERT	AZ	85234
2	SAWYERS DAVID L/SCHNURR GARY	745 N GILBERT RD # 124-360			GILBERT	AZ	85234
1	CAVINESS REBECCA ANN/MATHIESON ELI	29910 W BELLEVIEW ST			BUCKEYE	AZ	85236
4	DOETSCH DAVID JOHN	40353 N PARISI PL.			QUEEN CREEK	AZ	85242
1	KRITI LLC/VARNIMA HOLDINGS LLC	PO BOX 7911			CHANDLER	AZ	85246
1	JOKSIMOVICH GORDON	3225 S LAGUNA DR			CHANDLER	AZ	85248
1	GILLENWATER POWELL TR/ROAMIN-KORP INC/ET	6910 E 5TH AVE			SCOTTSDALE	AZ	85251
1	CBGD LLC	7521 E 1ST ST			SCOTTSDALE	AZ	85251
2	PUERTO DE CIELO L L C	6910 E 5TH AVE			SCOTTSDALE	AZ	85251
1	CHARLOFF GAIL	6125 E INDIAN SCHOOL RD APT 22			SCOTTSDALE	AZ	85251
2	SLPR L L C/GILBERT PAUL E/SUSAN	ATTN: LAURIE B CRAIG		4800 N SCOTTSDALE RD STE 6000	SCOTTSDALE	AZ	85251
1	LILLE INVESTMENTS LLC	10500 N 52ND ST			PARADISE VALLEY	AZ	85253
1	SUN VALLEY EQUINE LLC/KM BAKER FAMILY TR	5216 N 70TH PL			PARADISE VALLEY	AZ	85253
1	WILLIAMS ANDREW	6015 E ONYX AVE			SCOTTSDALE	AZ	85253
1	CELMINS FAMILY TRUST	5034 E BERNEIL DR			PARADISE VLY	AZ	85253
1	YOUNG EDWARD M TR	5530 E ORCHID LN			PARADISE VLY	AZ	85253
1	JOHNSON CHARLES N TR/CHARLES N II TR	8400 N GOLF DR			PARADISE VLY	AZ	85253
2	MONTHOFER INVESTMENTS LTD PTSHP PROFIT S	WOLFGANG MONTHOFER		6918 N HIGHLANDS DR	PARADISE VLY	AZ	85253
1	GOETT R BRETT TR	7001 N SCOTTSDALE RD STE 1040			SCOTTSDALE	AZ	85253
2	RJC PROPERTY VETNURES INC	3401 E CLAREMONT ST			PARADISE VLY	AZ	85253
1	JONES TROY D & LONA F	3312 E BERRIDGE LN			PARADISE VLY	AZ	85253
2	GARRETSON JOHN EMERY TR/JOHN P TR	3521 E ROSE LN			PARADISE VLY	AZ	85253
7	BIF BUCKEYE LLC	6730 N SCOTTSDALE RD STE 230			SCOTTSDALE	AZ	85253
4	CORTESSA LLC	6730 N SCOTTSDALE RD STE 230			SCOTTSDALE	AZ	85253
1	FAE HOLDINGS 101686R LLC	6730 N SCOTTSDALE RD STE 230			SCOTTSDALE	AZ	85253
1	SRITF	6730 N SCOTTSDALE RD STE 230			SCOTTSDALE	AZ	85253
3	STARDUST - SC SUN VALLEY LLC	6730 N SCOTTSDALE RD STE 230			SCOTTSDALE	AZ	85253
2	STARDUST CHARITABLE FUND	6730 N SCOTTSDALE RD STE 230			SCOTTSDALE	AZ	85253
5	SUN VALLEY PARTNERS LLC	6730 N SCOTTSDALE RD STE 230			SCOTTSDALE	AZ	85253
1	CHILDRESS CAROL L	10410 KELSO DR			SUN CITY	AZ	85254
1	SHARP MELVIN E/LESLIE A TR	6835 E HEARN RD			SCOTTSDALE	AZ	85254
1	BELMONT LKY 20K LIMITED PARTNERSHIP LLLP	5040 E SHEA BLVD STE 254			SCOTTSDALE	AZ	85254
2	SHEMER RYAN B TR/SHEMER D/C/CORK M A S	5230 E SHANGRI LA RD			SCOTTSDALE	AZ	85254
3	SHEMER WILLIAM BARRY/DONNA JEAN TR	5230 E SHANGRI LA RD			SCOTTSDALE	AZ	85254
3	SHEMER JACK E	C/O SHEMER W BARRY		5230 E SHANGRI LA RD	SCOTTSDALE	AZ	85254
1	BLUMEL LINDA A	25433 N RANCH GATE RD			SCOTTSDALE	AZ	85255
1	FIRST AMERICAN TITLE INSURANCE CO #8239A	PEARL SYDNEY N TR	CONTO	10040 E HAPPY VALLEY RD UNIT 633	SCOTTSDALE	AZ	85255
1	DAVIS LAURA A	PO BOX 25896			SCOTTSDALE	AZ	85255
1	BUCKEYE LAND LLC	8501 E PRINCESS DR STE 200			SCOTTSDALE	AZ	85255
1	AGUIRRE EDGAR A/NANCY A	7679 E STARLA DR			SCOTTSDALE	AZ	85255
1	SUNTRACK LLC	7349 VIA PASEO DEL SUR STE 515			SCOTTSDALE	AZ	85258
2	MAUGHAN REX/RUTH	7501 E MCCORMICK PKWY Ste. 100LL			SCOTTSDALE	AZ	85258
44	TEN THOUSAND WEST LLC	8777 N GAINEY CENTER DR STE 205			SCOTTSDALE	AZ	85258
1	APACHE & VAN BUREN LLLP	8800 N GAINEY CENTER DR STE 25			SCOTTSDALE	AZ	85258
1	PERSINGER ROBERT S	12596 N 72ND PL			SCOTTSDALE	AZ	85260
9	PULTE HOME CORP	15111 N PIMA RD			SCOTTSDALE	AZ	85260
21	RJC PROPERTY VENTURES INC	8422 E SHEA BLVD STE 101			SCOTTSDALE	AZ	85260
1	BLISS GEORGE LAWRENCE/SOUTHPAC TRUST INT	15770 N GREENWAY HAYDEN LOOP			SCOTTSDALE	AZ	85260
4	SUN VALLEY ASSEMBLAGE L L C	15770 N GREENWAY HAYDEN LOOP			SCOTTSDALE	AZ	85260

1	WEST COAST FUNDING LLC	15730 N PIMA RD STE D-4, PMB 321			SCOTTSDALE	AZ	85260
101	299 SUN VALLEY VB LLC	15730 N PIMA STE D-4 PMB 321			SCOTTSDALE	AZ	85260
22	PULTE HOME CORPORATION	15333 N PIMA RD STE 300			SCOTTSDALE	AZ	85260
2	JCS MANAGEMENT SERVICES L L C	15095 N THOMPSON PEAK PKWY			SCOTTSDALE	AZ	85260
1	SITTU NAJAH/LOIS A TR/LMMO LLC	13600 N 82ND ST			SCOTTSDALE	AZ	85260
1	CASHMAN JUNE M TR	12068 N 80TH PL			SCOTTSDALE	AZ	85260
2	WYATT JAMES D/DONNA K	8096 E SUNNYSIDE DR			SCOTTSDALE	AZ	85260
1	WALKER LONG HOLDINGS INC PROFIT SHARING	8820 E SHARON DR			SCOTTSDALE	AZ	85260
1	GREATER PHOENIX INCOME PROPERTIES LLC	JIM ZOMORRODI		PO BOX 5514	SCOTTSDALE	AZ	85261
3	JASTRZAB ROBERT J/REGINA S	7564 E CAMINO SALIDA DEL SOL			SCOTTSDALE	AZ	85262
5	JIN KWAN SUNG/EUN SOOK	7526 E BAKER DR			SCOTTSDALE	AZ	85262
1	KILLOREN JEFFREY S	38080 N CHARLES BLAIR MACDONAL			SCOTTSDALE	AZ	85262
4	BANCHIK NORMAN/PAULINE	33858 N 69TH ST			SCOTTSDALE	AZ	85262
1	BERNSTEIN DONALD J/AMERICAN EAGLE INVEST	33858 N 69TH ST			SCOTTSDALE	AZ	85262
1	MARTINI CYNTHIA A	28000 N 59TH PL			SCOTTSDALE	AZ	85262
1	GILLIGAN SUN VALLEY LLC ET AL	PO BOX 14567			SCOTTSDALE	AZ	85267
4	TERRA CORP INC	21 E 6TH ST 501			TEMPE	AZ	85281
9	THOROUGHBRED DEVELOPMENT CORPORATION	21 E 6TH ST STE 501			TEMPE	AZ	85281
1	FONG KIT WAN	2531 E UNIVERSITY DR			TEMPE	AZ	85281
1	PETRE LEWIS A JR/NANCY LEE TR	3003 S EVERGREEN RD			TEMPE	AZ	85282
1	NEWSOME ROGER D SR & SHIRLEY J	5435 S MITCHELL DR			TEMPE	AZ	85283
1	THOMAS MICHAEL KEITH/JOHN PATRICK	MICHAEL K THOMAS		621 E OXFORD DR	TEMPE	AZ	85283
1	GOODE ARNOLD/SHERRIA	CONTO	801 W BELL DE MAR DR		TEMPE	AZ	85283
18	ELIANTO LLC	1150 W GROVE PKWY STE 105			TEMPE	AZ	85283
4	SUN VALLEY 120 LTD LIABILITY CO	1121 W WARNER RD STE 109			TEMPE	AZ	85284
45	FIRST AMERICAN TITLE INSURANCE COMPANY T	W U S V HOLDINGS LLC		1121 W WARNER RD STE 109	TEMPE	AZ	85284
2	LASHER JEFFERY/SUZANNE	1462 E VERMONT DR			GILBERT	AZ	85296
2	TANYI CORNELIUS/EBAI COLETTE	1740 S HERITAGE DR			GILBERT	AZ	85296
1	SPURLOCK LAND LLC	11039 S 163RD ST			GILBERT	AZ	85296
1	W P E INVESTMENTS INC	WHITE ALETHEA/SWEENEY GREG	CONTO	5837 W NORTHVIEW AVE	GLENDALE	AZ	85301
3	PAKZADEN NASER TR	6132 W GLENDALE AVE			GLENDALE	AZ	85301
3	PROVO JULIA FRANCES/BURGE LAWRENCE M	6110 W SOLANO DR S			GLENDALE	AZ	85301
1	ATWATER DANIEL W/LORETTA P	5024 N 65TH AVE			GLENDALE	AZ	85301
1	BURGENER CLIFTON W/BILLIE M	6616 W CAMELBACK RD			GLENDALE	AZ	85301
1	KLASS MAX M & BETTY	6140 W ORANGE DR			GLENDALE	AZ	85301
1	SHARADA INVESTMENTS LLC	10324 N 32ND DR			GLENDALE	AZ	85302
6	BUONINCONTRO MARK/DIANA	20241 N 67TH AVE			GLENDALE	AZ	85302
2	OZANNE MARIE T TR	4834 W NEW WORLD DR			GLENDALE	AZ	85302
1	TRUJILLO LEONOR	8022 N 48TH LN			GLENDALE	AZ	85302
1	FARRIS WILLIAM J SR/VERNA L	5714 N 72ND AVE			GLENDALE	AZ	85303
1	LUCIO GUADALUPE HERNANDEZ	7340 N 71ST AVE			GLENDALE	AZ	85303
1	TO TRONG Q/TRAN DIEP T	7001 W GARDENIA AVE			GLENDALE	AZ	85303
8	GOLDSMITH JERRY C / CONNIE F	11209 N 52ND AVE			GLENDALE	AZ	85304
1	BIANCO MICHAEL	5114 W MERCER LN			GLENDALE	AZ	85304
1	SELMAN RALPH L TR	7925 N 107TH AVE			GLENDALE	AZ	85306
1	PULASKI BASIL THORPE / TAMMY	6111 W NANCY RD			GLENDALE	AZ	85306
1	OGLESBY KENNETH/LETRISH	16524 E WATFORD CT			GLENDALE	AZ	85308
1	EMERSON WILLIAM D/DURKIN LAURA L	3702 W VILLA THERESA DR			GLENDALE	AZ	85308
2	MEHROB LLC	7033 W SACK DR			GLENDALE	AZ	85308
1	QUALITY LAND AND HOMES INC	18922 N 73RD DR			GLENDALE	AZ	85308
1	TIBBLE RONALD J	18330 N 79TH AVE APT 1136			GLENDALE	AZ	85308
1	HANSEN JOSEPH	3830 W FALLEMLEAF LN			GLENDALE	AZ	85310
1	THAYER MICHAEL E/CANDACE A	4338 W CREEDANCE BLVD			GLENDALE	AZ	85310
1	BERGGREN TAMI A/STARTIN TIFFANY/ETAL	21944 N 69TH DR			GLENDALE	AZ	85310
1	HANLON DWIGHT LYNN	PO BOX 970			GLENDALE	AZ	85311
1	ADAME MADELIN/MADELIN	10922 W MONTE VISTA RD			AVONDALE	AZ	85323
1	LOFTHOUSE TIMOTHY/DIXIE/HARVEY DIANE S	12622 W CLARENDON AVE			AVONDALE	AZ	85323

1	SPRADLIN CARRA LISA	3128 W COPENHAGEN DR	AVONDALE	AZ	85323
2	RARE INC	PO BOX 1323	AVONDALE	AZ	85323
1	SHAWVER PATRICIA E	PO BOX 5	AVONDALE	AZ	85323
1	CARTER MARTHA E	PO BOX 422	AVONDALE	AZ	85323
1	GIGGS ALAN B	1333 N DYSART RD APT 3	AVONDALE	AZ	85323
1	LICANO MARIO	210 N 1ST AVE	AVONDALE	AZ	85323
1	BUSH JACK L SR & VALETA	201 W LAWRENCE BLVD	AVONDALE	AZ	85323
1	SALAZAR JESUS M & ENEDINA R	201 E KINDERMAN DR	AVONDALE	AZ	85323
5	GRIFFIN MAXINE K	27 S CENTRAL AVE	AVONDALE	AZ	85323
1	MADRIGAL POLI	629 E DEE ST	AVONDALE	AZ	85323
2	LDB MARKETING INC	11107 W DANA LN	AVONDALE	AZ	85323
2	WEEKS CHARLES T/JEONG S	11535 W CLOVER WAY	AVONDALE	AZ	85323
1	UPTEGROVE SAMUEL F	11885 W MCDOWELL RD	AVONDALE	AZ	85323
1	WOLF INVESTMENTS CORPORATION	2436 N 123RD AVE	AVONDALE	AZ	85323
1	IACOBELLI ANTHONY/LIZABETH A	11913 W MADISON ST	AVONDALE	AZ	85323
2	VUONG TAI Q/DOAN PHUONG T	11155 W EDGEMONT AVE	AVONDALE	AZ	85323
1	GARCIA ABRAHAM V JR/SILVIA L	12690 W FLOWER ST	AVONDALE	AZ	85323
1	CANO BRET W	12755 W INDIANOLA AVE	AVONDALE	AZ	85323
2	DELATORRE FRANCISCO/MARTINA	12440 W LOWER BUCKEYE RD	AVONDALE	AZ	85323
1	RIVERA EMILIO	1000 N 234TH AVE	BUCKEYE	AZ	85326
1	COTTEN DOROTHY LOUISE	101 DOTTY LN	BUCKEYE	AZ	85326
1	HOKANSON DAVID/KELLI	19402 E TAYLOR ST	BUCKEYE	AZ	85326
1	MORSE KEVIN/BILLIE	216 6TH AVE WEST	BUCKEYE	AZ	85326
1	GONZALES PEDRO P & YVONNE R	29231 W TONOPAH RD SALOME HWY	BUCKEYE	AZ	85326
1	AMEZCUA EDGAR/ORTEGA LUZ MARIA	29545 W ROOSEVELT	BUCKEYE	AZ	85326
1	GARRISON BASIL L JR/CHERI	29804 W POLK ST	BUCKEYE	AZ	85326
2	HIRTH DENNIS/DENISE M	29911 W LYNWOOD ST	BUCKEYE	AZ	85326
1	FULLER JIM/SUSAN	29949 W ROOSEVELT ST	BUCKEYE	AZ	85326
1	BARRIOS ERINEO M	30018 W LYNWOOD	BUCKEYE	AZ	85326
1	ROBERTS NORRIE	3022 W PORTLAND	BUCKEYE	AZ	85326
1	JACONELLI STEPHEN/MARTIN ANDREA	30221 W BELLVIEW ST	BUCKEYE	AZ	85326
1	PEREZ GUILLERMO/ROSA M	30236 W LATHAM ST	BUCKEYE	AZ	85326
1	MATHERSON DANIEL	30305 W BELLVIEW ST	BUCKEYE	AZ	85326
1	CHAVEZ LISA N	30316 W LATHAM ST	BUCKEYE	AZ	85326
1	FLIPPO CHRISTOPHER	303534 W BELLVIEW ST	BUCKEYE	AZ	85326
1	SCHROEDER MICHAEL J	30403 W LATHAM ST	BUCKEYE	AZ	85326
2	STRINGER ROBERT	30417 W PORTLAND	BUCKEYE	AZ	85326
1	SILVA ALFREDO/CYNTHIA R	30434 W BELLVIEW ST	BUCKEYE	AZ	85326
1	SHAULL CHARLES FREDERICK	30477 W LATHAM ST	BUCKEYE	AZ	85326
1	HENSON SR CHARLES D/SHARON R	30606 W LATHAM ST	BUCKEYE	AZ	85326
1	GUYKER DEVELOPMENT LLC	30710 W PORTLAND ST	BUCKEYE	AZ	85326
1	WRIGHT STEVEN B/MARYAN	30722 W PORTLAND ST	BUCKEYE	AZ	85326
1	SEEMANN ARTHUR R JR/MERRIVONNE J	30736 W LATHAM ST	BUCKEYE	AZ	85326
1	DIONNE GORDON E/KRISTI M	30737 W LATHAM ST	BUCKEYE	AZ	85326
1	CARON JAMES L/JUDY M	30748 W PORTLAND ST	BUCKEYE	AZ	85326
1	MENDEZ JOSE/PATRICIA A	30804 W ROOSEVELT	BUCKEYE	AZ	85326
1	REYNOLDS KELLY	30805 W BELLVIEW ST	BUCKEYE	AZ	85326
1	AYIYI OSAGINWEN	30842 W ROOSEVELT ST	BUCKEYE	AZ	85326
1	HICKS NOEL	30909 W PORTLAND ST	BUCKEYE	AZ	85326
1	WILSON DEBBIE J	30935 W LYNWOOD ST	BUCKEYE	AZ	85326
1	CUEVAS EBER N/MARIA ESTHER	31039 W BELLVIEW ST	BUCKEYE	AZ	85326
1	VAN SCOY RIES G	516 N 219TH AVE	BUCKEYE	AZ	85326
1	RAMSEY HAROLD L/LORI L	704 N PALO VERDE RD	BUCKEYE	AZ	85326
1	BABITZ JACK	PO BOX 1696	BUCKEYE	AZ	85326
2	BUCKEYE VALLEY RURAL VOLUNTEER FIRE DEPT	PO BOX 75	BUCKEYE	AZ	85326
1	SEDIG ALBERT R/SALLY F	PO BOX 242	BUCKEYE	AZ	85326
1	HERRON TODD D/RADER CATHY L	PO BOX 295	BUCKEYE	AZ	85326

2	SEDIG ALBERT RALPH JR/CHERYL	PO BOX 354	BUCKEYE	AZ	85326
1	ADAMS DULE/LYNNEA K	PO BOX 405	BUCKEYE	AZ	85326
1	C & W MINING INC	PO BOX 566	BUCKEYE	AZ	85326
1	BUCKEYE TOWN OF	PO BOX 776	BUCKEYE	AZ	85326
1	LONG RICHARD D/KIMBERLY A	PO BOX 925	BUCKEYE	AZ	85326
1	MCCLUNG BILL R/JESSIE K	PO BOX 1286	BUCKEYE	AZ	85326
1	GARCIA PABLO/FRANCISCA S	PO BOX 1341	BUCKEYE	AZ	85326
1	OLIVER DAVID ROBERT	PO BOX 1431	BUCKEYE	AZ	85326
1	BITTINGER GLENN O/ANGELA MIRT	PO BOX 1622	BUCKEYE	AZ	85326
1	ISMAEL TALAL AHMAD	105 E MONROE AVE	BUCKEYE	AZ	85326
1	HERRING STEPHEN W & LINDA M	816 E LINCOLN AVE	BUCKEYE	AZ	85326
1	RANEY WILLIAM F/PAMELA KAY	203 E IRWIN AVE	BUCKEYE	AZ	85326
1	ELMS JIMMIE M/ELVIERA E	23455 W DURANGO ST	BUCKEYE	AZ	85326
1	AHLSTOM WILEY J/KRISTEN ELIZABETH KRITER	23332 W WATKINS ST	BUCKEYE	AZ	85326
6	RICO NIEVES C & HORTENSIA	22403 W HAMMOND DR	BUCKEYE	AZ	85326
1	NAVEJAR ANTHONY	20612 W RAINBOW TRL	BUCKEYE	AZ	85326
1	MEDLIN CATHERINE A	18916 W ARLINGTON RD	BUCKEYE	AZ	85326
1	PARKER EARNEST R / MARY NATALIE	8405 S 274TH AVE	BUCKEYE	AZ	85326
1	CARBAJAL ARMIDA	501 N 293RD AVE	BUCKEYE	AZ	85326
1	JENKINS TEAL W/MELODY A	501 N 293RD AVE	BUCKEYE	AZ	85326
1	ELIZALDI AUGUSTINE V/JENNIFER K	30817 W LATHAM	BUCKEYE	AZ	85326
2	LITTLE BOBBY	31027 W PORTLAND ST	BUCKEYE	AZ	85326
1	KERR DAVID J/BRENDA L	1213 S JOHNSON RD	BUCKEYE	AZ	85326
1	BERGAU E ROBERT/CHERYL A	29909 W ROOSEVELT ST	BUCKEYE	AZ	85326
2	WALTERS CHARLES R JR/KARLA L	24313 W GROVE ST	BUCKEYE	AZ	85326
1	SCHRODER SCOTT B	30251 W LOWER RIVER RD	BUCKEYE	AZ	85326
1	CANNAN JAMES L/KARAYNN	PO BOX 1496	BUCKEYE	AZ	85326
1	LOBA LLC	23860 W US HIGHWAY 85	BUCKEYE	AZ	85326
2	TOWN OF BUCKEYE	100 N APACHE RD STE A	BUCKEYE	AZ	85326
1	DIAZ JOSE J	PO BOX 51	CASHION	AZ	85329
1	RODRIGUEZ DOMINGO H	PO BOX 749	CASHION	AZ	85329
1	JOHNSO ERIK	33844 N PATE PL	CAVE CREEK	AZ	85331
5	PINACOR LLC	4727 E RANCHO CALIENTE DR	CAVE CREEK	AZ	85331
1	HAYASHI JEANMARY S	4302 E DESERT MARIGOLD DR	CAVE CREEK	AZ	85331
1	GUTIERREZ EMMA M	PO BOX 644	EL MIRAGE	AZ	85335
1	LOZADA ANGEL/ROSIO	12754 W BOCA RATON RD	EL MIRAGE	AZ	85335
1	HERNANDEZ MARCOS/DIAZ MARIA D	12554 W HEARN RD	EL MIRAGE	AZ	85335
1	OCHOA JOSE G	PO BOX 179	GILA BEND	AZ	85337
1	BARRY VINCENT M/ANA F TR	1602 S 177TH AVE	GOODYEAR	AZ	85338
1	ROSE PROPERTIES SOUTHWEST LLC	1616 N LITCHFIELD RD NO 240	GOODYEAR	AZ	85338
1	SPOONER DONALD S	PO BOX 5278	GOODYEAR	AZ	85338
1	BECERRA FRANCISCO/MARIA	17411 W ELAINE DR	GOODYEAR	AZ	85338
1	BARRAZA FAMILY TRUST	13394 W CORONADO RD	GOODYEAR	AZ	85338
2	RICO GONZALO C/MARIA G	16357 W YUMA RD	GOODYEAR	AZ	85338
2	CASTIBLANQUE ANGEL	10278 S 175TH AVE	GOODYEAR	AZ	85338
1	MCGHEE CAREN L	416 N CITRUS RD	GOODYEAR	AZ	85338
1	SHAW DOUG/VALERIE	15813 W ADAMS ST	GOODYEAR	AZ	85338
1	BAKER BRADLEIGH M SR	1007 N 180TH DR	GOODYEAR	AZ	85338
1	CHAU THONG D/NANCY H LE	12512 W CAMPBELL AVE	LITCHFIELD PARK	AZ	85340
3	TRAN MUOI THI/ET AL	13026 W ALEGRA DR	LITCHFIELD PARK	AZ	85340
1	RUIZ MIRNA D	13718 W MARLETTE	LITCHFIELD PARK	AZ	85340
1	KIRKENDALL DANIEL/ANTOINETTE	17936 W GEORGIA AVE	LITCHFIELD PAK	AZ	85340
1	MEZA ISIDRO/EVANGELINE	3632 N 195TH AVE	LITCHFIELD PARK	AZ	85340
1	DAVID GLEN/JACQUE	6019 N MILANO CT	LITCHFIELD PARK	AZ	85340
3	ELENA LTD PARTNERSHIP	834 W PALO BREA DR	LITCHFIELD PARK	AZ	85340
1	TATTIE LAND LP	PO BOX 557	LITCHFIELD PK	AZ	85340
1	TUCKER CHRISTOPHER W / MARLA A	PO BOX 1987	LITCHFIELD PK	AZ	85340

1	CASTILLO CARLOS L/AIDA M	13002 W MISSOURI AVE	LITCHFIELD PK	AZ	85340
1	COPPOCK MICHAEL S/VIOLA J	12713 W MONTEBELLO AVE	LITCHFIELD PK	AZ	85340
1	NELSON BILLIE B TR	202 W ALEGRE DR	LITCHFIELD PK	AZ	85340
2	DESERT GOLD CONSTRUCTION LLP PENSION PLA	20022 W HIGHLAND AVE	LITCHFIELD PK	AZ	85340
1	OTIS WILLIAM R/LINDA V	6110 N 129TH AVE	LITCHFIELD PK	AZ	85340
1	JEFFERS JOSEPH P/MARILYN B TR	PO BOX 7	MORRISTOWN	AZ	85342
1	RANTA JOUKA Y TR	PO BOX 114	MORRISTOWN	AZ	85342
1	GACKE ROGER JOHN/MELISSA RAE	PO BOX 211	MORRISTOWN	AZ	85342
1	SALVATORE TERRY D	PO BOX 261	MORRISTOWN	AZ	85342
1	RANTA JOUKA Y/ULLA TR	PO BOX 366	MORRISTOWN	AZ	85342
1	MARTIN JAMES E/FRANCES A	PO BOX 385	MORRISTOWN	AZ	85342
1	BURNETT JAMES L/SHARON SUE	PO BOX 418	MORRISTOWN	AZ	85342
2	SKAGGS MICHAEL R/MARY E	PO BOX 486	MORRISTOWN	AZ	85342
11	KNIPP EDWARD A/BARBARA J	PO BOX 547	MORRISTOWN	AZ	85342
1	GUEST DONALD	8557 N 108TH DR	PEORIA	AZ	85345
1	QUILLEN OLEN/MELBA JOLENE	10009 N 97TH DR APT B	PEORIA	AZ	85345
2	RED CLIFFS 20 L L C	9949 W BELL RD STE 201	SUN CITY	AZ	85351
3	PATTON THELMA J	14239 N TUMBLEBROOK WAY	SUN CITY	AZ	85351
1	SIKORA EDWARD J/RUTH C TR	14008 N LAKEFOREST DR	SUN CITY	AZ	85351
1	MEREDITH JAMIE CLAY/GOODE MEREDITH CATRY	12201 N THUNDERBIRD RD	SUN CITY	AZ	85351
1	GARCIA BETTY J TR	11102 W KOLINA LN	SUN CITY	AZ	85351
2	MELVIN FRANKLIN E	10047 W IRONWOOD DR	SUN CITY	AZ	85351
1	GERBEN BOSCHMA DAIRY	8921 W BROADWAY RD	TOLLESON	AZ	85353
1	HOAR WILLIS BYRON & PATRICIA ANN	507 N BEVERLY WAY	TOLLESON	AZ	85353
1	GONZALEZ ISMAEL/CRUZ	2614 S 86TH LN	TOLLESON	AZ	85353
1	HANSON TARA J	5236 S 99TH AVE LOT 69	TOLLESON	AZ	85353
1	FISHER FRANK E/VICKY L	PO BOX 323	TONOPAH	AZ	85354
1	BLACK BRENDA L	PO BOX 383	TONOPAH	AZ	85354
3	VO QUANG HUY	PO BOX 1029	TONOPAH	AZ	85354
1	HOBSON TERRY L ETAL	8231 S 545TH AVE	TONOPAH	AZ	85354
1	WINTER MILTON TR	35007 W VAN BUREN ST	TONOPAH	AZ	85354
1	SACHS DANIEL E & MARY BEZANIUK	5801 S WINTERSBURG RD # MS7868	TONOPAH	AZ	85354
2	RIEFKOHL AUGUST L/JOANNE M	4800 S 331ST AVE	TONOPAH	AZ	85354
1	HOWARD LIONEL R OR VIRGINIA C	36827 W INDIAN SCHOOL RD	TONOPAH	AZ	85354
1	LEWIS ROBERT H/TANI S	7721 N CITRUS RD	WADDELL	AZ	85355
1	BROGDON EDWARD/BONNY S	8822 N 172ND DR	WADDELL	AZ	85355
1	DESERT GOLD CONSTRUCTION LLP	8822 N 172ND DR	WADDELL	AZ	85355
1	HOBGOOD RAYBAL E & RITA	PO BOX 3222	QUARTZSITE	AZ	85359
1	ROBLES PETER JR/CONNIE V	15748 W IRONWOOD ST	SURPRISE	AZ	85374
1	AGUILAR PHOENIX S	16590 N CUMBIE LN	SURPRISE	AZ	85374
1	TERRONES LUCY D TR	12946 W SANTA FE DR	SURPRISE	AZ	85374
1	MATHERSON DANIEL L/MIRELLA S	14716 W LAMOILLE DR	SURPRISE	AZ	85374
1	YOUNG DENIS C/KELLY	13557 W YOUNG ST	SURPRISE	AZ	85374
1	RANCH AND LAND SALES OF ARIZONA LLC	PO BOX 1221	CAREFREE	AZ	85377
1	BEAZLEY TERRY M	PO BOX 2674	CAREFREE	AZ	85377
2	SINGH RAYMOND/DIANE	16128 W CALAVAR RD	SURPRISE	AZ	85379
1	DELGADO GEORGE M/BARONE LANA L	15221 W CROCUS DR	SURPRISE	AZ	85379
1	WESTERN INVESTMENTS LLC	14509 N 153RD DR	SURPRISE	AZ	85379
1	SUER JEFFREY	6955 W CALAVAR RD	PEORIA	AZ	85381
2	SUER ROBERT	6955 W CALAVAR RD	PEORIA	AZ	85381
3	HARRISON DARREN K/TERRI L	7422 W PORT AU PRINCE LN	PEORIA	AZ	85381
1	RAINSHOWER APIARIES INC	14832 N 72ND DR	PEORIA	AZ	85381
3	AGUILERA RUBEN	13430 N 68TH DR	PEORIA	AZ	85381
1	BERTOLON THOMAS H	8610 W GREENBRIAN DR	PEORIA	AZ	85382
3	NOWAK LUDWIG/BETTINA	9502 W CAMINO DE ORO	PEORIA	AZ	85383
1	NOWAK THOMAS MARTIN	9502 W CAMINO DE ORO	PEORIA	AZ	85383
1	SULLIVAN JEAN MERIDAN	8903 W COUNTRY CLUB TRL	PEORIA	AZ	85383

1	GARCIA ALFONZO H /TERRI M /GARCIA F	27503 N 83RD GLN	PEORIA	AZ	85383
1	CHILSON LARRY RAYMOND/CAROLYN	PO BOX 6389	PEORIA	AZ	85385
1	FIGUEROA BUSTORGIO B/CLAUDIA M	30207 W BELLVIEW	BUCKEYE	AZ	85396
1	GOSPODAREK MARK E/REBECCA J	30632 W PORTLAND RD	BUCKEYE	AZ	85396
1	STANLEY RAYMOND C/KATHRYN	30749 W ROOSEVELT ST	BUCKEYE	AZ	85396
2	HASBROUCK CLARENCE/JULIE	3102 N 311TH AVE	BUCKEYE	AZ	85396
3	HAHN MERIDITH/BONNIE	3301 N 313TH AVE	BUCKEYE	AZ	85396
1	EASTERDAY LEONARD E	3855 N 313TH AVE	BUCKEYE	AZ	85396
1	TRUJILLO JOHN G/LUCIA L	29126 W MCDOWELL RD	BUCKEYE	AZ	85396
1	TAUTIMER GILBERT & DOLORES	29301 W MCDOWELL RD	BUCKEYE	AZ	85396
1	HAMBLIN RYNN/KATHY	324 N PALO VERDE RD	BUCKEYE	AZ	85396
1	UPTEGROVE SAMUEL EDWARD/MARY ANNETTE	1326 N PALO VERDE RD	BUCKEYE	AZ	85396
1	KING JOHN T JR/SANDRA D	1374 N PALO VERDE RD	BUCKEYE	AZ	85396
1	UPTEGROVE SAMUEL M	1404 N PALO VERDE RD	BUCKEYE	AZ	85396
1	HANNA JERRY JR/JOANN/BARBARA	29629 W PIERCE ST	BUCKEYE	AZ	85396
1	MCCULLOUGH JAMES DAVID	29209 W POLK ST	BUCKEYE	AZ	85396
1	CRENSHAW ALFRED & LOUISE	29221 W POLK ST	BUCKEYE	AZ	85396
1	DUNNING JOHN E & ALICE J	29233 W POLK ST	BUCKEYE	AZ	85396
1	HERNANDEZ RAFAELA V	29245 W POLK ST	BUCKEYE	AZ	85396
1	BRITO GUADALUPE C & TAMMY L	29139 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	HOYT RALPH D	29200 W ROOSEVELT ST	BUCKEYE	AZ	85396
5	CROSSWINDS DAIRY	29512 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	SMITH JERRY G & DEBORAH S	29633 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	CLOWARD ROBERT J	29817 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	MCLEAN TIMOTHY A/MARY L	29825 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	BLUMER JASON/JACQUE	30123 W LYNWOOD ST	BUCKEYE	AZ	85396
1	PRUETT WAYNE R/KAREN S	30137 W LYNWOOD ST	BUCKEYE	AZ	85396
1	WILLERT JAMES P	1103 N 293RD AVE	BUCKEYE	AZ	85396
1	SCARBOROUGH TOM L/ELMA FAYE	610 N 295TH AVE	BUCKEYE	AZ	85396
1	BOSS PHILLIP C/ETTA MAE	710 N 297TH AVE	BUCKEYE	AZ	85396
1	WAGNER VICKIE	29908 W PORTLAND ST	BUCKEYE	AZ	85396
1	RONQUILLO ROGELIO	29922 W PORTLAND ST	BUCKEYE	AZ	85396
1	DERKACH MICHAEL JOHN	29936 W PORTLAND ST	BUCKEYE	AZ	85396
1	SANDERS JOSEPH/VIRGINIA	29950 W PORTLAND ST	BUCKEYE	AZ	85396
1	NEWTON MARGO E	30348 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	RICHARDSON DANIEL/LINDA	30521 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	MYSCOFSKI BERNARD F & JUDITH R	29201 W TONOPAH SALOME HWY	BUCKEYE	AZ	85396
1	ADAMS JAMES AND SHIRLEY	29824 W VAN BUREN ST	BUCKEYE	AZ	85396
1	ELFORD JON H/ELLEN H	502 N PALO VERDE RD	BUCKEYE	AZ	85396
3	MILBOURN WILLIAM/PATRICIA/UDALL RYAN/TEN	29737 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	KING JEFFREY ALLEN	605 N 293RD AVE	BUCKEYE	AZ	85396
1	HENDERSON DONALD G/ELIZABETH K	30630 W LYNWOOD ST	BUCKEYE	AZ	85396
1	EDWARDS ROLSTON L/GLORIA J/HENDRICKSON G	30736 W PORTLAND ST	BUCKEYE	AZ	85396
1	MULL ERMAN/ NANCY	30711 W PORTLAND ST	BUCKEYE	AZ	85396
1	VERA SERGIO R/ANA L	30716 W LYNWOOD ST	BUCKEYE	AZ	85396
1	SHARP DONALD/BERVERLY	30752 W LYNWOOD ST	BUCKEYE	AZ	85396
1	SHATZER ROBERT K/HOUSE JOYCE E	30711 W LYNWOOD ST	BUCKEYE	AZ	85396
1	ANDRICK JAMES P	30723 W LYNWOOD ST	BUCKEYE	AZ	85396
1	GUETHE MICHAEL T	30836 W LYNWOOD ST	BUCKEYE	AZ	85396
1	HERRING KENT	30843 W LYNWOOD ST	BUCKEYE	AZ	85396
1	HALPIN MICHAEL R/JOAN C	30906 W LYNWOOD ST	BUCKEYE	AZ	85396
1	BROWN STEVEN ERIC/RHODES JODY L	30922 W LYNWOOD ST	BUCKEYE	AZ	85396
1	MARSHALL NICOLE L/NAQUIN LAUNEY R	30909 W LYNWOOD ST	BUCKEYE	AZ	85396
1	ORTIZ FELIPE/SOFIA	30921 W LYNWOOD ST	BUCKEYE	AZ	85396
1	BENTON CHANDLER/SUZI	31012 W LYNWOOD ST	BUCKEYE	AZ	85396
1	COZORY PAMELA J/VIRGINIA T	31020 W LYNWOOD ST	BUCKEYE	AZ	85396
1	BARNELLA SUSAN M	31003 W LYNWOOD ST	BUCKEYE	AZ	85396

1	TERRELL JACK L	31015 W LYNWOOD ST			BUCKEYE	AZ	85396
1	SCHUMAKER GREGORY	31027 W LYNWOOD ST			BUCKEYE	AZ	85396
1	ILLING M NEAL/VICENT ELIZABETH	30748 W BELLVIEW ST			BUCKEYE	AZ	85396
1	WHISTLER NAOMI F	30737 W BELLVIEW ST			BUCKEYE	AZ	85396
1	BRECHLER LARRY J/NANCY E	30749 W BELLVIEW ST			BUCKEYE	AZ	85396
1	HIGGINBOTHAM JOHN A JR	30804 W BELLVIEW ST			BUCKEYE	AZ	85396
1	SIMS WILLIAM E/ROMANOFF SIMS LESLIE	30843 W BELLVIEW ST			BUCKEYE	AZ	85396
1	PETERSEN ROBERT GARY/DEBRA	30920 W BELLVIEW ST			BUCKEYE	AZ	85396
1	FIRST AMERICAN TITLE INS CO TR	ICKE GARY/BEVERLY	CONTO	30934 W BELLVIEW ST	BUCKEYE	AZ	85396
1	SOTO RICKY LEE	30909 W BELLVIEW ST			BUCKEYE	AZ	85396
1	KILCOIN DONALD S/THELMA	30921 W BELLVIEW ST			BUCKEYE	AZ	85396
1	RODRIGUEZ FERNANDO/BRANDIEL	31002 W BELLVIEW ST			BUCKEYE	AZ	85396
1	BLEAM ROBERT D/MARY A	31026 W BELLVIEW ST			BUCKEYE	AZ	85396
1	NORMAN JONATHAN G/KELLY K	31038 W BELLVIEW ST			BUCKEYE	AZ	85396
1	NAPIER GAIL A	31003 W BELLVIEW ST			BUCKEYE	AZ	85396
1	SPENCER CLYDE E/SHARON M	30710 W LATHAM ST			BUCKEYE	AZ	85396
1	REYES ARISTEO/YANEZ LOURDES C	30722 W LATHAM ST			BUCKEYE	AZ	85396
1	BRYSON ROBERT E/VERA J	30723 W LATHAM ST			BUCKEYE	AZ	85396
1	RIVAS EDGAR D/MIRANDA ROSA M	30804 W LATHAM ST			BUCKEYE	AZ	85396
1	BENAVIDEZ JOSEPH	30842 W LATHAM ST			BUCKEYE	AZ	85396
1	CARLIN MARYELLEN L MASSEY	30908 W LATHAM ST			BUCKEYE	AZ	85396
1	YEO WILLIAM JR	30909 W LATHAM ST			BUCKEYE	AZ	85396
1	DENNIS HAROLD C/MARY J	30935 W LATHAM ST			BUCKEYE	AZ	85396
1	STUART MICHAEL H/ANDERSON DOROTHY	31002 W LATHAM ST			BUCKEYE	AZ	85396
1	HALL MICHAEL J/BONNIE J	FIRST AMERICAN TITLE INSURANCE CO TR		31026 W LATHAM ST	BUCKEYE	AZ	85396
1	WATSON KENNETH F JR/SUSAN M	31003 W LATHAM ST			BUCKEYE	AZ	85396
1	YEO WILLIAM ALAN SR/JOANN	31027 W LATHAM ST			BUCKEYE	AZ	85396
1	CHEW STEPHEN/CAROLYN	31039 W LATHAM ST			BUCKEYE	AZ	85396
1	BINGAMON JEFFREY A	30804 W PORTLAND ST			BUCKEYE	AZ	85396
1	WOLLMANN MERLYN J	30842 W PORTLAND ST			BUCKEYE	AZ	85396
1	GONZALEZ SAUL	30805 W PORTLAND ST			BUCKEYE	AZ	85396
1	BERG JAMES R	30817 W PORTLAND ST			BUCKEYE	AZ	85396
1	DWAYNE BRANDON	30843 W PORTLAND ST			BUCKEYE	AZ	85396
1	CARON MICHAEL G/CHARLENE K	30908 W PORTLAND ST			BUCKEYE	AZ	85396
1	SMITH LAWRENCE R/NANCY J	30920 W PORTLAND ST			BUCKEYE	AZ	85396
1	CABRERA JUAN/LORENA	30921 W PORTLAND ST			BUCKEYE	AZ	85396
1	INDERRIEDEN RAYMOND L/SANDRA J TR	31038 W PORTLAND ST			BUCKEYE	AZ	85396
1	FIRST AMERICAN TITLE INSURANCE CO TR #82	ERWIN ETHEL/ERWIN CARLA D	CONTO	31014 W PORTLAND ST LOT 89	BUCKEYE	AZ	85396
1	PELLUM RICHARD N/MARKUS-PELLUM CYNTHIA A	31003 W PORTLAND ST			BUCKEYE	AZ	85396
1	PEDERSON MATTHEW A	30711 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	RENDON JOSE B	30723 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	NIELSEN KURT C	30737 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	BELDEN JOHN R/SUSAN K	30816 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	PHASLEY DAVID A/LILLIAN M	30008 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	JODGE LOUIS JR	30908 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	MACKILLOP MICHELLE L	30920 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	STILLWELL KATHLEEN	30934 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	CLIFTON ROXIE L	30110 W BELLVIEW ST			BUCKEYE	AZ	85396
1	WILLIAMS SHABAZZ L SR	30138 W BELLVIEW ST			BUCKEYE	AZ	85396
1	GOODWILL LESLIE K/CHRISTINE A	31002 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	STREET KATHLEEN A	31038 W ROOSEVELT ST			BUCKEYE	AZ	85396
1	MIZE JAMES R & CONALLEE	1201 N 293RD AVE			BUCKEYE	AZ	85396
1	BUCKLEY DONNELL D/LORETTA G	910 N 295TH AVE			BUCKEYE	AZ	85396
1	KELLEY COY C SR/COY C JR	30404 W PORTLAND ST			BUCKEYE	AZ	85396
1	GALLATIN DAVID J	30432 W PORTLAND ST			BUCKEYE	AZ	85396
1	NOLAN RICHARD C/CYNTHIA L	30446 W PORTLAND ST			BUCKEYE	AZ	85396
1	BAUTISTA RAUL L/ROSA I	29924 W BELLVIEW ST			BUCKEYE	AZ	85396

1	RENTERIA JESUS	29938 W BELLVIEW ST	BUCKEYE	AZ	85396
1	ESQUIVEL ELENA/VALENTIN	29952 W BELLVIEW ST	BUCKEYE	AZ	85396
1	MCMURRY WAYNE K	30306 W PORTLAND ST	BUCKEYE	AZ	85396
1	ADKINS F M/M JUNIEL	30320 W PORTLAND ST	BUCKEYE	AZ	85396
1	THOMPSON ROBERT JAMES JR/ RACHEL	30419 W LYNWOOD ST	BUCKEYE	AZ	85396
1	HAYNIE CHARLES	29939 W LYNWOOD ST	BUCKEYE	AZ	85396
1	BARRY PATRICK M	30008 W LATHAM ST	BUCKEYE	AZ	85396
1	CARR KEITH H/ERICA M	30022 W LATHAM ST	BUCKEYE	AZ	85396
1	PHIPPS HEIDI/NAUGHTON MICHAEL	30036 W LATHAM ST	BUCKEYE	AZ	85396
1	BAKER TODD M/LEOLA J	30403 W PORTLAND ST	BUCKEYE	AZ	85396
3	FORTUNE AARON	30417 W PORTLAND ST	BUCKEYE	AZ	85396
1	GOULD CHARLES ALBERT	30445 W PORTLAND ST	BUCKEYE	AZ	85396
1	ECKERT GARY D	30605 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	DOUGLASS JERILYN D	30619 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	FUNCANNON JAMES F/BERNAL JUANITA	30221 W LYNWOOD ST	BUCKEYE	AZ	85396
1	RANKIN NATHAN H/DEBORAH A	30010 W PORTLAND ST	BUCKEYE	AZ	85396
1	GARCIA ANTONIO/SONIA R	30319 W PORTLAND ST	BUCKEYE	AZ	85396
1	PEREZ SALVADOR	30226 W LYNWOOD ST	BUCKEYE	AZ	85396
1	GONZALEZ VICTOR H/OCHOA MAYRA	29921 W PORTLAND ST	BUCKEYE	AZ	85396
2	SCHLOTZHAUER BRUCE A/MARLENE	29949 W PORTLAND ST	BUCKEYE	AZ	85396
1	MEDEIROS ANNIE	30007 W LYNWOOD ST	BUCKEYE	AZ	85396
2	ROTT GERALD S	30021 W LYNWOOD ST	BUCKEYE	AZ	85396
1	AGUILERA FRANCISCO/ELENA	30021 W BELLVIEW ST	BUCKEYE	AZ	85396
1	BENNETT LAURA J/BANKS DENISE A	30603 W PORTLAND ST	BUCKEYE	AZ	85396
1	YAZZIE ALEXANDER	30604 W BELLVIEW ST	BUCKEYE	AZ	85396
1	CYR JOEY	30618 W BELLVIEW ST	BUCKEYE	AZ	85396
1	MORALES ROBERTO P/LORINDA	30632 W BELLVIEW ST	BUCKEYE	AZ	85396
1	LANNON JOHN J	29116 W FILLMORE ST	BUCKEYE	AZ	85396
2	DAY DOUGLAS/LINDA	503 N 299TH AVE	BUCKEYE	AZ	85396
1	ADAMS GLEN/LORI	30403 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	CRONANDER HOWARD	703 N 293RD AVE	BUCKEYE	AZ	85396
1	ALBA ROSEMARY	30347 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	HIEBERT LESLIE JAMES/OPAL L	25812 W TONOPAH SALOME HWY	BUCKEYE	AZ	85396
1	RYAN JAMES W/CYNTHIA L	29921 W ROOSEVELT ST	BUCKEYE	AZ	85396
1	GIROUARD DENIS L/JOYCE E	30605 W LYNWOOD ST	BUCKEYE	AZ	85396
1	SUTTON KENNETH W	29923 W LATHAM ST	BUCKEYE	AZ	85396
1	SQUIRES RODNEY D/MARJORIE A	30234 W PORTLAND ST	BUCKEYE	AZ	85396
1	BELZER MILTON R/MARY J	30246 W PORTLAND ST	BUCKEYE	AZ	85396
1	BARRETT JOHN E/RAMONA L	30207 W PORTLAND ST	BUCKEYE	AZ	85396
1	KASTING RICHARD N SR/ANNETTE M	30431 W LATHAM ST	BUCKEYE	AZ	85396
1	KREIKEMEIER CHAD R	30222 W BELLVIEW ST	BUCKEYE	AZ	85396
1	DESSERO PHILLIP T/BARBARA A	30236 W BELLVIEW ST	BUCKEYE	AZ	85396
1	CASTREJON RAMON	30250 W BELLVIEW ST	BUCKEYE	AZ	85396
1	LOPEZ ALFREDO	30235 W BELLVIEW ST	BUCKEYE	AZ	85396
1	GREGG FRANCES K TR	30249 W BELLVIEW ST	BUCKEYE	AZ	85396
2	KIRK WALTER C/CAROL R	30310 W LYNWOOD ST	BUCKEYE	AZ	85396
1	SHROTH GEORGE S	30502 W LYNWOOD ST	BUCKEYE	AZ	85396
1	GREGG MICHAEL L/RHONDA F TR	30524 W LYNWOOD ST	BUCKEYE	AZ	85396
1	WILLIS JEANNETTE	30418 W LATHAM ST	BUCKEYE	AZ	85396
1	JANASHAK BRIAN R/LEAH M	30619 W LATHAM ST	BUCKEYE	AZ	85396
1	HIGHT TARESA C	29911 W BELLVIEW ST	BUCKEYE	AZ	85396
1	DAVIS PHILLIP S/MORIN-DAVIS HILDA	30620 W LATHAM ST	BUCKEYE	AZ	85396
1	DE ALEJANDRO ROLANDO	30335 W LYNWOOD ST	BUCKEYE	AZ	85396
1	SHAULL CHARLES F SR	30508 W LATHAM ST	BUCKEYE	AZ	85396
1	DEE WILLIAM A/MAGDALENA F	30522 W LATHAM ST	BUCKEYE	AZ	85396
1	DALEY JACY M	30531 W LYNWOOD ST	BUCKEYE	AZ	85396
1	WOODARD JOHN	30521 W LATHAM ST	BUCKEYE	AZ	85396

1	BENIGAR NEIL/YVONNDA L	30535 W LATHAM ST		BUCKEYE	AZ	85396
1	WELCH RANDALL W/BEVERLY A	29514 1/2 W VAN BUREN ST		BUCKEYE	AZ	85396
1	ABRAMS DANIEL	30209 W ROOSEVELT ST		BUCKEYE	AZ	85396
1	GRACE JOHN P/PATRICIA A	30223 W ROOSEVELT ST		BUCKEYE	AZ	85396
1	CHRISTY DAVID S/CATHERINE M	30604 W PORTLAND ST		BUCKEYE	AZ	85396
1	HOOD BILLY R/ROBERT A/CHARLES R	30618 W PORTLAND ST		BUCKEYE	AZ	85396
1	OSBORNE CLARK J/RESE-OSBORNE VALERIE	29930 W LYNWOOD ST		BUCKEYE	AZ	85396
1	PINKSTON CHRISTOPHER L	29948 W LYNWOOD ST		BUCKEYE	AZ	85396
1	LEE DON L	30002 W LYNWOOD ST		BUCKEYE	AZ	85396
3	HERRIAGE CARL A/FELICIA C	29210 W VAN BUREN ST		BUCKEYE	AZ	85396
1	MINNIS FRANK	30403 W BELLVIEW ST		BUCKEYE	AZ	85396
1	CASTELLANOS ERIC R/OLINKA M	30123 W ROOSEVELT ST		BUCKEYE	AZ	85396
1	WARREN STEVEN C	30303 W LATHAM ST		BUCKEYE	AZ	85396
1	GREGG MICHAEL J	30331 W LATHAM ST		BUCKEYE	AZ	85396
1	SANCHEZ FRANCISCO/DE SANCHEZ MARIA PEREZ	30347 W LATHAM ST		BUCKEYE	AZ	85396
1	MORRIS JUSTIN R/MELISSA K	512 N 295TH AVE		BUCKEYE	AZ	85396
1	MCCARTY CINDY L	522 N 296TH AVE		BUCKEYE	AZ	85396
1	MIRON WILLIAM L	30309 W BELLVIEW ST		BUCKEYE	AZ	85396
1	CLAXTON CORNELIUS JR	30347 W BELLVIEW ST		BUCKEYE	AZ	85396
1	CARROLL SHANE/ KELLI	107 N MILLER RD		BUCKEYE	AZ	85396
1	AGUIRRE JOSE L & ROSA P	29610 W PIERCE ST		BUCKEYE	AZ	85396
1	TRASK VICKIE L	30348 W BELLVIEW ST		BUCKEYE	AZ	85396
1	NASH KATHLEEN KELLY	30036 W BELLVIEW ST		BUCKEYE	AZ	85396
1	ZARAGOZA JAVIER	30109 W LATHAM ST		BUCKEYE	AZ	85396
1	BLOUIN ROY L/LINDA L	30251 W LATHAM ST		BUCKEYE	AZ	85396
1	GARCIA ATILANO/DELACRUZ CLAUDIA NELI/GAR	30102 W PORTLAND ST		BUCKEYE	AZ	85396
1	USSERY JIMMIE L/REBECCA	25831 W TONOPAH SALOME HWY		BUCKEYE	AZ	85396
3	SUBTERA ENTERPRISE CORPORATION	1419 N JACKRABBIT TRL		BUCKEYE	AZ	85396
1	REVETTE RICHARD L/BARBARA	30111 W BELLVIEW ST		BUCKEYE	AZ	85396
1	NUNEZ ESPINO ANA L	30125 W BELLVIEW ST		BUCKEYE	AZ	85396
1	CABRERA SERAFIN/MAGANA MIREYA	30404 W ROOSEVELT ST		BUCKEYE	AZ	85396
1	FIGUEROA LAURENTINO/RAMONA	30418 W ROOSEVELT ST		BUCKEYE	AZ	85396
2	BRAMLETTE JACK C/IDA M CO TR	19044 W LYNWOOD ST		BUCKEYE	AZ	85396
1	WALKINSHAW KEVIN/LAURA	38825 N 275TH AVE		MORRISTOWN	AZ	85432
2	AUSTIN MARY MARGARET	1406 N PETTET LN		PAYSON	AZ	85541
1	MILLER FORREST L & LOIS A	HC 3 BOX 672C		PAYSON	AZ	85541
1	ETCHISON RICHARD D JR/LAURA CONTO	PO BOX 3354		PAYSON	AZ	85547
1	WALKINSHAW ROY/SANDRA TR	ASSOCIATED PHYSICAL THERAPY AND REHAB PP	PO BOX 39	VAIL	AZ	85641
1	MARTAN EDWARD E ETAL	PO BOX 4532		TUBAC	AZ	85646
1	BRADY BETTY/CHRISTINA/CHARLES JR	2917 E SYLVIA ST		TUCSON	AZ	85716
1	EVO-ORA FOUNDATION	2525 E BROADWAY BLVD		TUCSON	AZ	85716
1	COLE FRANCES W	11155 E GOLF LN		TUCSON	AZ	85730
1	RHOTON IVAN L/EARLENE TR	1050 N 6TH ST		SHOW LOW	AZ	85901
1	SCHWERTFAGER ALAN C & MICHELLE L	PO BOX 1802		FOREST LAKES	AZ	85931
4	CRAWFORD LYNN A/MARY E	3344 S HILLARY WAY		FLAGSTAFF	AZ	86001
1	DREW DON W	6875 N GREENE LN		FLAGSTAFF	AZ	86001
1	HALL NANCY E & DYER GARY & VICKIE M	5675 BUCKBOARD TRL		FLAGSTAFF	AZ	86004
1	KETELHUT JERRY LEE & ILA MAE TR	HC 31 BOX 955		HAPPY JACK	AZ	86024
1	WHITEHOUSE JOSEPH/YVONNE	2165 VISTA RIDGE RD		PRESCOTT	AZ	86303
1	MULHORN JOHN D & ELEANOR J	PO BOX 490		CAMP VERDE	AZ	86322
1	WOLKEN FRED A & CAROL L	2050 W HIGHWAY 89A LOT 355		COTTONWOOD	AZ	86326
1	UHLMAN STEVEN/TERRY M/WP RITTER LP	901 N PRIMROSE PT		SEDONA	AZ	86336
1	HEIBULT EARL	5560 WINCHESTER RD SW		ALBUQUERQUE	NM	87121
1	JACKSON CLARENCE M / BETTY L	PO BOX 71		TRUTH CONSQ	NM	87901
1	AGUILERA MIKE V	PO BOX 1671		LAS CRUCES	NM	88004
1	COURTNEY DEION R/CHARLENE J	PO BOX 4102		ALAMOGORDO	NM	88311
1	NEIHART RUSSELL E	1022 NEVADA HWY #210		BOULDER CITY	NV	89005

22	TEMPE LEASING & RENTAL CO	PO BOX 60712		BOULDER CITY	NV	89006
1	NARANJA ROGELIO D & IMELDA T	59 COYOTE HILLS ST		HENDERSON	NV	89012
2	DANIEL ROSE MARIE	865 BERGAMONT DR		HENDERSON	NV	89015
1	FISHER JAMES R	PO BOX 5760		PAHRUMP	NV	89041
2	P.T. CORPORATION	2505 ANTHEM VILLAGE DRIVE #E-508		HENDERSON	NV	89052
1	K J INVESTMENT CORPORATION	2733 CHOKECHERRY AVE		HENDERSON	NV	89074
5	BUCKEYE 36 LLC/ETAL	3157 N RAINBOW BLVD # 305		LAS VEGAS	NV	89108
2	BECKER TR/CARPI TR/CARSON TR/311 LLC/ETA	8080 W SAHARA AVE STE A		LAS VEGAS	NV	89117
2	ALDABBAGH AMER	2025 REDBIRD DR		LAS VEGAS	NV	89134
1	BRUNNER AND CAMELBACK LLC	UNLIMITED HOLDINGS	2865 S JONES BLVD	LAS VEGAS	NV	89146
4	LEVYN ROBERT J & LOUISE L	9500 KIRKSIDE RD		LOS ANGELES	CA	90035
2	AUSTIN DORIS J/MAXFIELD EXIE L	12919 DALESIDE AVE		GARDENA	CA	90249
1	SMITH HARRY D	10707 PIONEER BLVD UNIT 3		SANTA FE SPGS	CA	90670
1	FIGUEROA ALFONSO SANDOVAL	11860 206TH ST		LAKEWOOD	CA	90715
1	DE LOS SANTOS ART/ILIANA	32564 THE OLD RD		CASTAIC	CA	91384
1	COVINGTON DENISE	4496 LOS SERRANOS BLVD		CHINO HILLS	CA	91709
1	VALDEZ JOSE REFUGIO	1725 E NANETTE AVE 3		WEST COVINA	CA	91792
1	TROCHANOWSKI ANDREW J/DARLENE TR	10600 NOAKES RD		LA MESA	CA	91941
4	MCCOLL IAN/ANNA	637 NEPTUNE AVE		ENCINITAS	CA	92024
1	VAN DYKE DAREN J/MALINDA R	608 RUSSELL RD		BRAWLEY	CA	92227
1	LARSON PATRICIA A	34783 VIA ECHO		CATHEDRAL CTY	CA	92234
1	ALBERT J TATU III	9 WINTERSWEET WAY		IRVINE	CA	92612
1	YOUNG TARAS P/DENNIS T ETAL	484 WALNUT PL		COSTA MESA	CA	92627
1	SUN ANDY/JENNIFER	49 BLUE HORIZON		LAGUNA NIGUEL	CA	92677
1	SABET MAHVASH	PO BOX 2755		MISSION VIEJO	CA	92690
4	HUNTER HALLEEN L/SALTZMAN JOAN L TR	2100 W PALMYRA #83		ORANGE	CA	92868
1	COUNTRYWIDE HOME LOAN INC	400 COUNTRYWIDE WAY		SIMI VALLEY	CA	93065
1	GOAD JIMMIE L & GEORGIA L	28120 LAKE TERRACE AVE		TAFT	CA	93268
2	HAYWARD HAZEL H	2106 AUBERRY AVE		BAKERSFIELD	CA	93304
1	FOREHAND PAUL	1810 SANIGER LN		BISHOP	CA	93514
2	FONG JANLEY	1161 HILLCREST PL		MILLBRAE	CA	94030
1	MCCUSKER VIOLA MARGARET TR	845 CALIFORNIA ST APT 201		SAN FRANCISCO	CA	94108
1	CAMPBELL HYLE/JOANNE	31624 BURNHAM WY		HAYWARD	CA	94544
1	HUNTER LEON & LILLIE MAE	109 PERIDOT CT		HERCULES	CA	94547
1	DURINGER PIERRE R	35 HARTWOOD CT		LAFAYETTE	CA	94549
1	SACKRISON BRUCE F/NANNETTE V	1370 TRANCAS ST # 401		NAPA	CA	94558
1	MOER DAVID R	2758 DERBY DR		SAN RAMON	CA	94583
1	NICORA VINCE & LORRAINE A	5333 MILES AVE		OAKLAND	CA	94618
1	CROW ROBERT L/DIANNA F	8040 HIHN RD		BEN LOMOND	CA	95005
1	BEAZLEY LANCE D	1131 MEREDITH AVE		SAN JOSE	CA	95125
1	WILLARD EDWARD	3113 INDEPENDENCE WAY		MODESTO	CA	95354
1	CAMPBELL VIRGINIA M	7609 PRINCE ST		CITRUS HTS	CA	95610
1	HEGARTY DESMOND A/ARLENE E TR	1169 SECRET LAKE LOOP		LINCOLN	CA	95648
2	CORNEJO ALFONSO G	604 RILATO DR		VACAVILLE	CA	95687
2	PEREZ JOSE	14423 TYLER RD		WALNUT GROVE	CA	95690
1	RAGSDALE LINCOLN J JR	3169 SPINNING ROD WAY		SACRAMENTO	CA	95833
1	WILLIS MICHAEL/JEANETTE	PO BOX 1305		HAYFORK	CA	96041
6	LEGG KENNETH	PO BOX 612		SHINGLETOWN	CA	96088
2	SCHULSON RONALD H/ROSE M	4580 VAN WELL RD		DALLAS	OR	97338
2	EDEN DEMERS MCCOLL 2005 TRUST ETAL	6775 N BANK RD		ROSEBERG	OR	97470
1	BOYD LEE G/LAURIE B	1604 MERIDIAN RD		EAGLE POINT	OR	97524
3	MARSHALL WAYNE E SR/SHARON L	26869 NE 143RD PL		DUVALL	WA	98019
1	GUTIERREZ RAYMOND Y/GRACIELA M	16614 PLEASANT BEACH DR		YELM	WA	98597
6	BRYANT RAYMOND	457 PIONEER AVE NE		CASTLE ROCK	WA	98611
1	POST JASON/JOSHUA/RICHARD	29 WILDCAT RD		GOLDENDALE	WA	98620
1	CYR DENNIS	11651 BRAMALEA RD	BRAMPTON ON L6T 3S1	CANADA		
1	YANG YAUJIAN	1629 FOSTERS WAY	DELTA AB V3M 6S7	CANADA		

1	BANK ADAM & CLARA IRENE	1-737 10TH ST	CANMORE AB T1W 2A3	CANADA
1	LORAC HOLDINGS INC	25414 32ND AVE	ALDERGROVE BC V4W 1Y2	CANADA
5	TERRA SUN VALLEY LLC	30 RASHEE LN BOX 10	TRAVERSE BAY MB R0E 2I0	CANADA
2	LETHAM BRAD/KATHERINE	412 HAMILTON AVE	NELSON BC V1L 3E9	CANADA
1	JONASSON JOHN	PO BOX 7791	EDSON AB T7E 1V8	CANADA
1	MILLER MARILYN J	PO BOX 911	LANIGAN SK S0K 2M0	CANADA

B.7 FEMA Correspondence

Federal Emergency Management Agency

Washington, D.C. 20472

OCT 2 4 2007

FLOOD CONTROL DISTRICT
RECEIVED
OCT 31 '07
CH & GM | FINANCE
PIO | LEGAL
ADMIN | CAO
REG | PR&PW
ENG | FCD
CONTRACTS
ROUTING
KAG

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Fulton Brock
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson, 10th Floor
Phoenix, AZ 85003

Community: Maricopa County, AZ
Community No.: 040037

Dear Mr. Brock:

This is in regard to a Letter of Map Revision (LOMR) request dated September 4, 2007, from Ms. Kathryn Gross, CFM, Project Manager, Flood Control District of Maricopa County, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) evaluate the effects that updated flood hazard data for White Tank Mountains Fans 3, 13, 16; 4, 5; 6; 17, 18, 19; 10, 11, and 20 would have on the flood hazard information shown on the effective Flood Insurance Rate Map (FIRM) for your community. This LOMR request is referred to as Case No. 07-09-1894P. This letter is based on the best available flood hazard information and is intended to improve upon that shown on the effective FIRM.

We reviewed the submitted data enclosed in the application package (with appendixes) entitled "Approximate Zone A Floodplain Delineation Study of White Tank – Technical Data Notebook, Fans 3, 13, and 16 – Fans 4, and 5 – Fan 6 – Fans 17, 18, and 19 – Fans 10, 11, and 20," prepared for the Flood Control District of Maricopa County by JE Fuller/Hydrology & Geomorphology, Inc., dated November 2006. We have determined that the submitted data meet the minimum floodplain management criteria of the National Flood Insurance Program (NFIP), but FEMA cannot issue a LOMR or Physical Map Revision at this time.

In accordance with Paragraph 60.3(b)(4) of the NFIP regulations (copy enclosed), we encourage your community to use the draft work maps entitled "Approximate Zone A Floodplain Delineation Study of White Tank Fans 3, 13, & 16, Sheet 2 to 5, FCD 2004C049, Sun Valley Area Drainage Master Plan;" "Approximate Zone A Floodplain Delineation Study of White Tank Fans 4 & 5, Sheet 2 to 6, FCD 2004C049, Sun Valley Area Drainage Master Plan;" "Approximate Zone A Floodplain Delineation Study of White Tank Fan 6, Sheet 2 and 3 , FCD 2004C049, Sun Valley Area Drainage Master Plan;" "Approximate Zone A Floodplain Delineation Study of White Tank Fans 17, 18, & 19, Sheet 2 to 4, FCD 2004C049, Sun Valley Area Drainage Master Plan;" and "Approximate Zone A Floodplain Delineation Study of White Tank Fans 10, 11, & 20, Sheet 2, FCD 2004C049, Sun Valley Area Drainage Master Plan," all dated November 2006, as the best available data for floodplain management purposes until such time as FEMA can physically revise the FIRM or issue a LOMR.

This letter is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the

Special Flood Hazard Area, the area subject to inundation by the base (1-percent-annual-chance) flood. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

If you have questions regarding floodplain management regulations for your community or the NFIP in general, please contact the Consultation Coordination Officer (CCO) for your community. Information on the CCO for your community may be obtained by calling the Director, Mitigation Division of FEMA in Oakland, California, at (510) 627-7175. If you have questions regarding this letter, please call our Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

Max H. Yuan, P.E., Project Engineer
Engineering Management Section
Mitigation Directorate

For: William R. Blanton Jr., CFM, Chief
Engineering Management Section
Mitigation Directorate

Enclosure

cc: The Honorable Bobby Bryant
Mayor, Town of Buckeye

Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County

Ms. Lynn M. Thomas, P.E., CFM
Technical Supervisor
Flood Control District of Maricopa County

Mr. Ted Collins, CFM
Principal Floodplain Coordinator
Flood Control District of Maricopa County

Ms. Kathryn Gross, CFM
Project Manager
Flood Control District of Maricopa County

Mr. Scott Lowe, P.E.
Director
Public Works
Town of Buckeye

Mr. Brian Cosson, CFM
NFIP Coordinator
Office of Dam Safety and Flood Mitigation
Arizona Department of Water Resources

Jonathan Fuller, P.E.
JE Fuller/Hydrology and Geomorphology, Inc.

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

September 17, 2007

Ms. Kathryn Gross, CFM
Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

IN REPLY REFER TO:
Case No.: 07-09-1894P
Communities: Town of Buckeye and Maricopa County, AZ
Community Nos.: 040039 and 040037

316-ACK

Dear Ms. Gross:

This responds to your request dated September 13. 2007, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Approximate Zone A Floodplain Delineations Study of White Tank Fans 17, 18, and 19
Flooding Source(s):	White Tank Mountains Fans 17, 18, and 19
FIRM Panel(s) Affected:	04013C1530J and 04013C1535H

We have completed an inventory of the items you submitted. Our review of the submitted data indicates we have the minimum data required to perform a detailed technical review of your request. If additional data are required or if delays are encountered, we will inform you within 60 days of the date of this letter.

As you may know, FEMA has implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. However, because your request is based on flood hazard information meant to improve upon that shown on the flood map or within the flood study and does not partially or wholly incorporate manmade modifications within the Special Flood Hazard Area, no fees will be assessed for our review.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

FLOOD CONTROL DISTRICT
RECEIVED
SEP 20 '07
CH & GM | FINANCE
PIO | LANDS
ADMIN | O & M
REG | P & PM
ENG | FILE
CONTRACTS
ROUTING KAG

3601 Eisenhower Avenue, Alexandria, VA 22304-6425 PH:1-877-FEMA MAP FX: 703.960.9125

If you have specific questions concerning your request, please contact the Revisions Coordinator for your State, Mounir Boudjemaa, M.S., at Mounir.Boudjemaa@mapmodteam.com or at (703) 317-6295.

Sincerely,

Syed Qayum

Syed Qayum, CFM
National LOMR Technical Manager
Michael Baker Jr., Inc.

cc: Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County

Mr. Scott Lowe, P.E.
Public Works Director
Town of Buckeye

Mr. Jonathan Fuller, PE
JE Fuller / Hydrology and & Geomorphology, Inc.

Mr. Brian Cosson, CFM
NFIP Coordinator
Arizona Department of Water Resources

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov
2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

September 4, 2007

Mr. Mounir Boudjemaa, Regional Manager
Michael Baker Jr. Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Subject: Sun Valley Area Drainage Master Plan – Approximate Zone A Floodplain Delineations for the White Tank Piedmont (FCD contract 2004C049), by JEFuller Hydrology and Geomorphology

Communities: Unincorporated Maricopa County, Community No. 040037
Town of Buckeye, Community No. 040039

Flooding Sources: White Tank Fans # 3, 13,16; White Tank Fans # 4, and 5; White Tank Fan # 6; White Tank Fans # 10, 11, 20; White Tank Fans # 17, 18, 19

FIRM panels affected:

04013C01090 J (Fan 3, 13, 16)
04013C01095 H (Fan 3, 13, 16)
04013C01530 J (Fans 3,13,16; 4, 5; 17, 18, 19)
04013C01535 H (Fans 3, 13, 16; 6; 4, 5; 17, 18, 19)
04013C01540 H (Fan 4, 5; 6)
04013C01545 H (Fan 4, 5; 6)
04013C01575 (unprinted) (Fan 4, 5)
04013C02030 H (Fans 10, 11, 20)

Dear Mr. Boudjemaa:

Enclosed is the technical supporting data for several Approximate Zone A Alluvial Fan Floodplain Delineation studies of a previously unstudied portion of the west side of the White Tank Mountain Piedmont. The study area is located in the west central portion of Maricopa County.

The delineations were a part of the District's Sun Valley Area Drainage Master Plan (FCD 2004C049). The Technical Data Notebooks were broken down into different geographic regions. Typically one to four alluvial fans are presented in each report. The submitted reports are as follows:

- Sun Valley Area Drainage Master Plan: Technical Data Notebook Approximate Zone A Floodplain Delineation Study of White Tank Fans 4 and 5
- Sun Valley Area Drainage Master Plan: Technical Data Notebook Approximate Zone A Floodplain Delineation Study of White Tank Fan 6

- Sun Valley Area Drainage Master Plan: Technical Data Notebook Approximate Zone A Floodplain Delineation Study of White Tank Fans 10, 11, 20
- Sun Valley Area Drainage Master Plan: Technical Data Notebook Approximate Zone A Floodplain Delineation Study of White Tank Fans 3, 13, 16
- Sun Valley Area Drainage Master Plan: Technical Data Notebook Approximate Zone A Floodplain Delineation Study of White Tank Fans 17, 18, 19

The analyses resulted in the identification of approximately 10 square miles of Approximate Zone A Alluvial Fan Floodplains and Approximate Zone A Alluvial Fan Administrative Floodways.

Documentation and analysis in support of the floodplain delineations, including the FEMA forms, can be found within each of the above listed reports. Along with the above TDNs, a separate binder entitled "Sun Valley Area Drainage Master Plan Technical Data Notebook: Approximate Zone A Floodplain Delineation Study of White Tank Piedmont Appendix G" has been submitted as well. This binder contains the supporting geomorphic documentation for all the above TDNs. Annotated FIRM panels are included at the end of each report under the tab "C Maps". Digital versions of the hydrologic and hydraulic analyses are included on cds in their respective reports.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Floodplain Delineation Branch

Enclosure

Copy to: Max Yuan, P.E.
Engineering Management Section
Mitigation Division
Federal Emergency Management Agency
500 C Street SW
Washington, D.C. 20472-0001

Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

Ray Lenaburg
Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

David Wilcox
Town Manager
Town of Buckeye
1101 East Ash Avenue
Buckeye, AZ 85326

Jon Fuller, P.E.
JEFuller Hydrology and Geomorphology
8400 Kyrene Rd., Suite 201
Tempe, AZ 85284

Appendix C

Survey Field Notes

Additional survey field notes were not gathered for this study.

Appendix D

Hydrologic Analysis Supporting Documentation

APPENDIX D

D.1 Precipitation Data

D.2 Physical Parameter Calculations

D.3 Hydrologic Calculations

D.1 Precipitation Data

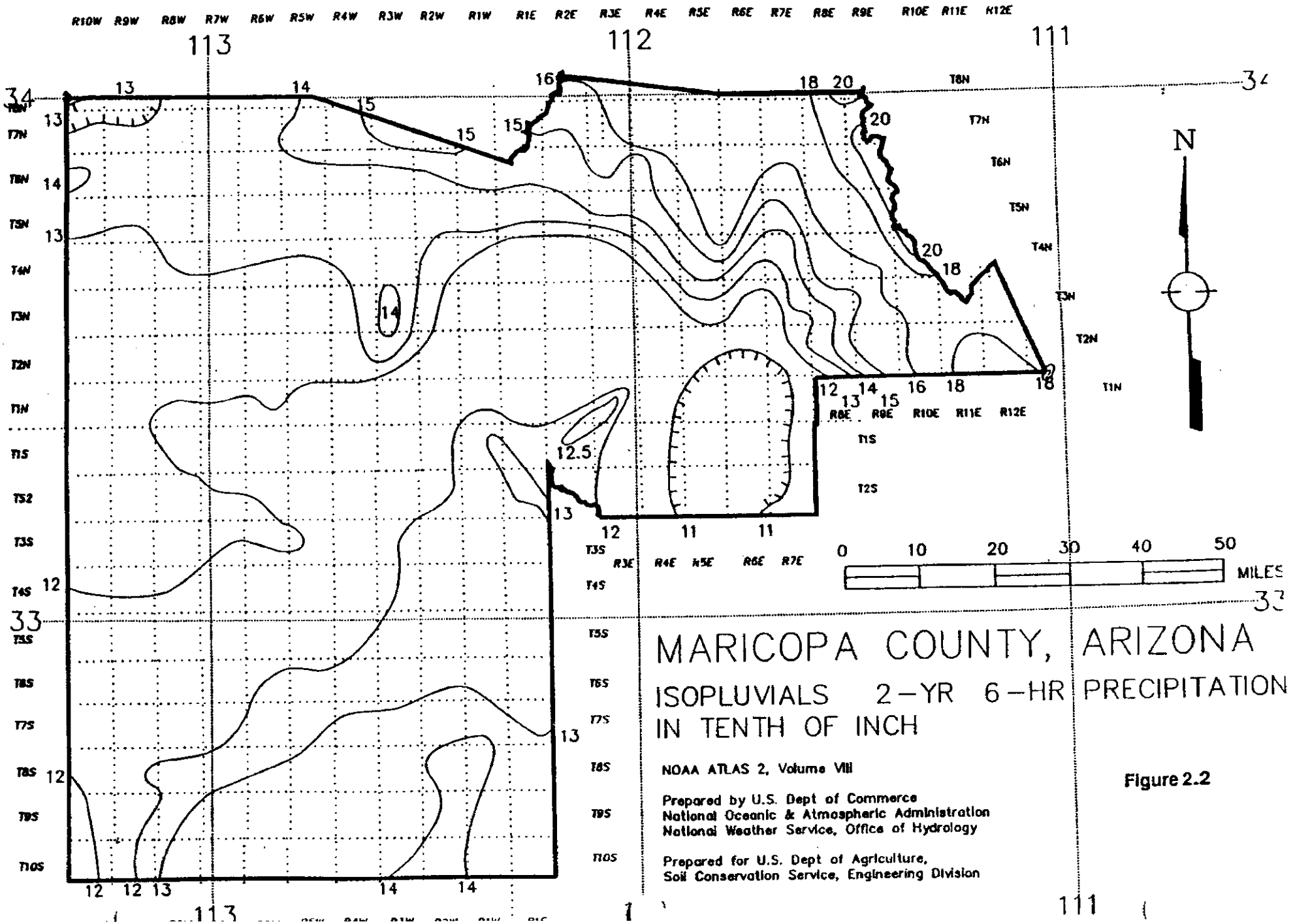

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 2-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
N
0 10 20 30 40 50
MILES
113
112
111
34
33

Figure 2.2

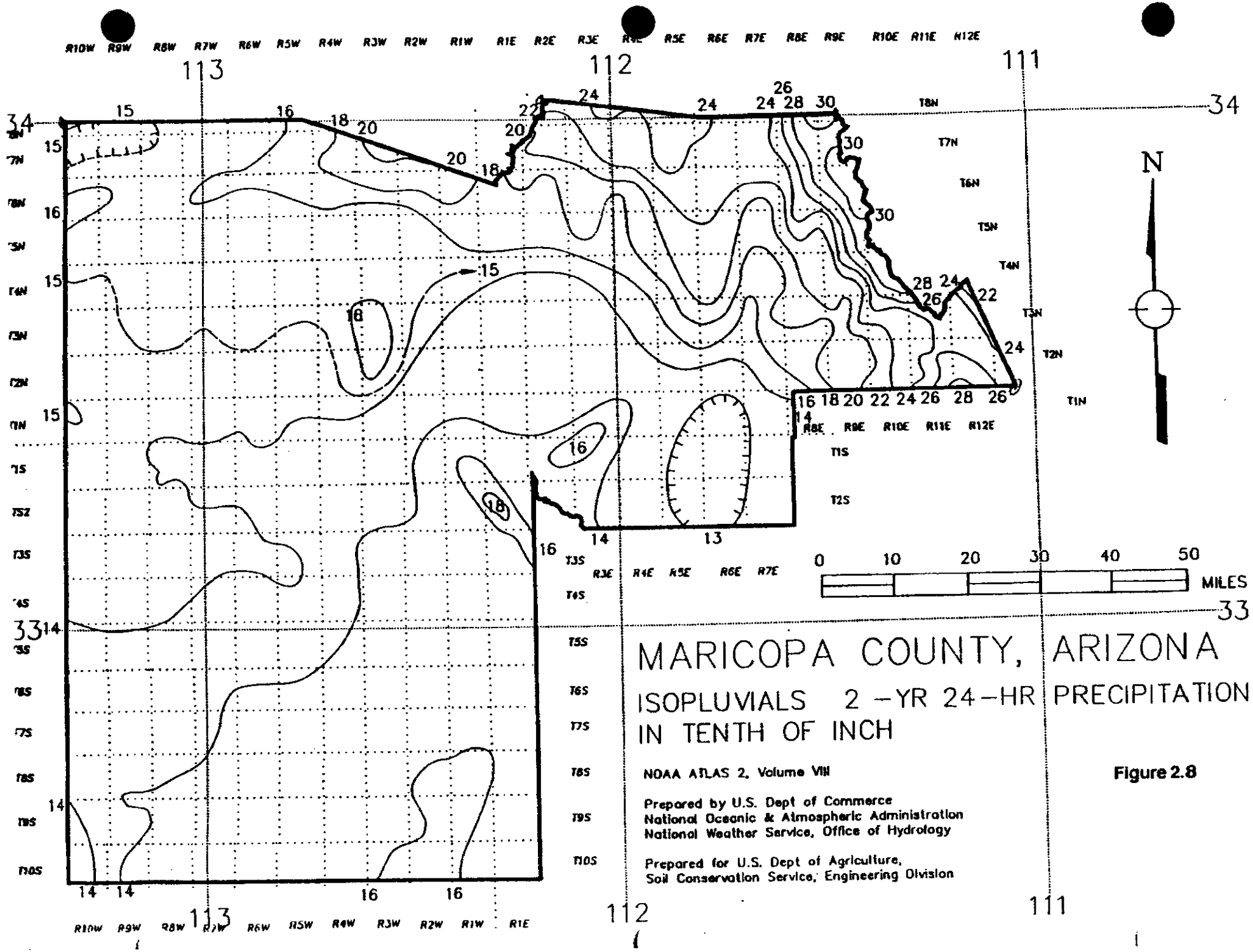
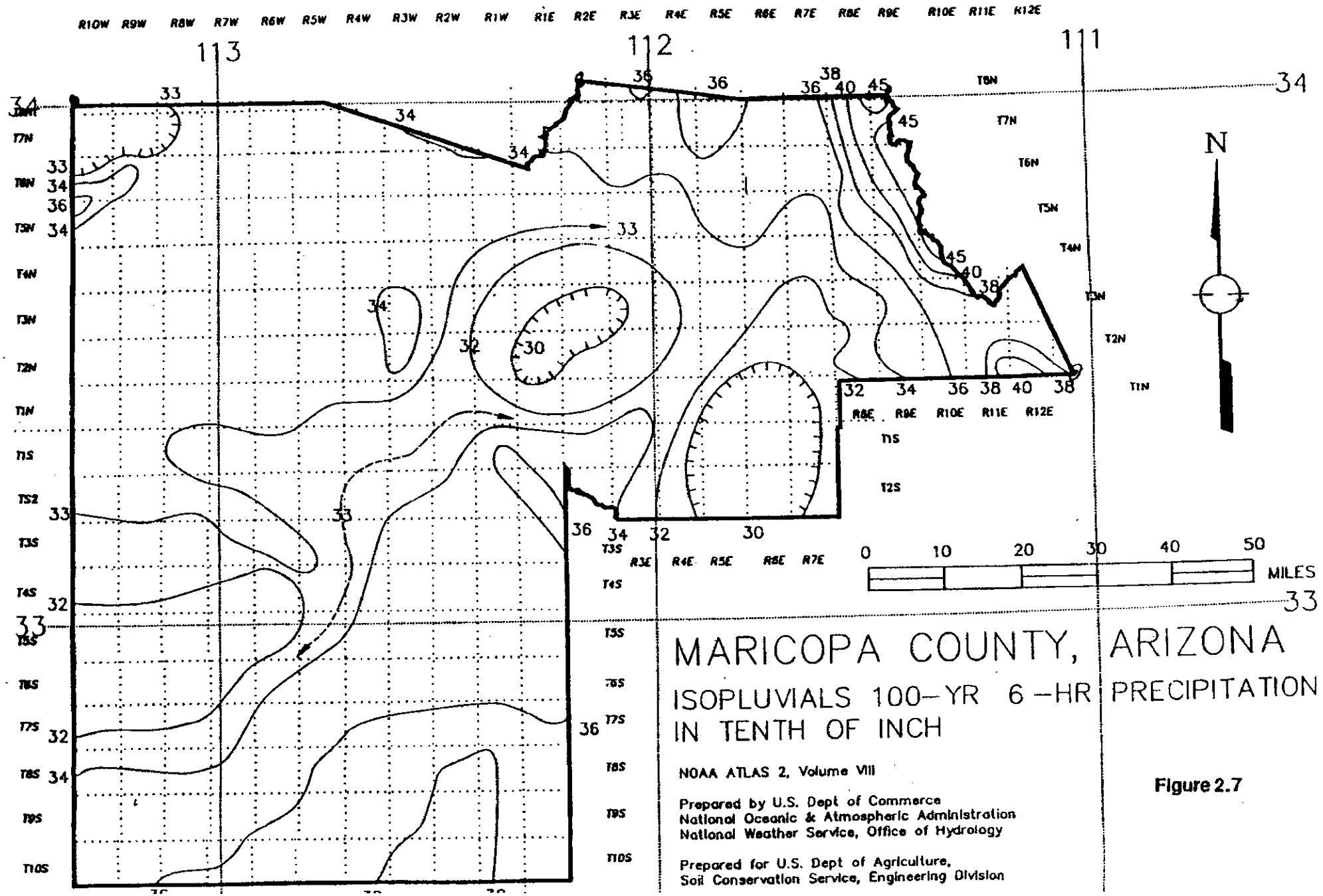

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 2 -YR 24-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
N
0 10 20 30 40 50
MILES
113
112
111
34
33
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S

Figure 2.8



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100-YR 6-HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.7

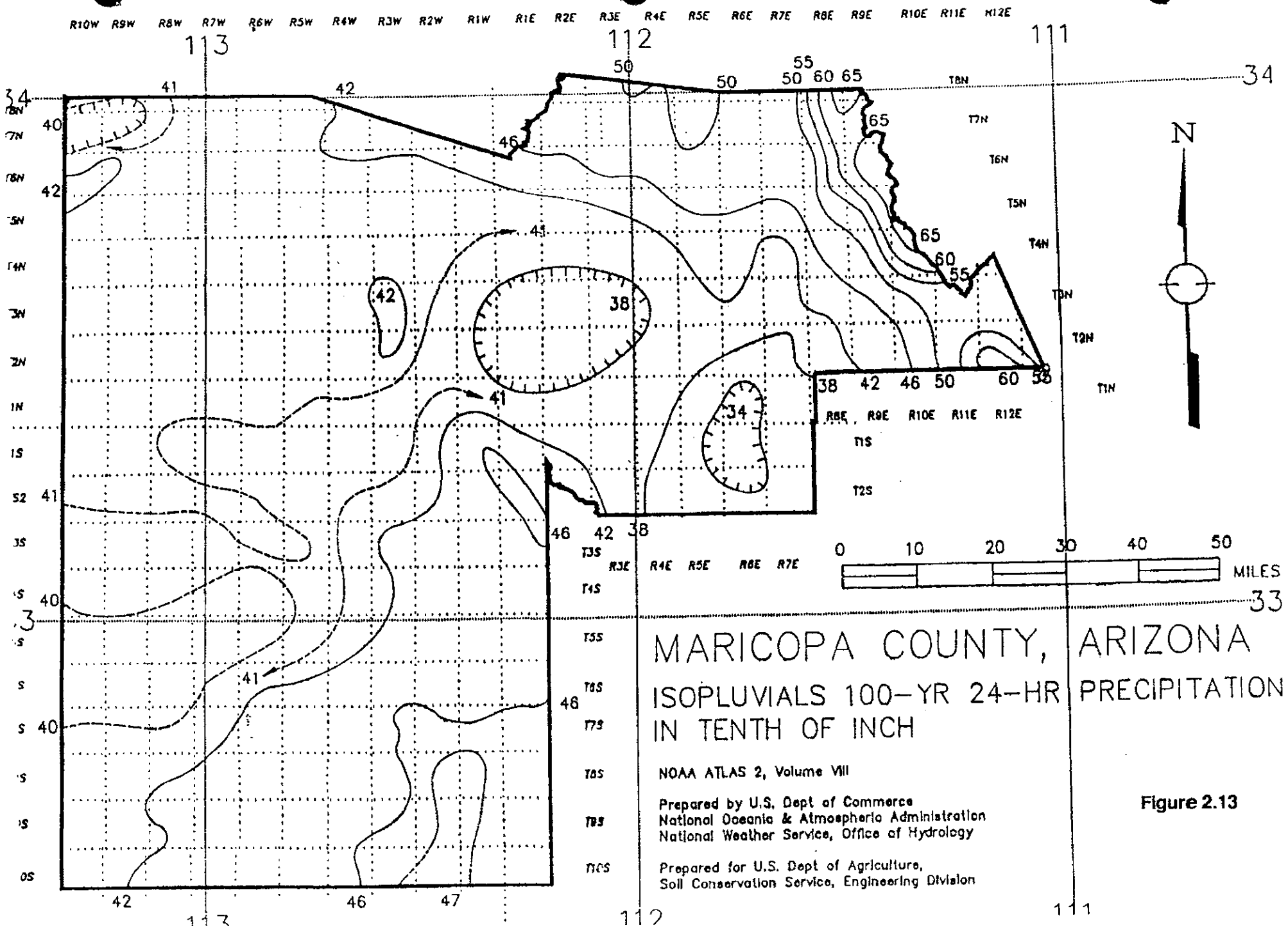

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 24-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
N
MILES
0 10 20 30 40 50
113
112
111
34
33

Figure 2.13

FCDMC
Drainage Design Management System
RAINFALL DATA
Project Reference: F4524

 4/26/2006

Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Rainfall Method: NOAA						
5 MIN	0.39	0.46	0.51	0.58	0.64	0.70
10 MIN	0.58	0.69	0.77	0.89	0.98	1.07
15 MIN	0.71	0.86	0.97	1.13	1.25	1.38
30 MIN	0.94	1.15	1.30	1.52	1.70	1.87
1 HOUR	1.14	1.42	1.62	1.90	2.12	2.33
2 HOUR	1.23	1.56	1.79	2.12	2.38	2.63
3 HOUR	1.29	1.66	1.91	2.27	2.55	2.83
6 HOUR	1.40	1.83	2.13	2.55	2.88	3.20
12 HOUR	1.50	2.04	2.41	2.91	3.31	3.70
24 HOUR	1.60	2.25	2.68	3.28	3.74	4.20

D.2 Physical Parameter Calculations

FCDMC
Drainage Design Management System
SOILS
Project Reference: F4524

Area ID	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
S400	645100	0.527	34.10	0.40	20.00	50
	645123	0.866	56.10	0.37	-	50
	64571	0.003	0.20	0.36	-	50
	645107	0.148	9.60	0.18	-	50
	64515	0.001	0.00	0.54	-	50
S410	645100	0.184	28.70	0.40	20.00	50
	645123	0.039	6.10	0.37	-	50
	64571	0.000	0.00	0.36	-	50
	645107	0.075	11.60	0.18	-	50
	64515	0.342	53.50	0.54	-	50
S500	645100	3.341	91.80	0.40	20.00	50
	64515	0.082	2.20	0.54	-	50
	64592	0.070	1.90	0.93	-	50
	64569	0.001	0.00	0.63	-	50
	64598	0.142	3.90	0.37	-	50
	645100	0.002	0.10	0.40	20.00	50

* Non default value

Soil ID	Book Number	XKSAT	% Rock Outcrop	Description	Type
645100	645	0.4	20	Quilotosa-Vaiva-Rock outcrop complex, 20 to 65 percent slopes	100
645123	645	0.37	0	Vaiva very gravelly loam, 1 to 20 percent slopes	123
64571	645	0.36	0	Gunsight-Rillito complex, low precipitation, 1 to 40 percent slopes	71
645107	645	0.18	0	Sal-Cipriano complex, low precipitation, 1 to 10 percent slopes	107
64515	645	0.54	0	Carrizo-Gunsight complex, 1 to 5 percent slopes	15
64592	645	0.93	0	Momoli-Carrizo complex, low precipitation	92
64569	645	0.63	0	Gunsight-Cipriano complex, low precipitation, 1 to 7 percent slopes	69
64598	645	0.37	0	Pinamt-Tremant complex, 1 to 10 percent slopes	98

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetable Cover (%)	DTHETA	Kn
Major Basin 01								
S400	930	1.544	100.0	0.25	0	30.0	DRY	0.05
		1.544	**100.0**					
S410	920	0.640	100.0	0.15	0	30.0	DRY	0.04
		0.640	**100.0**					
S500	930	3.638	100.0	0.25	0	30.0	DRY	0.05
		3.638	**100.0**					

Area ID	Area	Length	Slope	S-Graph	Lca	Lag	Velocity	Kn	IA	DTHETA	PSIF	XKSAT	RTIMP
	(sq.mi.)	(mi)	(ft/mi)		(mi)	(min)	(ft/s)		(in)		(in)	(in/hr)	(%)
S400	1.544	3.30	249.2	MOUNTAIN	1.75	49	3.5	0.050	0.25	0.35	4.20	0.43	3
S410	0.639	3.28	204.6	MOUNTAIN	1.70	40	4.3	0.040	0.15	0.35	3.85	0.43	3
S500	3.638	4.48	359.1	MOUNTAIN	3.39	66	3.6	0.050	0.25	0.35	3.92	0.41	9

D.3 Hydrologic Calculations

			24-hour					6-hour			
FAN	MODELID	AREA	Q100	TIMEPK100	VOL100	VOL100AF		Q100	TIMEPK100	VOL100	VOL100AF
		(sq.mi.)	(cfs)	(hrs)	(in)	(ac-ft)		(cfs)	(hrs)	(in)	(ac-ft)
Fan 4	S400	1.54	998	12.50	1.144	94		982	4.50	1.158	95
Fan 4	S410	0.64	492	12.33	1.200	41		594	4.50	1.405	48
Total at Fan 4	C410	2.18	1470	12.50	1.148	134		1339	4.50	1.113	130
Fan 5	S500	3.64	1981	12.83	1.340	260		1704	4.83	1.183	230

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   19SEP06  TIME  14:02:41  *
*                                      *
****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID    SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
  2           ID    JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
  3           ID    FILENAME: F4524.DAT
  4           ID
  5           ID    100-YEAR 24-HOUR MODEL
  6           ID    EXISTING CONDITIONS
  7           ID    Fan 4 WATERSHED AREA = 1.544 + 0.639 = 2.183 SQ. MILES
  8           ID    Fan 5 WATERSHED AREA = 3.638 SQ. MILES
  9           ID            MODELED AREA = 5.82 SQ. MILES
 10           ID
 11           ID    GREEN-AMPT LOSS METHOD
 12           ID    S-GRAPH UNIT HYDROGRAPHS
 13           ID      - MOUNTAIN
 14           ID    NORMAL-DEPTH CHANNEL ROUTING
 15           ID    LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
 16           ID      - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
 17           ID      - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
 18           ID      - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
 19           ID    SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
 20           ID        09/19/2006
 21           ID
 22           IT      10  1JAN99    1200    2000
 23           IN      15
 24           IO       3
              *DIAGRAM
              *
 25           JD   4.198  0.1000
 26           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 27           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 28           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 29           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 30           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 31           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 32           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 33           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 34           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 35           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 36           JD   3.990    10.0
              *

 37           KK    S400   BASIN
 38           KM        Compute runoff from subbasin 400 - to first split on Fan 4
 39           BA   1.544
 40           LG    0.25    0.35    4.20    0.43       3
 41           UI     207     339     673     935     999     633     518     413     307     246
 42           UI     194     138     117      81      66      52      45      20      21      20
 43           UI      20      20       0       0       0       0       0       0       0       0
              *

 44           KK    S410   BASIN
 45           KM        Compute runoff from subbasin 410 - total flow at Fan 4 apex
 46           BA   0.639
 47           LG    0.15    0.35    3.85    0.43       3
 48           UI      61     234     398     533     321     250     187     131     102      69
 49           UI      53      39      26      23      10      10      11      10       0       0
              *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  50          KK    C410 COMBINE
  51          HC       2
  52          KM        Combine runoff from S400 and S410
              *

  53          KK    S500   BASIN
  54          KM        Compute runoff from subbasin 500 - Fan 5 apex
  55          BA   3.638
  56          LG    0.25    0.35    3.92    0.41       9
  57          UI     185     349     825    1218    1497    2077    1357    1085     943     803
  58          UI     672     528     445     398     305     237     206     176     142     117
  59          UI      91      91      71      35      36      35      35      36      35      35
  60          UI       0       0       0       0       0       0       0       0       0       0
  61          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   37        S400
                .
                .
   44           .        S410
                .          .
                .          .
   50        C410............
                .
                .
   53           .        S500

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *            VERSION 4.1               *
 *                                      *
 *  RUN DATE   19SEP06  TIME  14:02:41  *
 *                                      *
 ****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
```

```
SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
FILENAME: F4524.DAT

100-YEAR 24-HOUR MODEL
EXISTING CONDITIONS
Fan 4 WATERSHED AREA = 1.544 + 0.639 = 2.183 SQ. MILES
Fan 5 WATERSHED AREA = 3.638 SQ. MILES
         MODELED AREA = 5.82 SQ. MILES

GREEN-AMPT LOSS METHOD
S-GRAPH UNIT HYDROGRAPHS
  - MOUNTAIN
NORMAL-DEPTH CHANNEL ROUTING
LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
  - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
  - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
  - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
    09/19/2006

 24 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

 23 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1JAN99  STARTING DATE
                     JXTIME        1200  STARTING TIME

    IT          HYDROGRAPH TIME DATA
                       NMIN          10  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN99  STARTING DATE
                      ITIME        1200  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     15JAN99  ENDING DATE
                     NDTIME        0910  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .17 HOURS
                      TOTAL TIME BASE  333.17 HOURS
```

```
ENGLISH UNITS
     DRAINAGE AREA          SQUARE MILES
     PRECIPITATION DEPTH    INCHES
     LENGTH, ELEVATION      FEET
     FLOW                   CUBIC FEET PER SECOND
     STORAGE VOLUME         ACRE-FEET
     SURFACE AREA           ACRES
     TEMPERATURE            DEGREES FAHRENHEIT

25 JD      INDEX STORM NO. 1
                STRM        4.20  PRECIPITATION DEPTH
                TRDA         .10  TRANSPOSITION DRAINAGE AREA

26 PI        PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .02       .02       .07
                .13       .18       .03       .02       .02       .02       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00
                .00       .00       .00       .00

36 JD      INDEX STORM NO. 2
                STRM        3.99  PRECIPITATION DEPTH
                TRDA       10.00  TRANSPOSITION DRAINAGE AREA

 0 PI        PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .02       .02       .07
                .13       .18       .03       .02       .02       .02       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00
                .00       .00       .00       .00

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
37 KK     *     S400   *        BASIN
          *            *
          **************
                         Compute runoff from subbasin 400 - to first split on Fan 4

            SUBBASIN RUNOFF DATA

39 BA        SUBBASIN CHARACTERISTICS
                TAREA        1.54  SUBBASIN AREA

40 LG        GREEN AND AMPT LOSS RATE
                STRTL         .25  STARTING LOSS
                  DTH         .35  MOISTURE DEFICIT
                 PSIF        4.20  WETTING FRONT SUCTION
                XKSAT         .43  HYDRAULIC CONDUCTIVITY
                RTIMP        3.00  PERCENT IMPERVIOUS AREA

38 UI        INPUT UNITGRAPH,  22 ORDINATES,  VOLUME = 1.00
                107.0     339.0     673.0     935.0     999.0     633.0     518.0     413.0     307.0     246.0
                194.0     138.0     117.0      81.0      66.0      52.0      45.0      20.0      21.0      20.0
                 20.0      20.0
                                                                    ***

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION     S400
                   TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.99, TOTAL EXCESS =    1.20

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                              (CFS)
+   1047.      12.50                193.         50.         17.          4.
                            (INCHES)      1.164       1.200       1.201       1.201
```

```
                    (AC-FT)        96.          99.          99.          99.

                    CUMULATIVE AREA =    1.54 SQ MI

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION     S400
                   TRANSPOSITION AREA     10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.88, TOTAL EXCESS =    1.11

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    333.17-HR
+  (CFS)        (HR)
                      (CFS)
+    965.      12.50                178.          46.          15.           3.
                   (INCHES)       1.070        1.105        1.105        1.105
                    (AC-FT)        88.          91.          91.          91.

                    CUMULATIVE AREA =    1.54 SQ MI

     ***            ***            ***            ***            ***


                    INTERPOLATED HYDROGRAPH AT     S400

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    333.17-HR
+  (CFS)        (HR)
                      (CFS)
+    998.      12.50                184.          47.          16.           3.
                   (INCHES)       1.108        1.143        1.144        1.144
                    (AC-FT)        91.          94.          94.          94.

                    CUMULATIVE AREA =    1.54 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  44 KK     *      S410  *        BASIN
            *            *
            **************
                                Compute runoff from subbasin 410 - total flow at Fan 4 apex

              SUBBASIN RUNOFF DATA

  46 BA         SUBBASIN CHARACTERISTICS
                      TAREA          .64  SUBBASIN AREA

  47 LG         GREEN AND AMPT LOSS RATE
                      STRTL          .15  STARTING LOSS
                        DTH          .35  MOISTURE DEFICIT
                       PSIF         3.85  WETTING FRONT SUCTION
                      XKSAT          .43  HYDRAULIC CONDUCTIVITY
                      RTIMP         3.00  PERCENT IMPERVIOUS AREA

  45 UI         INPUT UNITGRAPH,  18 ORDINATES,  VOLUME = 1.00
                     61.0      234.0      398.0      533.0      321.0      250.0      187.0      131.0      102.0       69.0
                     53.0       39.0       26.0       23.0       10.0       10.0       11.0       10.0
                                                                                  ***

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION     S410
                   TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.96, TOTAL EXCESS =    1.24

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    333.17-HR
+  (CFS)        (HR)
                      (CFS)
+    507.      12.33                 83.          21.           7.           2.
                   (INCHES)       1.201        1.237        1.238        1.238
                    (AC-FT)        41.          42.          42.          42.

                    CUMULATIVE AREA =     .64 SQ MI

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION     S410
                   TRANSPOSITION AREA     10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.84, TOTAL EXCESS =    1.15

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
```

```
                                        6-HR        24-HR        72-HR    333.17-HR
+   (CFS)        (HR)
                                  (CFS)
+    469.      12.33                 76.          20.           7.           1.
                              (INCHES)      1.110        1.144        1.145        1.145
                               (AC-FT)        38.          39.          39.          39.

                              CUMULATIVE AREA =     .64 SQ MI

      ***             ***             ***             ***             ***


                              INTERPOLATED HYDROGRAPH AT     S410

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    333.17-HR
+   (CFS)        (HR)
                                  (CFS)
+    492.      12.33                 80.          21.           7.           1.
                              (INCHES)      1.164        1.200        1.200        1.200
                               (AC-FT)        40.          41.          41.          41.

                              CUMULATIVE AREA =     .64 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  50 KK     *     C410   *      COMBINE
            *            *
            **************
                                   Combine runoff from S400 and S410

  51 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

      ***             ***             ***             ***             ***

                              HYDROGRAPH AT STATION     C410
                             TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    333.17-HR
+   (CFS)        (HR)
                                  (CFS)
+   1549.      12.50                276.          71.          24.           5.
                              (INCHES)      1.174        1.211        1.211        1.211
                               (AC-FT)       137.         141.         141.         141.

                              CUMULATIVE AREA =    2.18 SQ MI

      ***             ***             ***             ***             ***

                              HYDROGRAPH AT STATION     C410
                             TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    333.17-HR
+   (CFS)        (HR)
                                  (CFS)
+   1431.      12.50                254.          66.          22.           5.
                              (INCHES)      1.082        1.116        1.117        1.117
                               (AC-FT)       126.         130.         130.         130.

                              CUMULATIVE AREA =    2.18 SQ MI

      ***             ***             ***             ***             ***


                              INTERPOLATED HYDROGRAPH AT     C410

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    333.17-HR
+   (CFS)        (HR)
                                  (CFS)
+   1470.      12.50                261.          67.          22.           5.
                              (INCHES)      1.113        1.148        1.148        1.148
                               (AC-FT)       130.         134.         134.         134.

                              CUMULATIVE AREA =    2.18 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
  53 KK       *     S500   *        BASIN
              *            *
              **************
                                Compute runoff from subbasin 500 - Fan 5 apex

                 SUBBASIN RUNOFF DATA

  55 BA            SUBBASIN CHARACTERISTICS
                        TAREA        3.64  SUBBASIN AREA

  56 LG            GREEN AND AMPT LOSS RATE
                        STRTL         .25  STARTING LOSS
                          DTH         .35  MOISTURE DEFICIT
                         PSIF        3.92  WETTING FRONT SUCTION
                        XKSAT         .41  HYDRAULIC CONDUCTIVITY
                        RTIMP        9.00  PERCENT IMPERVIOUS AREA

  54 UI            INPUT UNITGRAPH,  30 ORDINATES,  VOLUME = 1.00
                       185.0     349.0     825.0    1218.0    1497.0    2077.0    1357.0    1085.0     943.0     803.0
                       672.0     528.0     445.0     398.0     305.0     237.0     206.0     176.0     142.0     117.0
                        91.0      91.0      71.0      35.0      36.0      35.0      35.0      36.0      35.0      35.0

                                                                                  ***

     ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S500
                      TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.78, TOTAL EXCESS =    1.42

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+   2097.      12.83                 511.        139.         46.          10.
                        (INCHES)    1.306       1.417       1.419        1.419
                         (AC-FT)     253.        275.        275.         275.

                      CUMULATIVE AREA =    3.64 SQ MI

     ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S500
                      TRANSPOSITION AREA     10.0 SQ MI

    TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.67, TOTAL EXCESS =    1.32

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+   1948.      12.83                 473.        129.         43.           9.
                        (INCHES)    1.210       1.316       1.318        1.318
                         (AC-FT)     235.        255.        256.         256.

                      CUMULATIVE AREA =    3.64 SQ MI

     ***             ***             ***             ***             ***


                      INTERPOLATED HYDROGRAPH AT     S500

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+   1981.      12.83                 482.        131.         44.           9.
                        (INCHES)    1.231       1.338       1.340        1.340
                         (AC-FT)     239.        260.        260.         260.

                      CUMULATIVE AREA =    3.64 SQ MI

1
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                       TIME IN HOURS,  AREA IN SQUARE MILES

                                                PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION        STATION              FLOW    PEAK                                           AREA      STAGE       MAX STAGE
+                                                                     6-HOUR      24-HOUR     72-HOUR

          HYDROGRAPH AT
+                           S400                998.   12.50          184.         47.         16.       1.54

          HYDROGRAPH AT
+                           S410                492.   12.33           80.         21.          7.        .64

          2 COMBINED AT
+                           C410               1470.   12.50          261.         67.         22.       2.18
```

```
          HYDROGRAPH AT
+                         S500      1981.   12.83        482.        131.        44.       3.64

 *** NORMAL END OF HEC-1 ***
```

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN  1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   19SEP06  TIME  14:02:50  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                    HEC-1 INPUT                                                    PAGE  1

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    1           ID    SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
    2           ID    JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
    3           ID    FILENAME: F456.DAT
    4           ID
    5           ID    100-YEAR 6-HOUR MODEL
    6           ID    EXISTING CONDITIONS
    7           ID    Fan 4 WATERSHED AREA = 1.544 + 0.639 = 2.183 SQ. MILES
    8           ID    Fan 5 WATERSHED AREA = 3.638 SQ. MILES
    9           ID             MODELED AREA = 5.82 SQ. MILES
   10           ID
   11           ID    GREEN-AMPT LOSS METHOD
   12           ID    S-GRAPH UNIT HYDROGRAPHS
   13           ID      - MOUNTAIN
   14           ID    NORMAL-DEPTH CHANNEL ROUTING
   15           ID    LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
   16           ID      - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
   17           ID      - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
   18           ID      - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
   19           ID    SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
   20           ID        09/19/2006
   21           ID
   22           IT      10  1JAN99    1200    2000
   23           IN      15
   24           IO       3
                *DIAGRAM
                *
   25           JD   3.196  0.1000
   26           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   27           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   28           PC   0.962   0.972   0.983   0.991   1.000
   29           JD   3.181  0.5000
   30           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   31           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   32           PC   0.962   0.972   0.983   0.991   1.000
   33           JD   3.120     2.8
   34           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.068   0.077
   35           PC   0.088   0.101   0.121   0.164   0.253   0.451   0.694   0.836   0.900   0.938
   36           PC   0.950   0.963   0.975   0.988   1.000
   37           JD   2.950    16.0
   38           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
   39           PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
   40           PC   0.946   0.960   0.973   0.987   1.000
                *

   41           KK    S400   BASIN
   42           KM        Compute runoff from subbasin 400 - to first split on Fan 4
   43           BA   1.544
   44           LG    0.25    0.35    4.20    0.43       3
   45           UI     107     339     673     935     999     633     518     413     307     246
   46           UI     194     138     117      81      66      52      45      20      21      20
   47           UI      20      20       0       0       0       0       0       0       0       0
                *
1                                    HEC-1 INPUT                                                    PAGE  2

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
48          KK    S410   BASIN
49          KM        Compute runoff from subbasin 410 - total flow at Fan 4 apex
50          BA   0.639
51          LG    0.15    0.35    3.85    0.43       3
52          UI      61     234     398     533     321     250     187     131     102      69
53          UI      53      39      26      23      10      10      11      10       0       0
            *

54          KK    C410 COMBINE
55          HC       2
56          KM        Combine runoff from S400 and S410
            *

57          KK    S500   BASIN
58          KM        Compute runoff from subbasin 500 - Fan 5 apex
59          BA   3.638
60          LG    0.25    0.35    3.92    0.41       9
61          UI     185     349     825    1218    1497    2077    1357    1085     943     803
62          UI     672     528     445     398     305     237     206     176     142     117
63          UI      91      91      71      35      36      35      35      36      35      35
64          UI       0       0       0       0       0       0       0       0       0       0
65          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    41        S400
                .
                .
    48          .        S410
                .           .
                .           .
    54        C410............
                .
                .
    57          .        S500

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   19SEP06  TIME  14:02:50  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************
```

```
SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
FILENAME: F456.DAT

100-YEAR 6-HOUR MODEL
EXISTING CONDITIONS
Fan 4 WATERSHED AREA = 1.544 + 0.639 = 2.183 SQ. MILES
Fan 5 WATERSHED AREA = 3.638 SQ. MILES
         MODELED AREA = 5.82 SQ. MILES

GREEN-AMPT LOSS METHOD
S-GRAPH UNIT HYDROGRAPHS
  - MOUNTAIN
NORMAL-DEPTH CHANNEL ROUTING
LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
  - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
  - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
  - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
    09/19/2006


 24 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           3  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

 23 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1JAN99  STARTING DATE
                     JXTIME        1200  STARTING TIME

    IT          HYDROGRAPH TIME DATA
                       NMIN          10  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN99  STARTING DATE
                      ITIME        1200  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     15JAN99  ENDING DATE
                     NDTIME        0910  ENDING TIME
                      ICENT          19  CENTURY MARK
```

```
                COMPUTATION INTERVAL     .17 HOURS
                     TOTAL TIME BASE  333.17 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

  25 JD          INDEX STORM NO. 1
                       STRM        3.20  PRECIPITATION DEPTH
                       TRDA         .10  TRANSPOSITION DRAINAGE AREA

  26 PI            PRECIPITATION PATTERN
                      .01       .01       .01       .01       .01       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .01       .03
                      .05       .11       .21       .30       .05       .03       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01

  29 JD          INDEX STORM NO. 2
                       STRM        3.18  PRECIPITATION DEPTH
                       TRDA         .50  TRANSPOSITION DRAINAGE AREA

  30 PI            PRECIPITATION PATTERN
                      .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .01       .01       .03
                      .05       .11       .21       .30       .05       .03       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01

  33 JD          INDEX STORM NO. 3
                       STRM        3.12  PRECIPITATION DEPTH
                       TRDA        2.80  TRANSPOSITION DRAINAGE AREA

  34 PI            PRECIPITATION PATTERN
                      .01       .01       .00       .01       .01       .01       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .01       .03       .04
                      .06       .13       .15       .16       .09       .07       .04       .03       .02       .01
                      .01       .01       .01       .01       .01       .01

  37 JD          INDEX STORM NO. 4
                       STRM        2.95  PRECIPITATION DEPTH
                       TRDA       16.00  TRANSPOSITION DRAINAGE AREA

  38 PI            PRECIPITATION PATTERN
                      .01       .01       .00       .01       .01       .01       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .02       .03       .04
                      .05       .11       .12       .13       .08       .07       .05       .03       .03       .02
                      .01       .01       .01       .01       .01       .01

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
  41 KK   *     S400   *        BASIN
          *            *
          **************
                          Compute runoff from subbasin 400 - to first split on Fan 4

             SUBBASIN RUNOFF DATA

  43 BA          SUBBASIN CHARACTERISTICS
                      TAREA        1.54  SUBBASIN AREA

  44 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .25  STARTING LOSS
                        DTH         .35  MOISTURE DEFICIT
                       PSIF        4.20  WETTING FRONT SUCTION
                      XKSAT         .43  HYDRAULIC CONDUCTIVITY
                      RTIMP        3.00  PERCENT IMPERVIOUS AREA

  42 UI          INPUT UNITGRAPH,  22 ORDINATES,  VOLUME = 1.00
                     107.0     339.0     673.0     935.0     999.0     633.0     518.0     413.0     307.0     246.0
                     194.0     138.0     117.0      81.0      66.0      52.0      45.0      20.0      21.0      20.0
                      20.0      20.0
                                                                  ***

     ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     S400
                      TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.80, TOTAL EXCESS =    1.39

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
```

```
+    1279.      4.50                    230.         58.         19.          4.
                          (INCHES)     1.387       1.390       1.390       1.390
                           (AC-FT)      114.        114.        114.        114.

                          CUMULATIVE AREA =    1.54 SQ MI


      ***              ***             ***             ***             ***

                          HYDROGRAPH AT STATION     S400
                         TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.80, TOTAL EXCESS =    1.38

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    333.17-HR
+   (CFS)        (HR)
                            (CFS)
+    1269.      4.50                    228.         57.         19.          4.
                          (INCHES)     1.375       1.378       1.378       1.378
                           (AC-FT)      113.        113.        113.        113.

                          CUMULATIVE AREA =    1.54 SQ MI


      ***              ***             ***             ***             ***

                          HYDROGRAPH AT STATION     S400
                         TRANSPOSITION AREA      2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.08, TOTAL EXCESS =    1.04

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    333.17-HR
+   (CFS)        (HR)
                            (CFS)
+     831.      4.50                    173.         43.         14.          3.
                          (INCHES)     1.039       1.042       1.042       1.042
                           (AC-FT)       86.         86.         86.         86.

                          CUMULATIVE AREA =    1.54 SQ MI


      ***              ***             ***             ***             ***

                          HYDROGRAPH AT STATION     S400
                         TRANSPOSITION AREA     16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.22, TOTAL EXCESS =     .73

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    333.17-HR
+   (CFS)        (HR)
                            (CFS)
+     567.      4.50                    121.         30.         10.          2.
                          (INCHES)      .729        .733        .733        .733
                           (AC-FT)       60.         60.         60.         60.

                          CUMULATIVE AREA =    1.54 SQ MI

      ***              ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT     S400

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    333.17-HR
+   (CFS)        (HR)
                            (CFS)
+     982.      4.50                    192.         48.         16.          3.
                          (INCHES)     1.155       1.158       1.158       1.158
                           (AC-FT)       95.         95.         95.         95.

                          CUMULATIVE AREA =    1.54 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  48 KK     *     S410   *        BASIN
            *            *
            **************
                                Compute runoff from subbasin 410 - total flow at Fan 4 apex

               SUBBASIN RUNOFF DATA

  50 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .64  SUBBASIN AREA

  51 LG          GREEN AND AMPT LOSS RATE
```

```
                    STRTL        .15  STARTING LOSS
                      DTH        .35  MOISTURE DEFICIT
                     PSIF       3.85  WETTING FRONT SUCTION
                    XKSAT        .43  HYDRAULIC CONDUCTIVITY
                    RTIMP       3.00  PERCENT IMPERVIOUS AREA

 49 UI          INPUT UNITGRAPH,  18 ORDINATES,  VOLUME = 1.00
                    61.0     234.0     398.0     533.0     321.0     250.0     187.0     131.0     102.0      69.0
                    53.0      39.0      26.0      23.0      10.0      10.0      11.0      10.0
                                                                        ***

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION     S410
                    TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =   3.20, TOTAL LOSS =   1.73, TOTAL EXCESS =   1.47

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+     628.      4.50                101.         25.          8.          2.
                        (INCHES)    1.463       1.465       1.465       1.465
                         (AC-FT)     50.         50.         50.         50.

                      CUMULATIVE AREA =     .64 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION     S410
                    TRANSPOSITION AREA        .5 SQ MI

   TOTAL RAINFALL =   3.18, TOTAL LOSS =   1.72, TOTAL EXCESS =   1.46

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+     624.      4.50                100.         25.          8.          2.
                        (INCHES)    1.452       1.453       1.453       1.453
                         (AC-FT)     49.         50.         50.         50.

                      CUMULATIVE AREA =     .64 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION     S410
                    TRANSPOSITION AREA      2.8 SQ MI

   TOTAL RAINFALL =   3.12, TOTAL LOSS =   2.00, TOTAL EXCESS =   1.12

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+     414.      4.50                 77.         19.          6.          1.
                        (INCHES)    1.115       1.117       1.117       1.117
                         (AC-FT)     38.         38.         38.         38.

                      CUMULATIVE AREA =     .64 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION     S410
                    TRANSPOSITION AREA     16.0 SQ MI

   TOTAL RAINFALL =   2.95, TOTAL LOSS =   2.14, TOTAL EXCESS =    .81

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+     289.      4.50                 55.         14.          5.          1.
                        (INCHES)     .804        .807        .807        .807
                         (AC-FT)     27.         27.         27.         27.

                      CUMULATIVE AREA =     .64 SQ MI

     ***            ***            ***            ***            ***


                    INTERPOLATED HYDROGRAPH AT      S410

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                          (CFS)
+     594.      4.50                 96.         24.          8.          2.
                        (INCHES)    1.404       1.405       1.405       1.405
```

```
                    (AC-FT)        48.          48.          48.          48.

                    CUMULATIVE AREA =      .64 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
  54 KK   *      C410  *      COMBINE
          *            *
          **************
                              Combine runoff from S400 and S410

  55 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     C410
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                         (CFS)
+    1907.      4.50                331.         83.         28.           6.
                       (INCHES)    1.409       1.412       1.412        1.412
                        (AC-FT)    164.        164.        164.         164.

                       CUMULATIVE AREA =    2.18 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     C410
                     TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                         (CFS)
+    1892.      4.50                328.         82.         27.           6.
                       (INCHES)    1.397       1.400       1.400        1.400
                        (AC-FT)    163.        163.        163.         163.

                       CUMULATIVE AREA =    2.18 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     C410
                     TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                         (CFS)
+    1245.      4.50                249.         62.         21.           5.
                       (INCHES)    1.061       1.064       1.064        1.064
                        (AC-FT)    124.        124.        124.         124.

                       CUMULATIVE AREA =    2.18 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     C410
                     TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                         (CFS)
+     856.      4.50                176.         44.         15.           3.
                       (INCHES)     .751        .755        .755         .755
                        (AC-FT)     87.         88.         88.          88.

                       CUMULATIVE AREA =    2.18 SQ MI

     ***             ***             ***             ***             ***


                       INTERPOLATED HYDROGRAPH AT     C410

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    333.17-HR
+   (CFS)       (HR)
                         (CFS)
```

```
+    1339.      4.50                 261.        65.        22.         5.
                        (INCHES)    1.110      1.113      1.113      1.113
                        (AC-FT)      129.       130.       130.       130.

                        CUMULATIVE AREA =    2.18 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
   57 KK    *     S500   *        BASIN
            *            *
            **************
                            Compute runoff from subbasin 500 - Fan 5 apex

              SUBBASIN RUNOFF DATA

   59 BA        SUBBASIN CHARACTERISTICS
                      TAREA         3.64  SUBBASIN AREA

   60 LG        GREEN AND AMPT LOSS RATE
                      STRTL          .25  STARTING LOSS
                        DTH          .35  MOISTURE DEFICIT
                       PSIF         3.92  WETTING FRONT SUCTION
                      XKSAT          .41  HYDRAULIC CONDUCTIVITY
                      RTIMP         9.00  PERCENT IMPERVIOUS AREA

   58 UI        INPUT UNITGRAPH,  30 ORDINATES,  VOLUME = 1.00
                   185.0     349.0     825.0    1218.0    1497.0    2077.0    1357.0    1085.0     943.0     803.0
                   672.0     528.0     445.0     398.0     305.0     237.0     206.0     176.0     142.0     117.0
                    91.0      91.0      71.0      35.0      36.0      35.0      35.0      36.0      35.0      35.0

                                                                         ***

      ***          ***          ***          ***          ***

                         HYDROGRAPH AT STATION      S500
                        TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.64, TOTAL EXCESS =    1.55

   PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR      72-HR    333.17-HR
+    (CFS)        (HR)
                         (CFS)
+    2589.        4.83               601.       152.        51.        11.
                        (INCHES)    1.536      1.552      1.552      1.552
                        (AC-FT)      298.       301.       301.       301.

                        CUMULATIVE AREA =    3.64 SQ MI


      ***          ***          ***          ***          ***

                         HYDROGRAPH AT STATION      S500
                        TRANSPOSITION AREA       .5 SQ MI

     TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.64, TOTAL EXCESS =    1.54

   PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR      72-HR    333.17-HR
+    (CFS)        (HR)
                         (CFS)
+    2570.        4.83               596.       151.        50.        11.
                        (INCHES)    1.524      1.541      1.541      1.541
                        (AC-FT)      296.       299.       299.       299.

                        CUMULATIVE AREA =    3.64 SQ MI


      ***          ***          ***          ***          ***

                         HYDROGRAPH AT STATION      S500
                        TRANSPOSITION AREA      2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.89, TOTAL EXCESS =    1.23

   PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR      72-HR    333.17-HR
+    (CFS)        (HR)
                         (CFS)
+    1779.        4.83               474.       120.        40.         9.
                        (INCHES)    1.211      1.228      1.228      1.228
                        (AC-FT)      235.       238.       238.       238.

                        CUMULATIVE AREA =    3.64 SQ MI


      ***          ***          ***          ***          ***

                         HYDROGRAPH AT STATION      S500
```

TRANSPOSITION AREA 16.0 SQ MI

TOTAL RAINFALL = 2.95, TOTAL LOSS = 2.02, TOTAL EXCESS = .93

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	333.17-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1283.	4.83		356.	91.	30.	7.
		(INCHES)	.910	.932	.932	.932
		(AC-FT)	177.	181.	181.	181.

CUMULATIVE AREA = 3.64 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT S500

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	333.17-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1704.	4.83		456.	116.	39.	8.
		(INCHES)	1.165	1.183	1.183	1.183
		(AC-FT)	226.	230.	230.	230.

CUMULATIVE AREA = 3.64 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	S400	982.	4.50	192.	48.	16.	1.54		
+	HYDROGRAPH AT	S410	594.	4.50	96.	24.	8.	.64		
+	2 COMBINED AT	C410	1339.	4.50	261.	65.	22.	2.18		
+	HYDROGRAPH AT	S500	1704.	4.83	456.	116.	39.	3.64		

*** NORMAL END OF HEC-1 ***

Appendix E

Hydraulic Analysis Supporting Documentation

E.1: Roughness Coefficient Determination

E.2: Cross Section Plots

E.3: Detailed HEC-RAS Output

E.1 Roughness Coefficient Estimation

PREFACE

The following report describes the evaluation of Manning's roughness coefficients for this floodplain delineation study.

FLOODPLAIN DELINEATION STUDY
of
Fan Apex Containment Reaches – Fans 1, 2, 3, 4, 5, 10, 11, 13E, 13W, 17, 18, & 19
SUN VALLEY AREA DRAINAGE MASTER PLAN

Reconnaissance Report
Appendix E, Part 7, Volume 4

FCD 2004CO049

For
Flood Control District of Maricopa County
2801 W Durango St
Phoenix, AZ 85009

By
JE Fuller Hydrology & Geomorphology, Inc.
8400 S Kyrene Road Suite 201
Tempe, Arizona 85284
480-752-2124

September, 2005, Revised August, 2006

1. Introduction

JE Fuller/Hydrology & Geomorphology, Inc., (JEF), performed field reconnaissance along 12 selected water courses studies during the months of August and September 2005. The reconnaissance was performed to document channel and overbank conditions for the purpose of determining Manning's Roughness Coefficient for the selected 12 water courses throughout the study area.

2. Manning's "n" Values

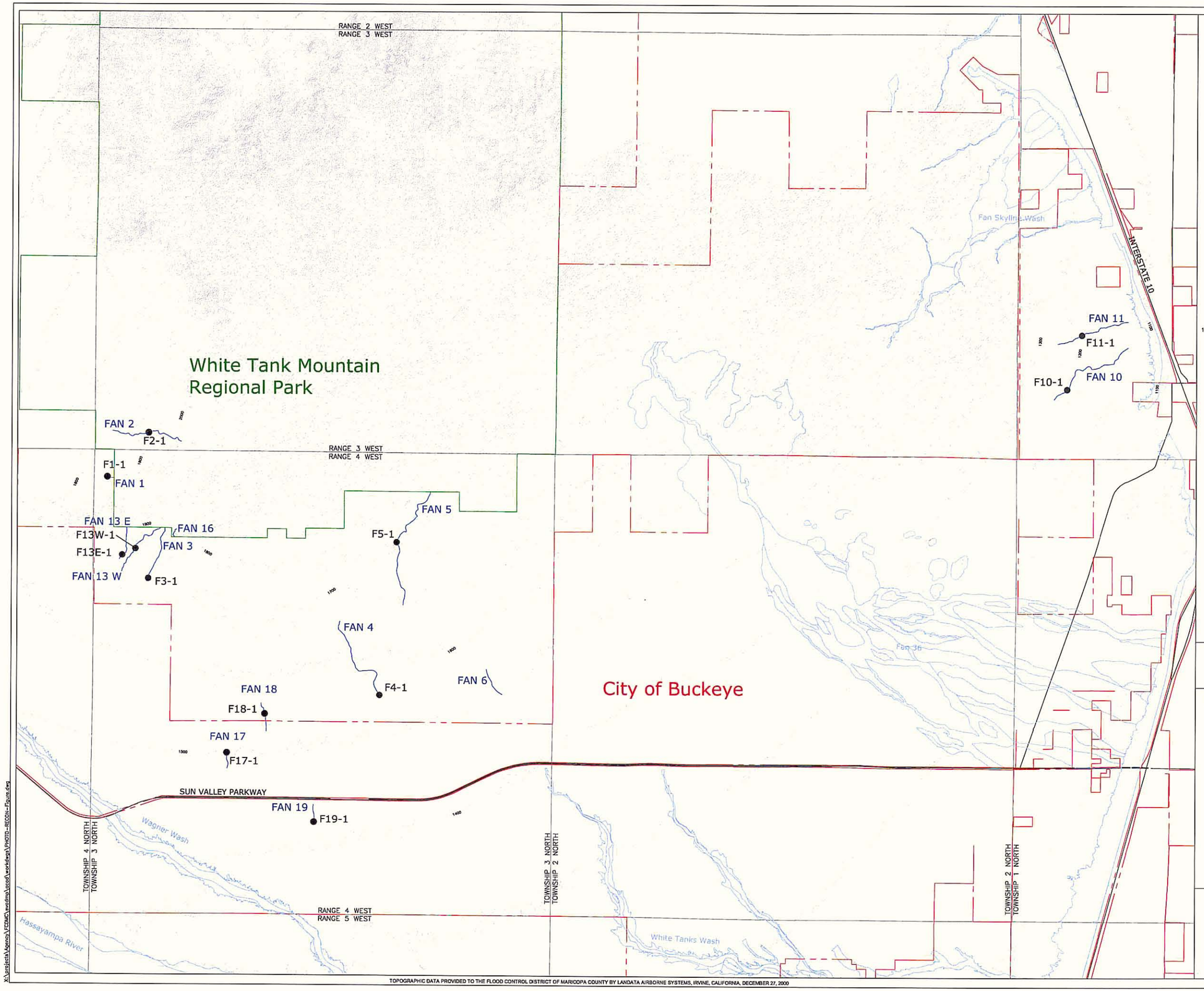
Manning's "n" values were determined using the methodology outlined in the USGS report titled, "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" by B.W. Thomsen and H.W. Hjalmarson, (April, 1991). Reach designations were assigned based on distinctions in general channel morphology, vegetation, and channel and overbank soil characteristics.

This floodplain delineation study has 12 selected water courses. The table below identifies each water courses name and the approximate study reach mileage.

Table 1

Name	Study Mileage	Name	Study Mileage
FAN 1	0.1	FAN 11	1.0
FAN 2	1.0	FAN 13W	0.9
FAN 3	0.8	FAN 13E	0.5
FAN 4	1.3	FAN 17	0.2
FAN 5	1.8	FAN 18	0.4
FAN 10	1.4	FAN 19	0.2

On the following pages, photographs showing typical reach conditions are preceded by the worksheet used to determine the reach-average Manning's "n" values for the reach depicted in the photographs. Figure 1 illustrates the field reconnaissance photo locations as well as the study reaches. References to left bank and right bank associated with a downstream viewing orientation.



TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000

A:\projects\Vegas\FCDMC\exodus\ecod\workdwgs\PHOTO--RECON--Figure.dwg

LEGEND

PHOTOGRAPHY LOCATION

FAN APEX CONTAINMENT REACH

N

NOTES

1. PHOTOGRAPHY WAS TAKEN IN THE FOLLOWING ORDER AT EACH LOCATION: UPSTREAM, DOWNSTREAM, LEFT BANK, RIGHT BANK

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOODPLAIN DELINEATION STUDY OF
FAN APEX CONTAINMENT REACHES
FANS 1, 2, 3, 4, 5, 10, 11, 13E, 13W,
17, 18, AND 19

FIGURE 1:
PHOTO LOCATIONS

FCD 2004CO49

SUN VALLEY
AREA DRAINAGE MASTER PLAN
AUGUST, 2006

SCALE IN FEET

3000' 0' 3000' 6000'

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

SHEET 1 OF 1

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 1
Location: F1-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	0.026
	Gravel		0.028-0.035	0.03		
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.005	0.008
	Medium		0.010-0.025	0.01		
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.062	0.043	0.056
			Use	**0.06**	**0.04**	**0.055**

Location: F1-1

Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 2
Location: F2-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.03		0.03
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.002	
	Medium		0.010-0.025	0.015		0.01
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.067	0.04	0.062
			Use	**0.07**	**0.04**	**0.06**

Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 3
Location: F3-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.002	
	Medium		0.010-0.025			0.01
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.058	0.04	0.06
			Use	**0.06**	**0.04**	**0.06**

Location: F3-1

Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 4
Location: F4-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.026		0.026
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.002	.008
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.056	0.04	0.056
			Use	**0.055**	**0.04**	**0.055**

Locati F4-1

Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 5
Location: F5-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035			
	Gravel		0.028-0.035		0.03	
	Cobble		0.030-0.050	0.030		.030
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015			
	Appreciable		0.020-0.030	0.02	0.02	0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.002	
	Medium		0.010-0.025	0.015		0.015
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.067	0.054	0.067
			Use	**0.065**	**0.055**	**0.065**

Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 10
Location: F10-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015	0.015	0.005	0.015
	Appreciable		0.020-0.030			
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.002	
	Medium		0.010-0.025	0.010		0.010
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.055	0.035	0.055
			Use	**0.055**	**0.035**	**0.055**

Looking upstream

Looking downstream

Left bank

Right bank

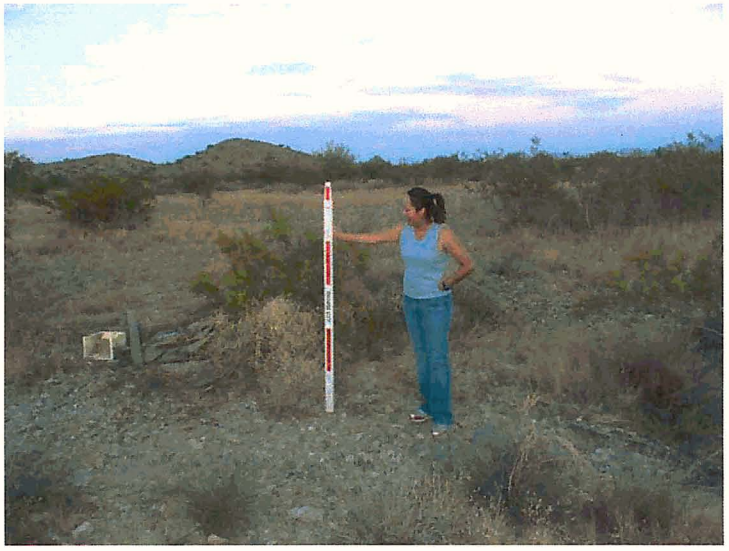
DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 11
Location: F11-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035			
	Gravel		0.028-0.035	0.028	0.028	0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015			
	Appreciable		0.020-0.030	0.015	0.015	0.015
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.007	0.007	0.007
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	*Gradual*	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.052	0.052	0.052
			Use	**0.05**	**0.05**	**0.05**

Looking upstream

Looking downstream



Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 13E
Location: F13E-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.015		0.015
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.005	
	Medium		0.010-0.025			0.01
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.053	0.043	0.053
			Use	**0.055**	**0.04**	**0.055**

Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 13W
Location: F13W-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.002	.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	*Gradual*	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.058	0.045	0.059
			Use	**0.06**	**0.045**	**0.06**

Location: F13W-1

Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 17
Location: F17-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032	0.028		0.028
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035			
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.009	0.002	0.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.059	0.045	0.059
			Use	**0.06**	**0.045**	**0.06**

Location: F17-1

Looking Upstream at Channel and Left Bank

Looking Downstream at Channel and Right Bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 18
Location: F18-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032	0.028		0.028
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035			
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.009	0.007	0.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.059	0.05	0.059
			Use	**0.06**	**0.05**	**0.06**

Location: F18-1

Looking Upstream at Channel and Banks

Looking Downstream at Channel and Banks

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 19
Location: F19-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032	0.028		0.028
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035			
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.009	0.002	0.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.059	0.045	0.059
			Use	**0.06**	**0.045**	**0.06**

Location: F19-1

Looking Upstream at Channel and Banks

Looking Downstream at Channel and Banks

3. Significant Hydraulic Structures

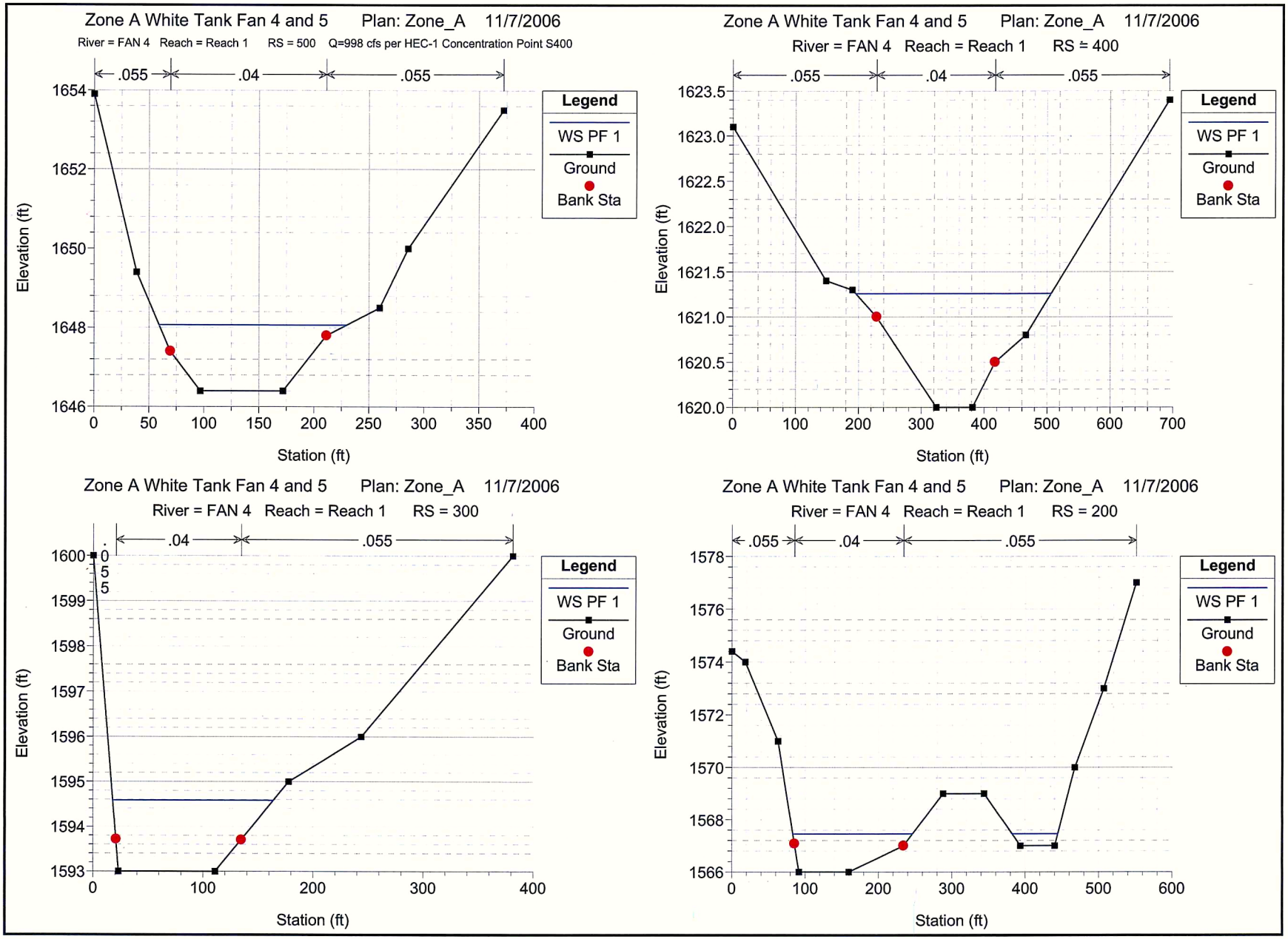
All 12 study areas were free of hydraulic structures.

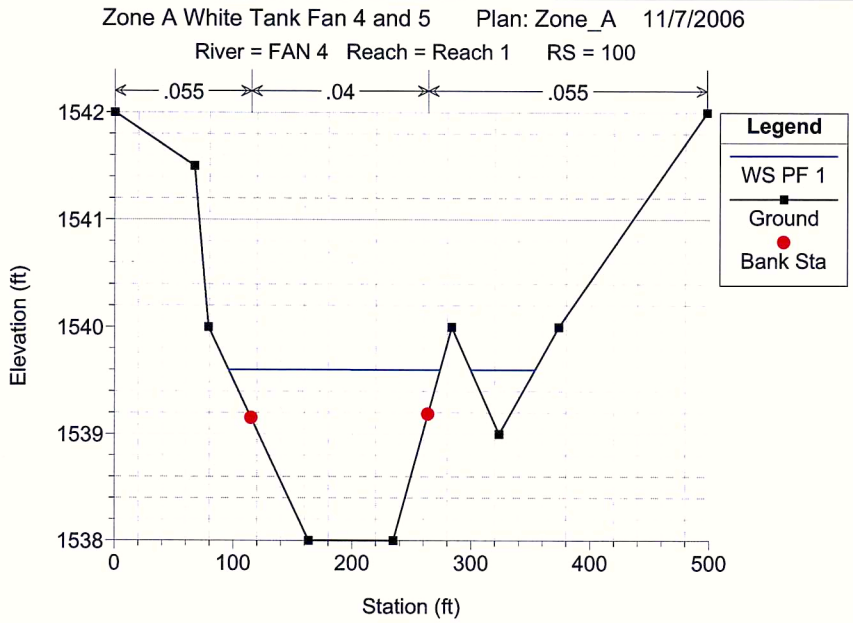
4. *General Floodplain Conditions*

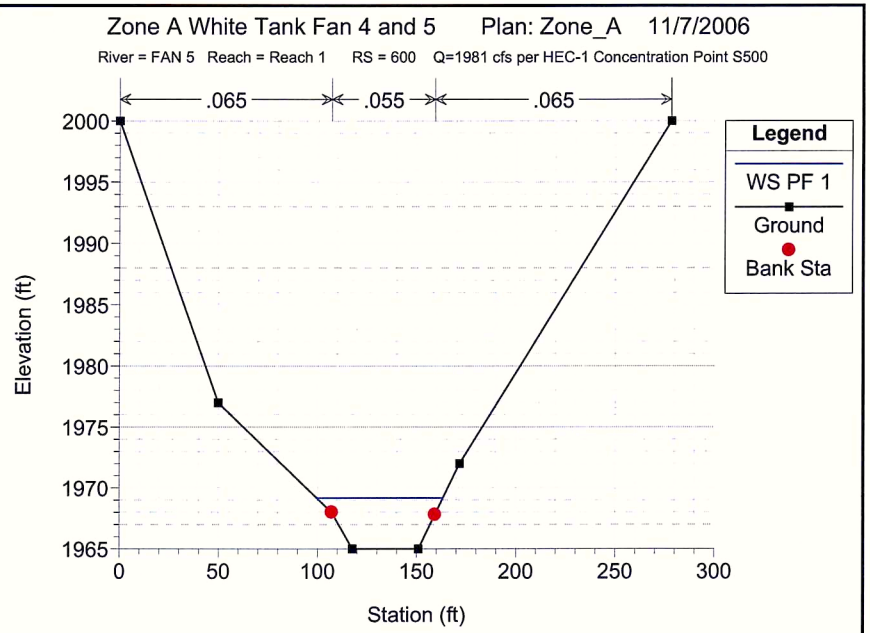
The study areas generally consist of gravelly to cobbly channel bottoms in the main channels to small cobbles and coarse sands in the overbank areas. Main channels are moderately well defined.

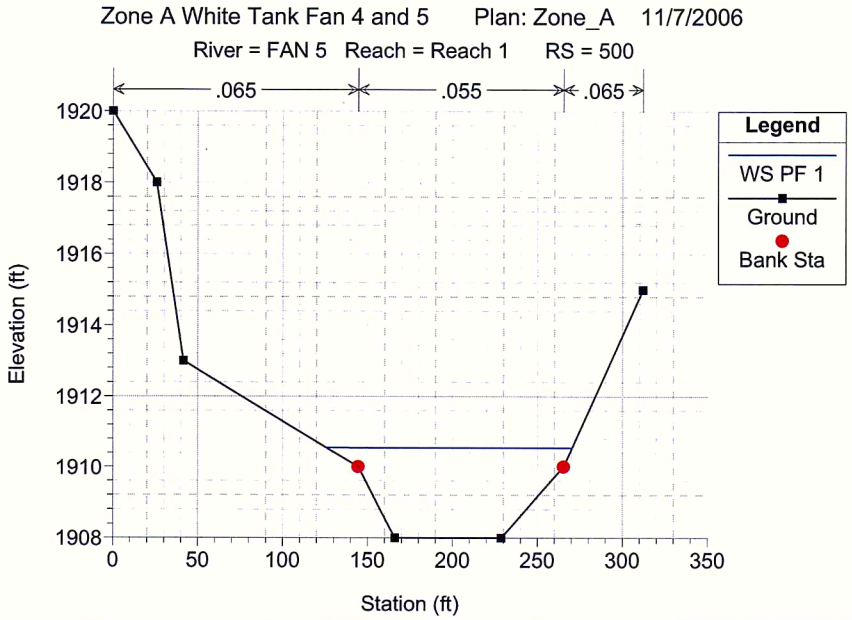
In general, the study area is covered by the Upper Sonoran plant community. Vegetation throughout the study reaches include trees such as mesquite, little leaf palo verde, creosote and ocotillo, cacti including saguaro, barrel, staghorn, and teddy bear cholla, and various shrubs such as desert broom, jojoba, brittle bush and hackberry.

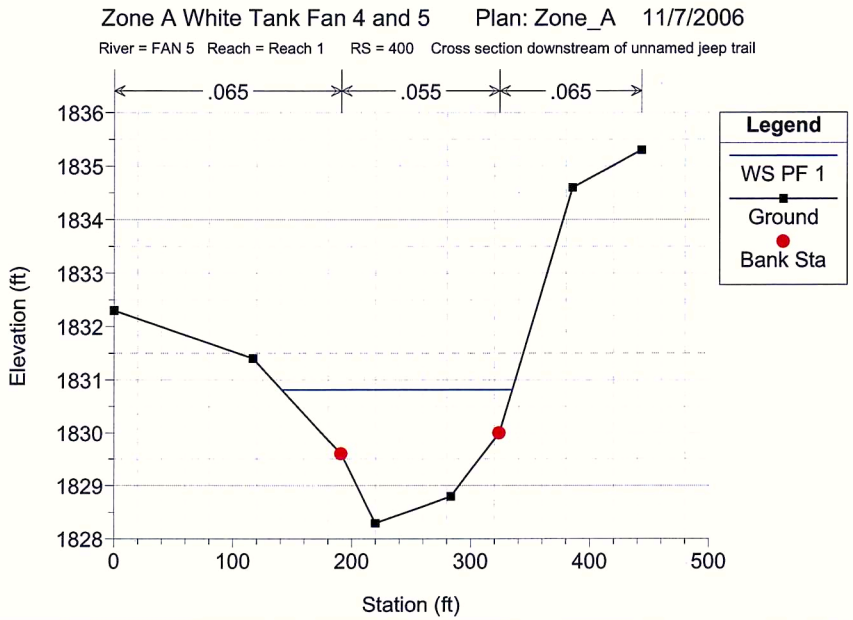
E.2 Cross Section Plots

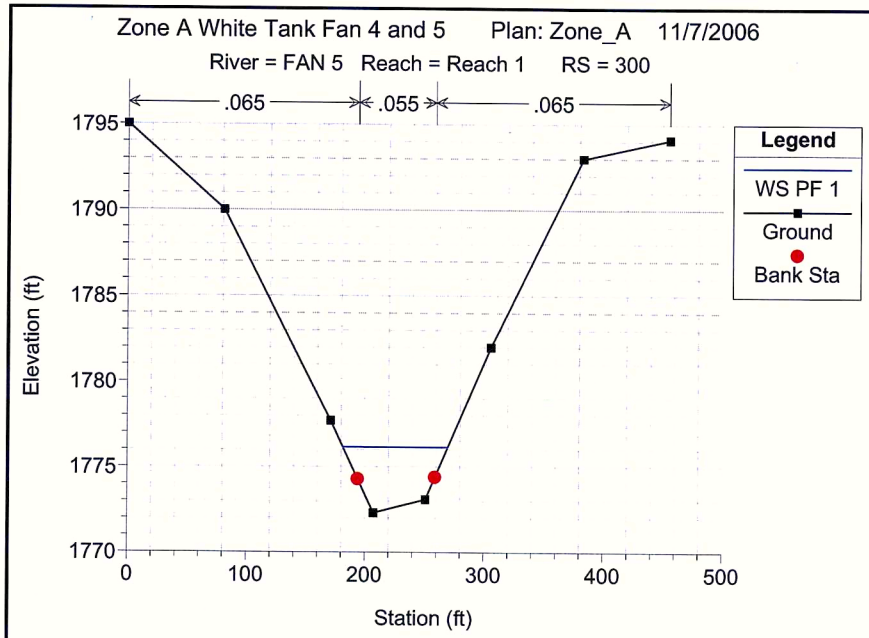

Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 4 Reach = Reach 1 RS = 500 Q=998 cfs per HEC-1 Concentration Point S400
.055
.04
.055
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 4 Reach = Reach 1 RS = 400
.055
.04
.055
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 4 Reach = Reach 1 RS = 300
.04
.055
.055
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 4 Reach = Reach 1 RS = 200
.055
.04
.055
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

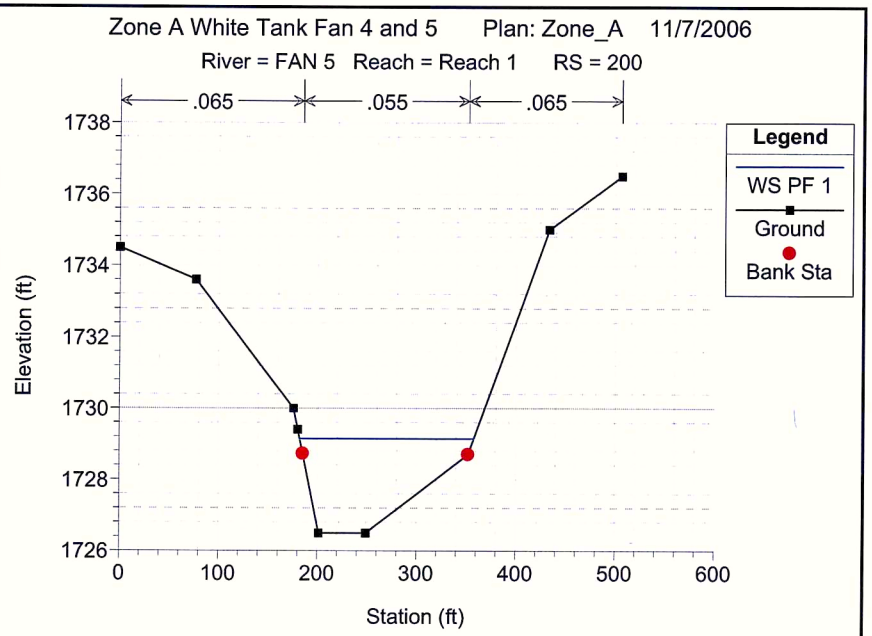

Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 4 Reach = Reach 1 RS = 100
.055
.04
.055
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

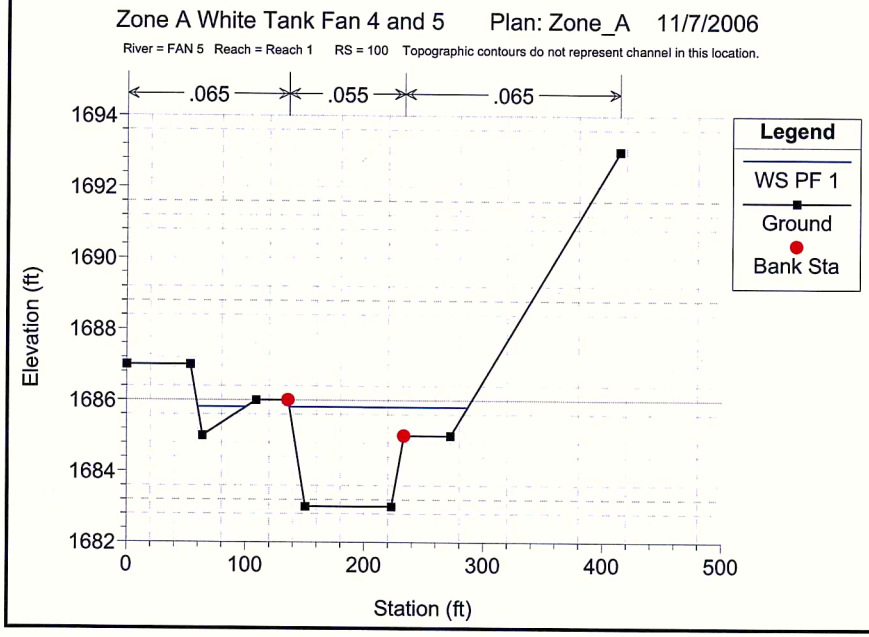

Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 5 Reach = Reach 1 RS = 600 Q=1981 cfs per HEC-1 Concentration Point S500
.065
.055
.065
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 5 Reach = Reach 1 RS = 500
.065
.055
.065
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 5 Reach = Reach 1 RS = 400 Cross section downstream of unnamed jeep trail
.065
.055
.065
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 5 Reach = Reach 1 RS = 300
.065
.055
.065
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1795
1790
1785
1780
1775
1770
0
100
200
300
400
500
Station (ft)


Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 5 Reach = Reach 1 RS = 200
.065
.055
.065
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1738
1736
1734
1732
1730
1728
1726
0
100
200
300
400
500
600
Station (ft)


Zone A White Tank Fan 4 and 5 Plan: Zone_A 11/7/2006
River = FAN 5 Reach = Reach 1 RS = 100 Topographic contours do not represent channel in this location.
.065
.055
.065
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1694
1692
1690
1688
1686
1684
1682
0
100
200
300
400
500
Station (ft)

E.3 Detailed HEC-RAS Output

```
                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp of Engineers
                    Hydrologic Engineering Center
                          609 Second Street
                          Davis, California

X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Zone A White Tank Fan 4 and 5
Project File : zone_a45.prj
Run Date and Time: 11/7/2006 8:13:29 AM

Project in English units

Project Description:
Approximate Zone A Floodplain Delineation Study for select washes on the White Tank Mountains *upstream of the alluvial fan apecies.* This study was performed under contract to the Flood Control District of Maricopa County (2004C0049), by JE Fuller Hydrology & Geomorphology, Inc., in March, 2006. The Flood Control District Project Manager is Valerie Swick. This model was developed in HEC-RAS v3.1.3 (May 2005), Based on 1"=500', 10' contour interval topographic mapping provided by FCDMC, Flown by Landata Airborne Systems, Flight Date = December 2000, vertical datum = NAVD88, horizontal projection = NAD83. Discharges are from HEC-1 modeling produced from this same contract by JEF, Inc. Starting water surface elevation determined using normal depth proceedures. This run assumes sub-critical flow conditions.

PLAN DATA

Plan Title: Zone_A
Plan File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.p01

Geometry Title: zone_a
Geometry File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.g01

Flow Title : zone_a
Flow File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.f01

Plan Summary Information:

Number of:	Cross Sections =	11	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: *At breaks in n values only*
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: zone_a
Flow File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.f01

Flow Data (cfs)

River	Reach	RS	PF 1
FAN 4	Reach 1	500	998
FAN 5	Reach 1	600	1981

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
FAN 4	Reach 1	PF 1		Normal S = 0.013
FAN 5	Reach 1	PF 1		Normal S = 0.03

GEOMETRY DATA

Geometry Title: zone_a
Geometry File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.g01

CROSS SECTION

RIVER: FAN 4
REACH: Reach 1 RS: 500

INPUT
Description: Q=998 cfs per HEC-1 Concentration Point S400
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1653.9	38.7615	1649.4	69.4072	1647.4	96.7925	1646.4	171.8766	1646.4
211.1817	1647.8	259.6745	1648.5	285.5673	1650	372.1072	1653.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.055	69.4072	.042	211.1817	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
69.4072	211.1817	1560	1725	1774	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1648.46	Element			
Vel Head (ft)	0.40	Wt. n-Val.	0.055	0.040	0.055
W.S. Elev (ft)	1648.06	Reach Len. (ft)	1560.00	1725.00	1774.00
Crit W.S. (ft)	1647.84	Flow Area (sq ft)	3.30	193.61	2.27
E.G. Slope (ft/ft)	0.012549	Area (sq ft)	3.30	193.61	2.27
Q Total (cfs)	998.00	Flow (cfs)	4.74	991.51	1.75
Top Width (ft)	169.58	Top Width (ft)	10.06	141.77	17.75
Vel Total (ft/s)	5.01	Avg. Vel. (ft/s)	1.44	5.12	0.77
Max Chl Dpth (ft)	1.66	Hydr. Depth (ft)	0.33	1.37	0.13
Conv. Total (cfs)	8908.8	Conv. (cfs)	42.3	8850.8	15.6
Length Wtd. (ft)	1726.39	Wetted Per. (ft)	10.08	141.82	17.75
Min Ch El (ft)	1646.40	Shear (lb/sq ft)	0.26	1.07	0.10
Alpha	1.04	Stream Power (lb/ft s)	0.37	5.48	0.08
Frctn Loss (ft)	26.83	Cum Volume (acre-ft)	0.36	28.93	3.41
C & E Loss (ft)	0.01	Cum SA (acres)	1.97	23.97	8.98

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	55.53	69.41	4.74	3.30	10.08	0.48	0.33	1.44
2	Chan	69.41	89.66	84.24	20.78	20.27	8.44	1.03	4.05
3	Chan	89.66	109.91	178.61	32.62	20.26	17.90	1.61	5.48
4	Chan	109.91	130.17	187.20	33.54	20.25	18.76	1.66	5.58
5	Chan	130.17	150.42	187.20	33.54	20.25	18.76	1.66	5.58
6	Chan	150.42	170.67	187.20	33.54	20.25	18.76	1.66	5.58
7	Chan	170.67	190.93	130.97	27.08	20.27	13.32	1.34	4.84
8	Chan	190.93	211.18	36.08	12.50	20.27	3.62	0.62	2.89
9	ROB	211.18	243.37	1.75	2.27	17.75	0.18	0.13	0.77

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: FAN 4
REACH: Reach 1 RS: 400

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1623.1	148.4167	1621.4	190.1917	1621.3	228.5987	1621	324.0319	1620
381.6493	1620	417.2533	1620.5	466.1582	1620.8	694.2639	1623.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.055	228.5987	.044	417.2533	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
228.5987	417.2533	1676	1626	1601	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1621.62	Element			
Vel Head (ft)	0.37	Wt. n-Val.	0.055	0.040	0.055
W.S. Elev (ft)	1621.25	Reach Len. (ft)	1676.00	1626.00	1601.00
Crit W.S. (ft)	1621.23	Flow Area (sq ft)	4.13	179.94	38.57
E.G. Slope (ft/ft)	0.019743	Area (sq ft)	4.13	179.94	38.57
Q Total (cfs)	998.00	Flow (cfs)	3.96	910.03	84.02
Top Width (ft)	309.88	Top Width (ft)	32.50	188.65	88.72

Vel Total (ft/s)	4.48	Avg. Vel. (ft/s)	0.96	5.06	2.18
Max Chl Dpth (ft)	1.25	Hydr. Depth (ft)	0.13	0.95	0.43
Conv. Total (cfs)	7102.7	Conv. (cfs)	28.2	6476.6	597.9
Length Wtd. (ft)	1624.81	Wetted Per. (ft)	32.50	188.66	88.73
Min Ch El (ft)	1620.00	Shear (lb/sq ft)	0.16	1.18	0.54
Alpha	1.18	Stream Power (lb/ft s)	0.15	5.95	1.17
Frctn Loss (ft)	26.54	Cum Volume (acre-ft)	0.23	21.53	2.58
C & E Loss (ft)	0.01	Cum SA (acres)	1.21	17.43	6.81

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	182.88	228.60	3.96	4.13	32.50	0.40	0.13	0.96
2	Chan	228.60	255.55	28.33	10.65	26.95	2.84	0.40	2.66
3	Chan	255.55	282.50	69.59	18.26	26.95	6.97	0.68	3.81
4	Chan	282.50	309.45	124.39	25.87	26.95	12.46	0.96	4.81
5	Chan	309.45	336.40	183.62	32.68	26.95	18.40	1.21	5.62
6	Chan	336.40	363.35	194.17	33.79	26.95	19.46	1.25	5.75
7	Chan	363.35	390.30	189.16	33.27	26.95	18.95	1.23	5.69
8	Chan	390.30	417.25	120.78	25.42	26.95	12.10	0.94	4.75
9	ROB	417.25	472.66	76.87	32.24	55.40	7.70	0.58	2.38
10	ROB	472.66	528.06	7.15	6.33	33.32	0.72	0.19	1.13

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: FAN 4
REACH: Reach 1 RS: 300

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1600	20.71	593.719	23.07	1593	111.02	1593	134.61	593.706
177.82	1595	243.62	1596	381.35	1600				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.055	20.7	.04	134.6	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.7	134.6	1685	1781	1613	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1595.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.	0.055	0.040	0.055
W.S. Elev (ft)	1594.58	Reach Len. (ft)	1685.00	1781.00	1613.00
Crit W.S. (ft)	1594.43	Flow Area (sq ft)	1.22	170.70	12.73
E.G. Slope (ft/ft)	0.013738	Area (sq ft)	1.22	170.70	12.73
Q Total (cfs)	998.00	Flow (cfs)	2.14	972.67	23.20
Top Width (ft)	145.90	Top Width (ft)	2.84	113.90	29.17
Vel Total (ft/s)	5.40	Avg. Vel. (ft/s)	1.75	5.70	1.82
Max Chl Dpth (ft)	1.58	Hydr. Depth (ft)	0.43	1.50	0.44
Conv. Total (cfs)	8514.6	Conv. (cfs)	18.2	8298.5	197.9
Length Wtd. (ft)	1774.72	Wetted Per. (ft)	2.96	114.02	29.18
Min Ch El (ft)	1593.00	Shear (lb/sq ft)	0.35	1.28	0.37
Alpha	1.09	Stream Power (lb/ft s)	0.62	7.32	0.68
Frctn Loss (ft)	27.18	Cum Volume (acre-ft)	0.13	14.99	1.63
C & E Loss (ft)	0.02	Cum SA (acres)	0.53	11.78	4.64

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	16.56	20.70	2.14	1.22	2.96	0.21	0.43	1.75
2	Chan	20.70	36.97	141.92	24.84	16.38	14.22	1.53	5.71
3	Chan	36.97	53.24	150.78	25.70	16.27	15.11	1.58	5.87
4	Chan	53.24	69.51	150.78	25.70	16.27	15.11	1.58	5.87
5	Chan	69.51	85.79	150.78	25.70	16.27	15.11	1.58	5.87
6	Chan	85.79	102.06	150.78	25.70	16.27	15.11	1.58	5.87
7	Chan	102.06	118.33	143.02	24.90	16.27	14.33	1.53	5.74
8	Chan	118.33	134.60	84.61	18.17	16.28	8.48	1.12	4.66
9	ROB	134.60	183.95	23.20	12.73	29.18	2.32	0.44	1.82

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: FAN 4
REACH: Reach 1 RS: 200

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1574.4	18.157	1574	62.844	1571	85.41	1567.087	91.662	1566
159.563	1566	233.992	1567	288.291	1569	344.111	1569	393.622	1567
440.279	1567	467.488	1570	506.822	1573	550.976	1577		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.055	85.4	.04	233.992	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
85.4	233.992	1812	1880	1726	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1567.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.	0.055	0.040	0.055
W.S. Elev (ft)	1567.45	Reach Len. (ft)	1812.00	1880.00	1726.00
Crit W.S. (ft)	1567.41	Flow Area (sq ft)	0.38	174.76	27.13
E.G. Slope (ft/ft)	0.017176	Area (sq ft)	0.38	174.76	27.13
Q Total (cfs)	998.00	Flow (cfs)	0.43	947.58	50.00
Top Width (ft)	224.74	Top Width (ft)	2.09	148.59	74.06
Vel Total (ft/s)	4.93	Avg. Vel. (ft/s)	1.12	5.42	1.84
Max Chl Dpth (ft)	1.45	Hydr. Depth (ft)	0.18	1.18	0.37
Conv. Total (cfs)	7614.9	Conv. (cfs)	3.2	7230.2	381.5
Length Wtd. (ft)	1874.09	Wetted Per. (ft)	2.12	148.69	74.10
Min Ch El (ft)	1566.00	Shear (lb/sq ft)	0.19	1.26	0.39
Alpha	1.15	Stream Power (lb/ft s)	0.21	6.83	0.72
Frctn Loss (ft)	27.89	Cum Volume (acre-ft)	0.10	7.92	0.90
C & E Loss (ft)	0.02	Cum SA (acres)	0.44	6.42	2.73

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth (ft)	Velocity (ft/s)
1	LOB	68.32	85.40	0.43	0.38	2.12	0.04	0.18	1.12
2	Chan	85.40	106.63	151.53	27.36	21.32	15.18	1.29	5.54
3	Chan	106.63	127.85	184.77	30.77	21.23	18.51	1.45	6.01
4	Chan	127.85	149.08	184.77	30.77	21.23	18.51	1.45	6.01
5	Chan	149.08	170.31	177.06	29.99	21.23	17.74	1.41	5.90
6	Chan	170.31	191.54	127.91	24.68	21.23	12.82	1.16	5.18
7	Chan	191.54	212.76	80.01	18.62	21.23	8.02	0.88	4.30
8	Chan	212.76	233.99	41.54	12.57	21.23	4.16	0.59	3.31
9	ROB	233.99	297.39	3.59	2.74	12.21	0.36	0.22	1.31
10	ROB	297.39	360.79						
11	ROB	360.79	424.18	30.65	16.24	41.70	3.07	0.39	1.89
12	ROB	424.18	487.58	15.76	8.15	20.20	1.58	0.40	1.93

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: FAN 4
REACH: Reach 1 RS: 100

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1542	67.24	1541.5	79.1	1540	115	1539.149	163.48	1538
234.62	1538	263.7	1539.184	283.74	1540	323.63	1539	373.59	1540
498.02	1542								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.055	115	.04	263.7	.055

Bank Sta: Left	Right	Coeff Contr.	Expan.
115	263.7	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1539.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.055	0.040	0.055
W.S. Elev (ft)	1539.60	Reach Len. (ft)			
Crit W.S. (ft)	1539.44	Flow Area (sq ft)	4.24	192.47	18.13
E.G. Slope (ft/ft)	0.013022	Area (sq ft)	4.24	192.47	18.13
Q Total (cfs)	998.00	Flow (cfs)	4.82	968.83	24.35
Top Width (ft)	231.45	Top Width (ft)	18.92	148.70	63.83
Vel Total (ft/s)	4.65	Avg. Vel. (ft/s)	1.14	5.03	1.34
Max Chl Dpth (ft)	1.60	Hydr. Depth (ft)	0.22	1.29	0.28

Conv. Total (cfs)	8745.8	Conv. (cfs)	42.3	8490.2	213.3
Length Wtd. (ft)		Wetted Per. (ft)	18.92	148.74	63.85
Min Ch El (ft)	1538.00	Shear (lb/sq ft)	0.18	1.05	0.23
Alpha	1.14	Stream Power (lb/ft s)	0.21	5.30	0.31
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	92.00	115.00	4.82	4.24	18.92	0.48	0.22	1.14
2	Chan	115.00	136.24	47.65	14.87	21.25	4.77	0.70	3.20
3	Chan	136.24	157.49	117.55	25.57	21.25	11.78	1.20	4.60
4	Chan	157.49	178.73	184.51	33.51	21.24	18.49	1.58	5.51
5	Chan	178.73	199.97	188.44	33.93	21.24	18.88	1.60	5.55
6	Chan	199.97	221.21	188.44	33.93	21.24	18.88	1.60	5.55
7	Chan	221.21	242.46	176.97	32.68	21.25	17.73	1.54	5.41
8	Chan	242.46	263.70	65.28	17.97	21.26	6.54	0.85	3.63
9	ROB	263.70	310.56	3.24	3.55	20.93	0.32	0.17	0.91
10	ROB	310.56	357.43	21.11	14.58	42.92	2.12	0.34	1.45

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: FAN 5
REACH: Reach 1 RS: 600

INPUT
Description: Q=1981 cfs per HEC-1 Concentration Point S500
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2000	49.82	1977	107.1	1968	117.59	1965	150.85	1965
159.21	1967.803	171.7	1972	278.32	2000				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	107.1	.055	159.2	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
107.1	159.2	1687	1926	2011	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1970.81	Element			
Vel Head (ft)	1.68	Wt. n-Val.	0.065	0.055	0.065
W.S. Elev (ft)	1969.13	Reach Len. (ft)	1687.00	1926.00	2011.00
Crit W.S. (ft)	1969.13	Flow Area (sq ft)	4.08	187.86	2.63
E.G. Slope (ft/ft)	0.027666	Area (sq ft)	4.08	187.86	2.63
Q Total (cfs)	1981.00	Flow (cfs)	10.53	1963.11	7.36
Top Width (ft)	63.27	Top Width (ft)	7.21	52.10	3.96
Vel Total (ft/s)	10.18	Avg. Vel. (ft/s)	2.58	10.45	2.79
Max Chl Dpth (ft)	4.13	Hydr. Depth (ft)	0.57	3.61	0.66
Conv. Total (cfs)	11909.9	Conv. (cfs)	63.3	11802.4	44.2
Length Wtd. (ft)	1925.05	Wetted Per. (ft)	7.30	52.98	4.18
Min Ch El (ft)	1965.00	Shear (lb/sq ft)	0.97	6.12	1.09
Alpha	1.04	Stream Power (lb/ft s)	2.49	64.00	3.04
Frctn Loss (ft)	57.96	Cum Volume (acre-ft)	2.36	52.37	1.47
C & E Loss (ft)	0.21	Cum SA (acres)	4.41	23.83	2.48

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	85.68	107.10	10.53	4.08	7.30	0.53	0.57	2.58
2	Chan	107.10	114.54	117.30	16.35	7.74	5.92	2.20	7.17
3	Chan	114.54	121.99	317.27	29.43	7.57	16.02	3.95	10.78
4	Chan	121.99	129.43	345.21	30.76	7.44	17.43	4.13	11.22
5	Chan	129.43	136.87	345.21	30.76	7.44	17.43	4.13	11.22
6	Chan	136.87	144.31	345.21	30.76	7.44	17.43	4.13	11.22
7	Chan	144.31	151.76	341.11	30.62	7.49	17.22	4.11	11.14
8	Chan	151.76	159.20	151.80	19.19	7.85	7.66	2.58	7.91
9	ROB	159.20	183.02	7.36	2.63	4.18	0.37	0.66	2.79

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for

additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: FAN 5
REACH: Reach 1 RS: 500

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1920	25.68	1918	41.53	1913	144.46	1910	166.09	1908
228.64	1908	265.33	1910	311.95	1915				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	144.46	.055	265.33	.065

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
144.46 265.33 2009 1998 1677 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1911.51	Element			
Vel Head (ft)	0.97	Wt. n-Val.	0.065	0.055	0.065
W.S. Elev (ft)	1910.54	Reach Len. (ft)	2009.00	1998.00	1677.00
Crit W.S. (ft)	1910.54	Flow Area (sq ft)	5.01	248.72	1.36
E.G. Slope (ft/ft)	0.032890	Area (sq ft)	5.01	248.72	1.36
Q Total (cfs)	1981.00	Flow (cfs)	8.67	1969.98	2.35
Top Width (ft)	144.44	Top Width (ft)	18.54	120.87	5.04
Vel Total (ft/s)	7.77	Avg. Vel. (ft/s)	1.73	7.92	1.73
Max Chl Dpth (ft)	2.54	Hydr. Depth (ft)	0.27	2.06	0.27
Conv. Total (cfs)	10923.3	Conv. (cfs)	47.8	10862.6	13.0
Length Wtd. (ft)	1997.29	Wetted Per. (ft)	18.54	121.02	5.07
Min Ch El (ft)	1908.00	Shear (lb/sq ft)	0.55	4.22	0.55
Alpha	1.03	Stream Power (lb/ft s)	0.96	33.42	0.95
Frctn Loss (ft)	64.32	Cum Volume (acre-ft)	2.18	42.72	1.38
C & E Loss (ft)	0.05	Cum SA (acres)	3.91	20.01	2.27

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	115.57	144.46	8.67	5.01	18.54	0.44	0.27	1.73
2	Chan	144.46	161.73	130.79	23.11	17.34	6.60	1.34	5.66
3	Chan	161.73	178.99	368.61	42.98	17.29	18.61	2.49	8.58
4	Chan	178.99	196.26	381.55	43.86	17.27	19.26	2.54	8.70
5	Chan	196.26	213.53	381.55	43.86	17.27	19.26	2.54	8.70
6	Chan	213.53	230.80	379.66	43.74	17.27	19.17	2.53	8.68
7	Chan	230.80	248.06	245.76	33.71	17.29	12.41	1.95	7.29
8	Chan	248.06	265.33	82.07	17.46	17.29	4.14	1.01	4.70
9	ROB	265.33	274.65	2.35	1.36	5.07	0.12	0.27	1.73

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: FAN 5
REACH: Reach 1 RS: 400

INPUT
Description: Cross section downstream of unnamed jeep trail
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1832.3	116.904	1831.4	190.9595	1829.6	219.8352	1828.3	283.4321	1828.8
324.0146	1830	385.2954	1834.6	443.2868	1835.3				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	190.9595	.055	324.0146	.065

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

190.9595324.0146 1709 1686 1712 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1831.62	Element			
Vel Head (ft)	0.81	Wt. n-Val.	0.065	0.055	0.065
W.S. Elev (ft)	1830.81	Reach Len. (ft)	1709.00	1686.00	1712.00
Crit W.S. (ft)	1830.81	Flow Area (sq ft)	30.15	254.73	4.38
E.G. Slope (ft/ft)	0.031534	Area (sq ft)	30.15	254.73	4.38
Q Total (cfs)	1981.00	Flow (cfs)	87.55	1883.74	9.71
Top Width (ft)	193.66	Top Width (ft)	49.80	133.06	10.80
Vel Total (ft/s)	6.85	Avg. Vel. (ft/s)	2.90	7.40	2.22
Max Chl Dpth (ft)	2.51	Hydr. Depth (ft)	0.61	1.91	0.41
Conv. Total (cfs)	11155.6	Conv. (cfs)	493.0	10607.9	54.7
Length Wtd. (ft)	1687.00	Wetted Per. (ft)	49.82	133.10	10.83
Min Ch El (ft)	1828.30	Shear (lb/sq ft)	1.19	3.77	0.80
Alpha	1.12	Stream Power (lb/ft s)	3.46	27.86	1.77
Frctn Loss (ft)	47.55	Cum Volume (acre-ft)	1.37	31.17	1.27
C & E Loss (ft)	0.05	Cum SA (acres)	2.34	14.18	1.97

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	114.58	152.77	1.63	1.64	11.62	0.08	0.14	0.99
2	LOB	152.77	190.96	85.92	28.51	38.20	4.34	0.75	3.01
3	Chan	190.96	209.97	201.49	31.14	19.03	10.17	1.64	6.47
4	Chan	209.97	228.98	374.98	45.20	19.02	18.93	2.38	8.30
5	Chan	228.98	247.98	371.43	44.93	19.01	18.75	2.36	8.27
6	Chan	247.98	266.99	333.13	42.09	19.01	16.82	2.21	7.91
7	Chan	266.99	286.00	295.60	39.18	19.01	14.92	2.06	7.54
8	Chan	286.00	305.01	204.68	31.43	19.02	10.33	1.65	6.51
9	Chan	305.01	324.01	102.44	20.75	19.02	5.17	1.09	4.94
10	ROB	324.01	347.87	9.71	4.38	10.83	0.49	0.41	2.22

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: FAN 5
REACH: Reach 1 RS: 300

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1795	81.035	1790	171.053	1777.7	194	1774.271	207.196	1772.3
250.974	1773.1	258.91	1774.389	305.695	1782	382.859	1793	455.48	1794.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	194	.055	258.9	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
194	258.9	1769	1888	1976	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1777.42	Element			
Vel Head (ft)	1.29	Wt. n-Val.	0.065	0.055	0.065
W.S. Elev (ft)	1776.12	Reach Len. (ft)	1769.00	1888.00	1976.00
Crit W.S. (ft)	1776.04	Flow Area (sq ft)	11.48	206.17	9.25
E.G. Slope (ft/ft)	0.025348	Area (sq ft)	11.48	206.17	9.25
Q Total (cfs)	1981.00	Flow (cfs)	39.41	1911.26	30.34
Top Width (ft)	87.96	Top Width (ft)	12.40	64.90	10.66
Vel Total (ft/s)	8.73	Avg. Vel. (ft/s)	3.43	9.27	3.28
Max Chl Dpth (ft)	3.82	Hydr. Depth (ft)	0.93	3.18	0.87
Conv. Total (cfs)	12442.7	Conv. (cfs)	247.5	12004.6	190.5
Length Wtd. (ft)	1887.50	Wetted Per. (ft)	12.53	65.16	10.80
Min Ch El (ft)	1772.30	Shear (lb/sq ft)	1.45	5.01	1.35
Alpha	1.09	Stream Power (lb/ft s)	4.98	46.42	4.44
Frctn Loss (ft)	47.45	Cum Volume (acre-ft)	0.56	22.25	1.00
C & E Loss (ft)	0.20	Cum SA (acres)	1.12	10.35	1.55

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	155.20	194.00	39.41	11.48	12.53	1.99	0.93	3.43
2	Chan	194.00	203.27	185.50	23.59	9.37	9.36	2.54	7.86
3	Chan	203.27	212.54	343.10	34.04	9.32	17.32	3.67	10.08
4	Chan	212.54	221.81	339.46	33.76	9.27	17.14	3.64	10.06
5	Chan	221.81	231.09	313.54	32.19	9.27	15.83	3.47	9.74
6	Chan	231.09	240.36	288.45	30.61	9.27	14.56	3.30	9.42
7	Chan	240.36	249.63	264.21	29.04	9.27	13.34	3.13	9.10
8	Chan	249.63	258.90	176.99	22.94	9.38	8.93	2.47	7.72
9	ROB	258.90	298.22	30.34	9.25	10.80	1.53	0.87	3.28

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: FAN 5
REACH: Reach 1 RS: 200

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1734.5	76.843	1733.6	175.63	1730	180	1729.407	185	1728.729
201.433	1726.5	249.081	1726.5	352	1728.7	352.001	1728.7	433.18	1735
506.356	1736.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	185	.055	352.001	.065

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
185 352.001 1625 1762 1740 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1729.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.065	0.055	0.065
W.S. Elev (ft)	1729.13	Reach Len. (ft)	1625.00	1762.00	1740.00
Crit W.S. (ft)	1728.91	Flow Area (sq ft)	0.61	308.38	1.21
E.G. Slope (ft/ft)	0.024932	Area (sq ft)	0.61	308.38	1.21
Q Total (cfs)	1981.00	Flow (cfs)	0.75	1978.67	1.58
Top Width (ft)	175.58	Top Width (ft)	2.99	167.00	5.59
Vel Total (ft/s)	6.39	Avg. Vel. (ft/s)	1.24	6.42	1.30
Max Chl Dpth (ft)	2.63	Hydr. Depth (ft)	0.20	1.85	0.22
Conv. Total (cfs)	12546.1	Conv. (cfs)	4.7	12531.4	10.0
Length Wtd. (ft)	1760.33	Wetted Per. (ft)	3.02	167.18	5.61
Min Ch El (ft)	1726.50	Shear (lb/sq ft)	0.31	2.87	0.34
Alpha	1.01	Stream Power (lb/ft s)	0.39	18.42	0.44
Frctn Loss (ft)	43.09	Cum Volume (acre-ft)	0.31	11.10	0.76
C & E Loss (ft)	0.02	Cum SA (acres)	0.80	5.33	1.18

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	148.00	185.00	0.75	0.61	3.02	0.04	0.20	1.24
2	Chan	185.00	208.86	266.83	44.53	24.01	13.47	1.87	5.99
3	Chan	208.86	232.71	475.79	62.84	23.86	24.02	2.63	7.57
4	Chan	232.71	256.57	468.22	62.24	23.86	23.64	2.61	7.52
5	Chan	256.57	280.43	357.46	52.94	23.86	18.04	2.22	6.75
6	Chan	280.43	304.29	231.33	40.77	23.86	11.68	1.71	5.67
7	Chan	304.29	328.14	128.14	28.61	23.86	6.47	1.20	4.48
8	Chan	328.14	352.00	50.91	16.44	23.86	2.57	0.69	3.10
9	ROB	352.00	382.87	1.58	1.21	5.61	0.08	0.22	1.30

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: FAN 5
REACH: Reach 1 RS: 100

INPUT
Description: Topographic contours do not represent channel in this location.
Estimated cross section geometry based on bank contours and aerial photographs.
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	1687	53.53	1687	63.89	1685	108.94	1686	135.94	1686
150.49	1683	222.99	1683	233.31	1685	272.5	1685	414.21	1693

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	135.94	.055	233.31	.065

Bank Sta: Left	Right	Coeff Contr.	Expan.
135.94	233.31	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1686.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.86	Wt. n-Val.	0.065	0.055	0.065
W.S. Elev (ft)	1685.80	Reach Len. (ft)			
Crit W.S. (ft)	1685.80	Flow Area (sq ft)	16.06	240.55	37.00
E.G. Slope (ft/ft)	0.024035	Area (sq ft)	16.06	240.55	37.00
Q Total (cfs)	1981.00	Flow (cfs)	30.84	1847.47	102.70
Top Width (ft)	189.91	Top Width (ft)	40.16	96.40	53.35
Vel Total (ft/s)	6.75	Avg. Vel. (ft/s)	1.92	7.68	2.78
Max Chl Dpth (ft)	2.80	Hydr. Depth (ft)	0.40	2.50	0.69
Conv. Total (cfs)	12777.9	Conv. (cfs)	198.9	11916.6	662.4
Length Wtd. (ft)		Wetted Per. (ft)	40.25	96.88	53.38
Min Ch El (ft)	1683.00	Shear (lb/sq ft)	0.60	3.73	1.04
Alpha	1.22	Stream Power (lb/ft s)	1.15	28.62	2.89
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	54.38	81.56	26.72	12.32	21.90	1.35	0.56	2.17
2	LOB	81.56	108.75	4.11	3.74	18.35	0.21	0.20	1.10
3	LOB	108.75	135.94						
4	Chan	135.94	149.85	84.09	17.26	13.21	4.24	1.33	4.87
5	Chan	149.85	163.76	314.64	38.90	13.92	15.88	2.80	8.09
6	Chan	163.76	177.67	315.41	38.94	13.91	15.92	2.80	8.10
7	Chan	177.67	191.58	315.41	38.94	13.91	15.92	2.80	8.10
8	Chan	191.58	205.49	315.41	38.94	13.91	15.92	2.80	8.10
9	Chan	205.49	219.40	315.41	38.94	13.91	15.92	2.80	8.10
10	Chan	219.40	233.31	187.09	28.62	14.10	9.44	2.06	6.54
11	ROB	233.31	269.49	85.90	28.93	36.18	4.34	0.80	2.97
12	ROB	269.49	305.67	16.80	8.07	17.20	0.85	0.47	2.08

Warning: Divided flow computed for this cross-section.
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

SUMMARY OF MANNING'S N VALUES

River:FAN 4

Reach	River Sta.	n1	n2	n3
Reach 1	500	.055	.04	.055
Reach 1	400	.055	.04	.055
Reach 1	300	.055	.04	.055
Reach 1	200	.055	.04	.055
Reach 1	100	.055	.04	.055

River:FAN 5

Reach	River Sta.	n1	n2	n3
Reach 1	600	.065	.055	.065
Reach 1	500	.065	.055	.065
Reach 1	400	.065	.055	.065
Reach 1	300	.065	.055	.065
Reach 1	200	.065	.055	.065
Reach 1	100	.065	.055	.065

SUMMARY OF REACH LENGTHS

River: FAN 4

Reach	River Sta.	Left	Channel	Right
Reach 1	500	1560	1725	1774
Reach 1	400	1676	1626	1601
Reach 1	300	1685	1781	1613
Reach 1	200	1812	1880	1726
Reach 1	100			

River: FAN 5

Reach	River Sta.	Left	Channel	Right
Reach 1	600	1687	1926	2011
Reach 1	500	2009	1998	1677
Reach 1	400	1709	1686	1712
Reach 1	300	1769	1888	1976
Reach 1	200	1625	1762	1740
Reach 1	100			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: FAN 4

Reach	River Sta.	Contr.	Expan.
Reach 1	500	.1	.3
Reach 1	400	.1	.3
Reach 1	300	.1	.3
Reach 1	200	.1	.3
Reach 1	100	.1	.3

River: FAN 5

Reach	River Sta.	Contr.	Expan.
Reach 1	600	.1	.3
Reach 1	500	.1	.3
Reach 1	400	.1	.3
Reach 1	300	.1	.3
Reach 1	200	.1	.3
Reach 1	100	.1	.3

CHECK-RAS Program: NT Check
Manning's n Value and Transition Loss Coefficient Review

Project File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.prj
Plan File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.p01
Geometry File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.g01
Flow File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.f01
Report File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.nt
Selected profiles: PF 1
Date: 9/21/2006
Time: 10:05:35 AM

SECNO	STRUCTURE	NLOB	NCHL	NROB	CNTR	EXP
FAN 4,Reach 1						
500		0.055	0.04	0.055	0.1	0.3
400		0.055	0.04	0.055	0.1	0.3
300		0.055	0.04	0.055	0.1	0.3
200		0.055	0.04	0.055	0.1	0.3
FAN 5,Reach 1						
100		0.055	0.04	0.055	0.1	0.3
600		0.065	0.055	0.065	0.1	0.3
500		0.065	0.055	0.065	0.1	0.3
400		0.065	0.055	0.065	0.1	0.3
300		0.065	0.055	0.065	0.1	0.3
200		0.065	0.055	0.065	0.1	0.3
100		0.065	0.055	0.065	0.1	0.3

---Summary of Statistics---

	Minimum	*Maximum*
Left Overbank n Value:	0.055	0.065
Right Overbank n Value:	0.055	0.065
Channel n Value:	0.04	0.055
Contraction Coefficient:	0.1	0.1
Expansion Coefficient:	0.3	0.3

ROUGHNESS COEFFICIENT CHECK

TRANSITION LOSS COEFFICIENT CHECK

ROUGHNESS COEFFICIENT AT STRUCTURES

---END---

CHECK-RAS Program, XS Check
Cross Section Location and Alignment Review

Project File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.prj
Plan File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.p01
Geometry File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.g01
Flow File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.f01
Report File: X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans4-5\zone_a45.xs
Selected profiles: PF 1
Date: 9/21/2006
Time: 10:05:47 AM

SECNO	Len Lob	Len Chl	Len Rob	TopWdthAct	Q Total	Flow Code

FAN 4,Reach 1						
500	1560	1725	1774	169.58	998	
400	1676	1626	1601	309.88	998	
300	1685	1781	1613	145.9	998	
200	1812	1880	1726	224.74	998	D
100	0	0	0	231.45	998	D
FAN 5,Reach 1						
600	1687	1926	2011	63.27	1981	C
500	2009	1998	1677	144.44	1981	C
400	1709	1686	1712	193.66	1981	C
300	1769	1888	1976	87.96	1981	
200	1625	1762	1740	175.58	1981	
100	0	0	0	189.91	1981	D,C

B=blocked obstruction XS SC 05
C=critial depth XS SC 03
D=divided flow XS SC 01
E=cross section extended XS SC 02
K=known water-surface XS SC 04

DISTANCE CHECK

SPACING CHECK

INEFFECTIVE FLOW CHECK

DISCHARGE CHECK

XS DC 02 Constant dicharge used for the FAN 4,Reach 1

XS DC 02 Constant dicharge used for the FAN 5,Reach 1

LOCATION CHECK

BOUNDARY CONDITION CHECK

XS BC 02 The name of the stream is FAN 4,Reach 1
Normal S = 0.013 is specified as the downstream boundary
for profile PF 1

XS BC 02 The name of the stream is FAN 5,Reach 1
Normal S = 0.03 is specified as the downstream boundary
for profile PF 1

XS BC 03 Maximum number of iterations is 0
It should not be less than 20.

LATERAL WEIRS CHECK

---END---

WARNING EXPLANATIONS:

XS DC 02: The reaches are relatively short with only a few cross sections. The peak discharge used in all cross sections of a given reach was computed at the most downstream cross section and applied to all cross sections. The discharge used is therefore considered conservative.

XS BC 02: The downstream channel slope is estimated from 10 foot contour intervals in the vicinity of the cross section. The downstream cross sections are located at or near the alluvial fan apices. To adjust this slope based on the resulting predicted energy slope would imply a detailed level of understanding of the flow regime at the apex. Furthermore, a single cross section normal depth computation is acceptable for an Approximate Zone A FDS.

XS BC 03: The warning seems to be in error, the number of iterations reported by HEC-RAS is 20. With multiple cross sections running at supercritical, the energy equation could not be balanced and required the maximum number of iterations (20) before the WSEL defaulted to critical depth in the specified sub-critical flow regime model run.

Appendix F

Erosion/Sediment Transport

No erosion or sediment transport analyses were conducted for this study.

Appendix G
(Separate Volume)

Geomorphology Analyses Supporting Documentation

EXHIBIT A

HYDROLOGY EXHIBIT MAPS

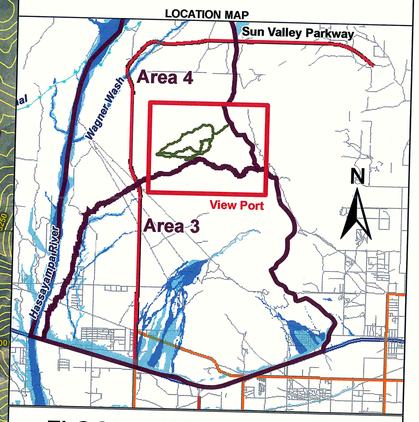
PLATE 1
WATERSHED MAP

HYDROLOGY FOR FANS 4 & 5 APPROXIMATE FDS

- Subbasin Boundaries
- Lca Paths
- Lag Time Paths
- Fan Apices
- Subbasin Centroids
- Elevation Points
- 50-ft Index Contours

N
W E
S

LOCATION MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

FAN 4 & FAN 5

FCD 2004C049
SUN VALLEY
AREA DRAINAGE MASTER PLAN

SEPTEMBER 2006

Feet
0 1,000 2,000 3,000

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

PLATE 2
SOIL MAP

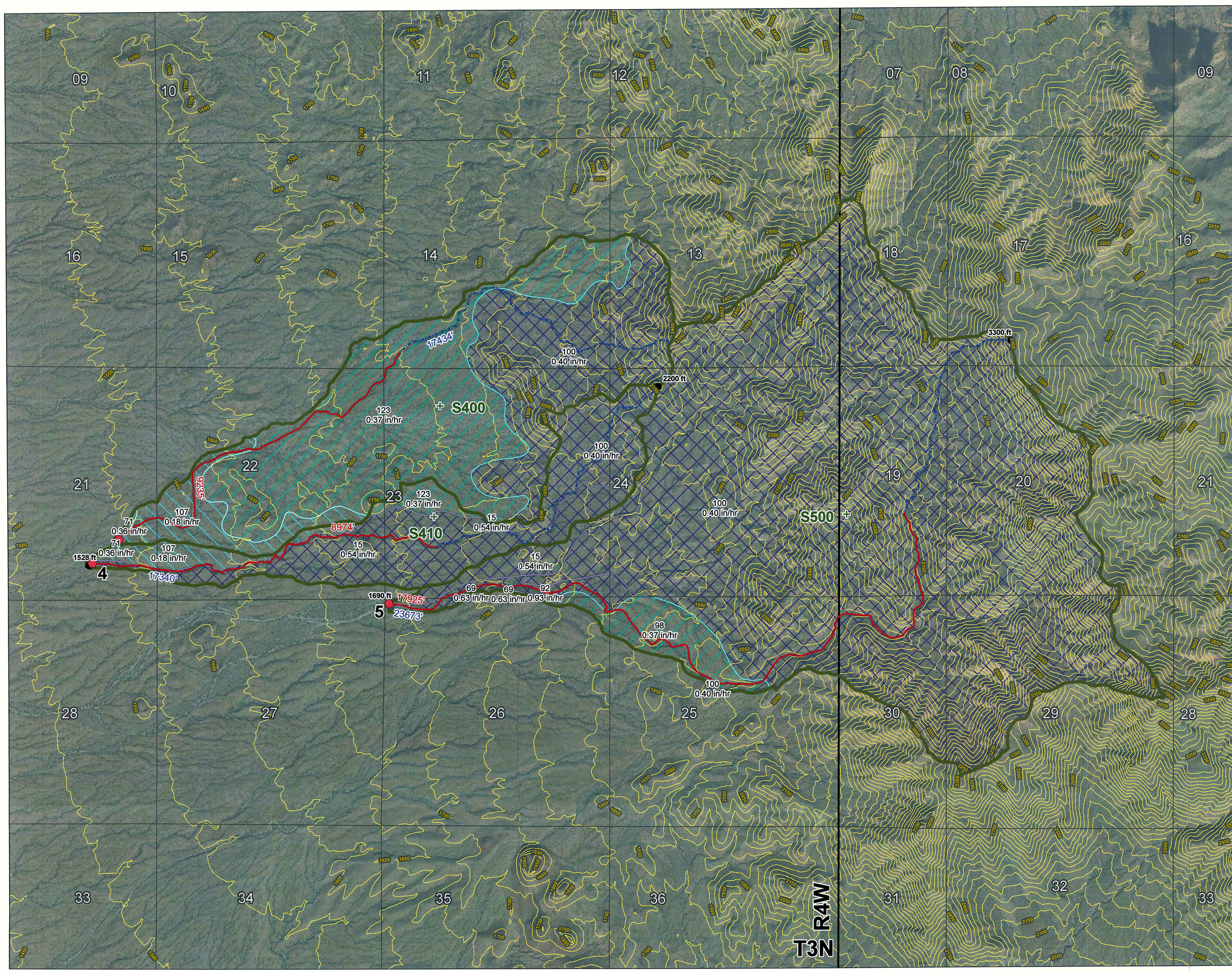
HYDROLOGY FOR FANS 4 & 5 APPROXIMATE FDS

- Subbasin Boundaries
- Lca Paths
- Lag Time Paths
- Fan Apices
- Subbasin Centroids
- Elevation Points
- 50-ft Index Contours

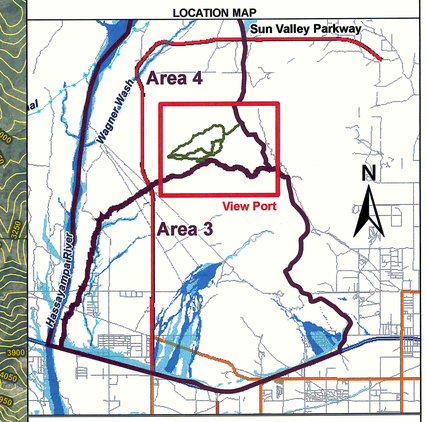
NRCS Soil Data

XKSAT

- 0 - 0.01
- 0.01 - 0.02
- 0.03 - 0.04
- 0.05 - 0.06
- 0.07 - 0.10
- 0.11 - 0.15
- 0.16 - 0.25
- 0.26 - 0.40
- 0.41 - 1.20



LOCATION MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A
FLOODPLAIN DELINEATION STUDY OF

FAN 4 & FAN 5

FCD 2004C049
SUN VALLEY
AREA DRAINAGE MASTER PLAN

SEPTEMBER 2006

Feet
0 1,000 2,000 3,000

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC

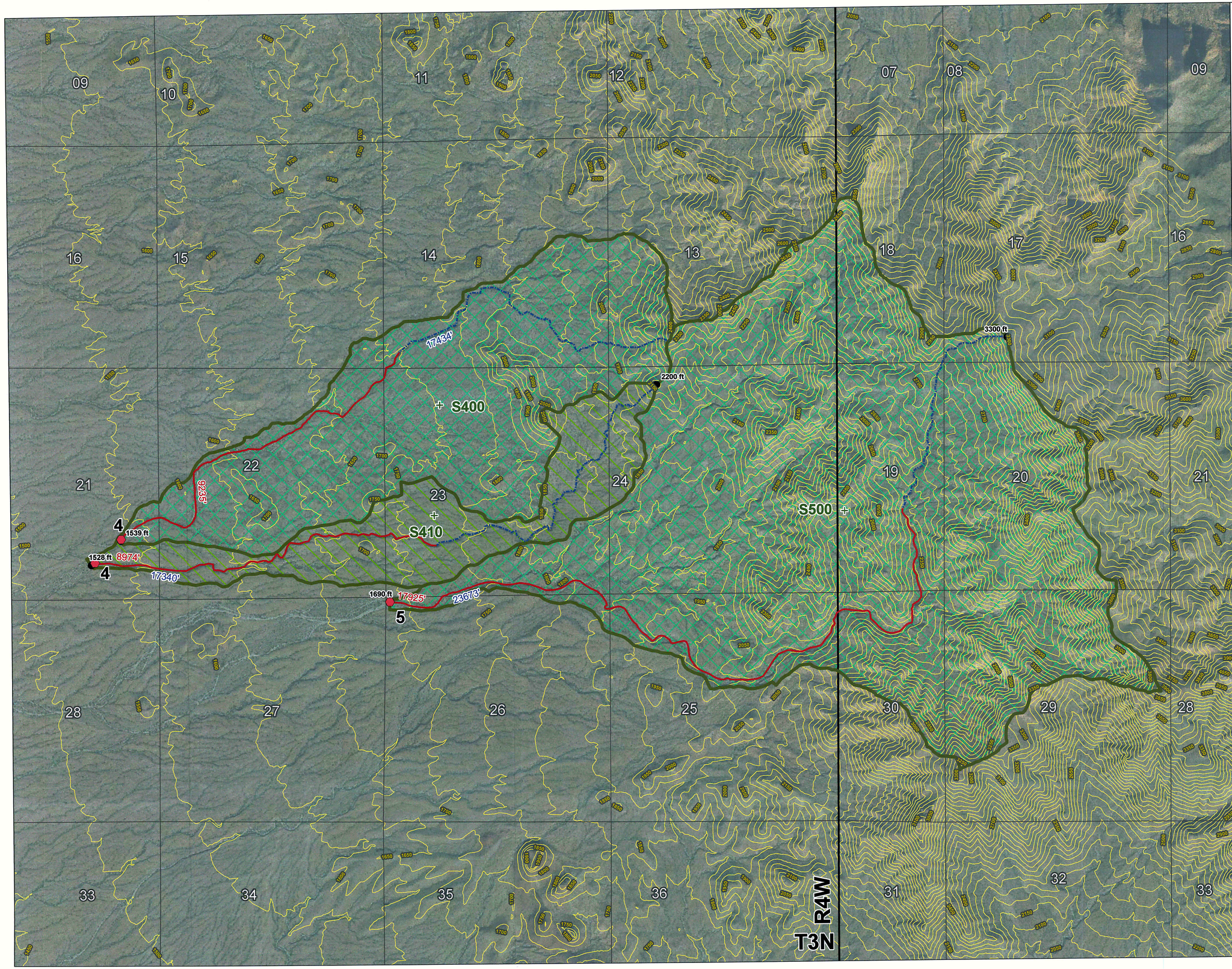


PLATE 3
LAND USE MAP

HYDROLOGY FOR FANS 4 & 5 APPROXIMATE FDS

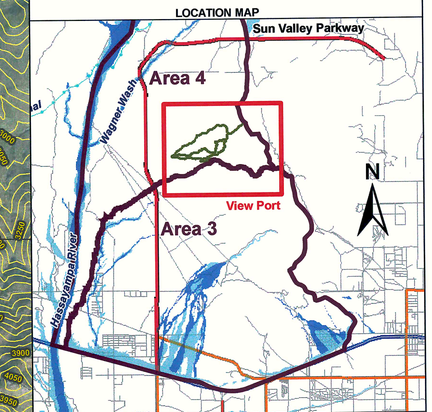
- Subbasin Boundaries
- Lca Paths
- Lag Time Paths
- Fan Apices
- Subbasin Centroids
- Elevation Points
- 50-ft Index Contours

Land Use Type

- Hillslopes (NHS), 5 - 10 % slopes
- Mountain Terrain (NMT), > 10 % Slopes

N
W E
S

LOCATION MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

FAN 4 & FAN 5

FCD 2004C049
SUN VALLEY
AREA DRAINAGE MASTER PLAN

SEPTEMBER 2006

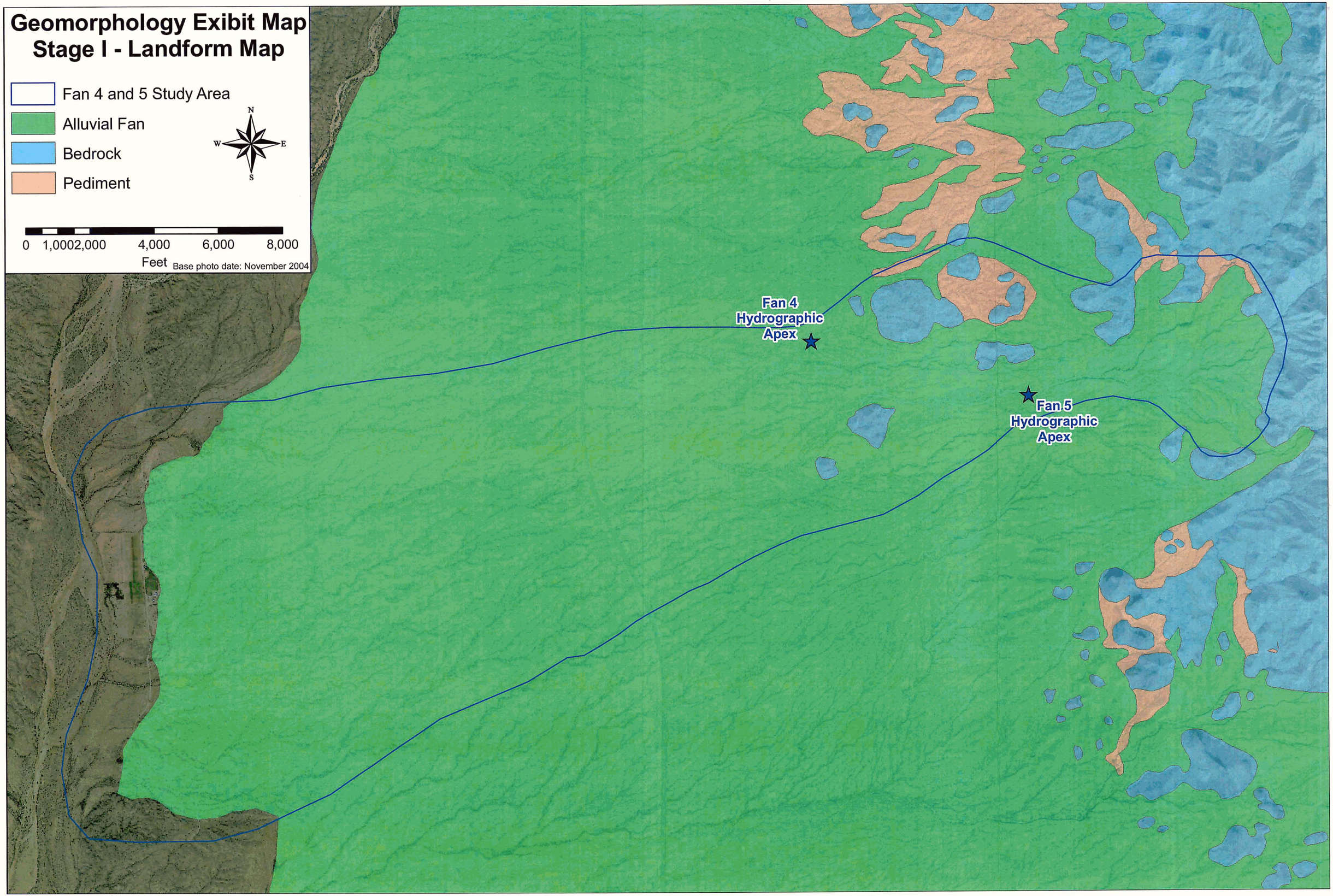
Feet
0 1,000 2,000 3,000

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

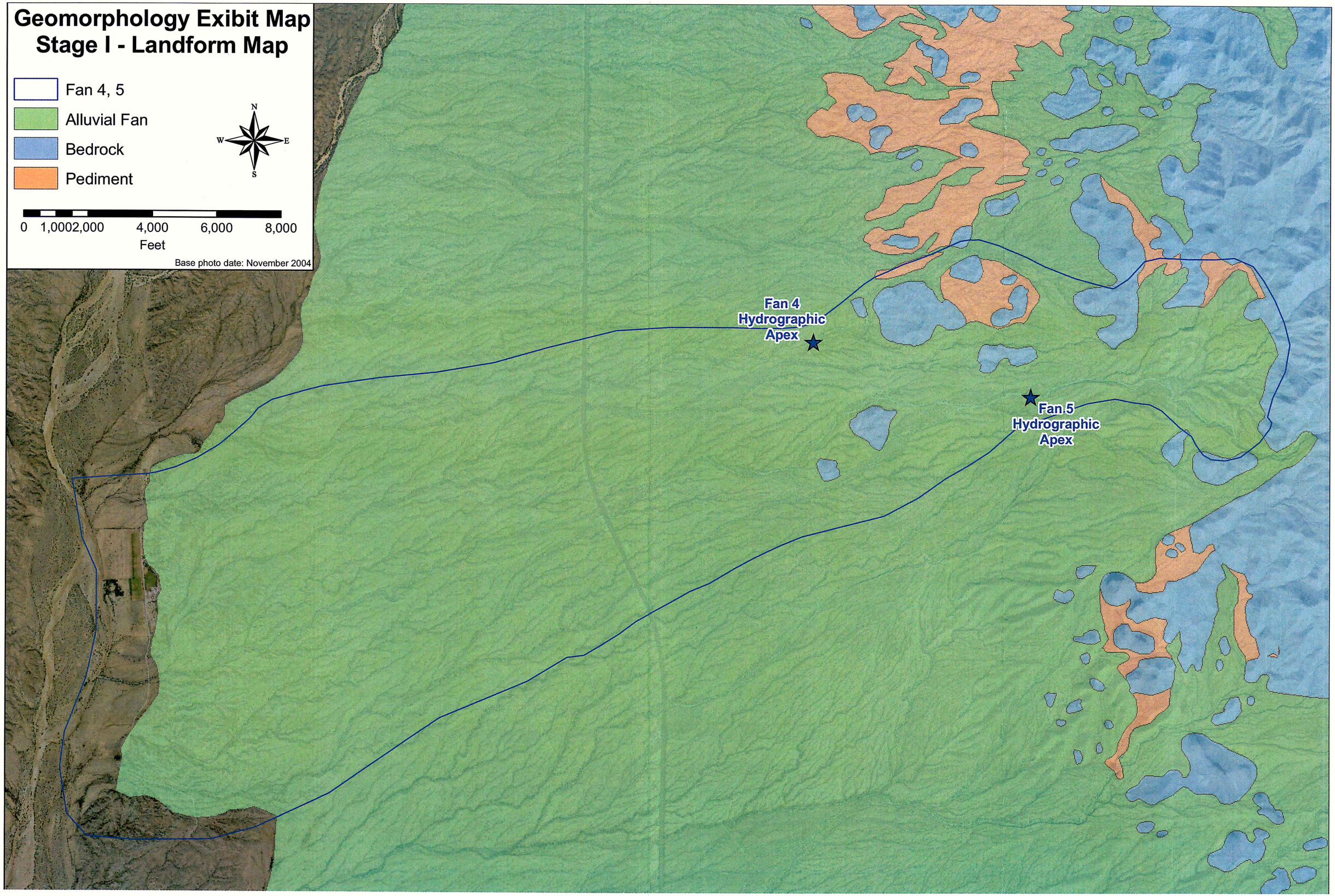
EXHIBIT B

GEOMORPHOLOGY EXHIBIT MAPS

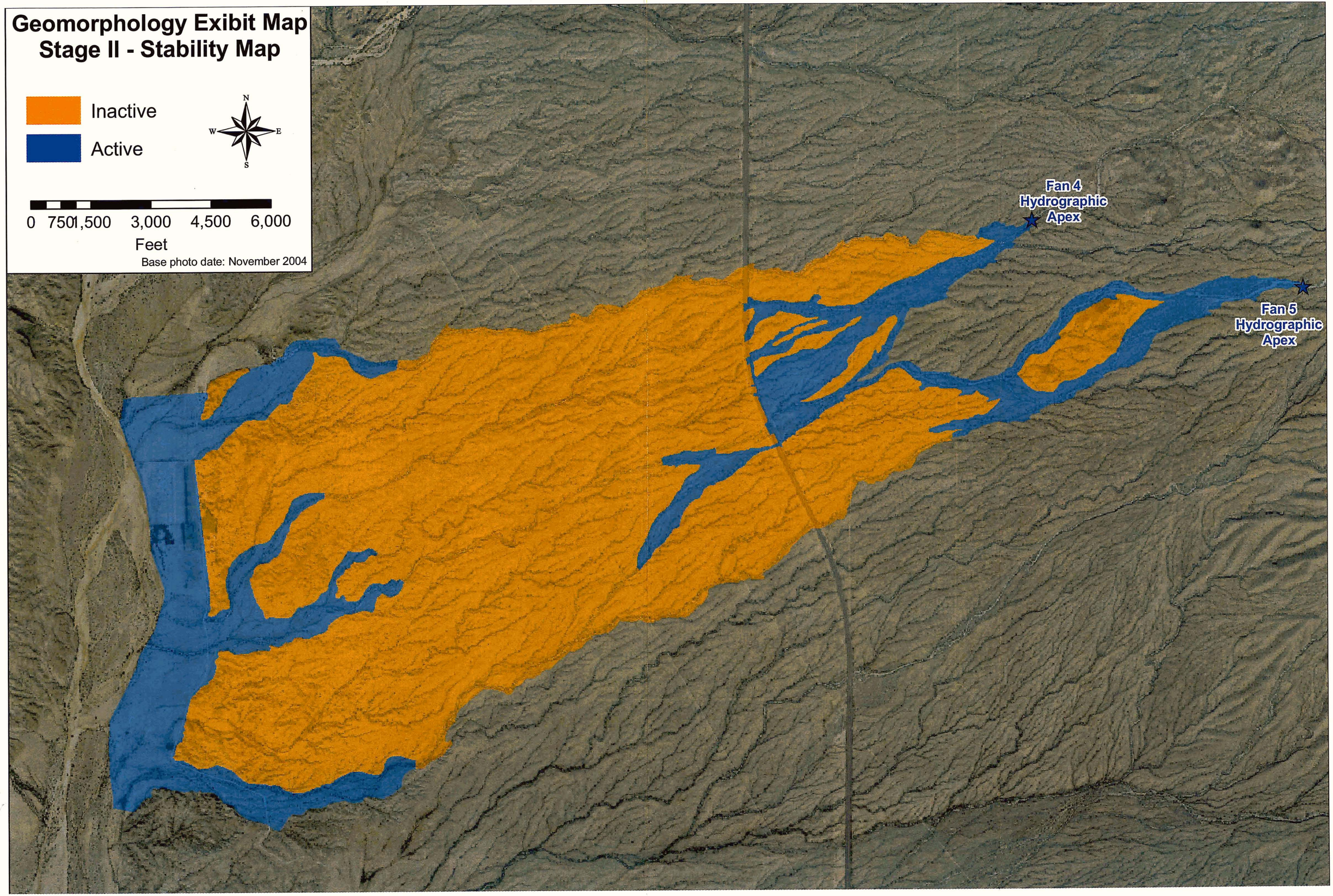
Geomorphology Exibit Map
Stage I - Landform Map



Geomorphology Exibit Map
Stage I - Landform Map



Geomorphology Exibit Map
Stage II - Stability Map



Geomorphology Exibit Map
Stage III - Floodplain Map

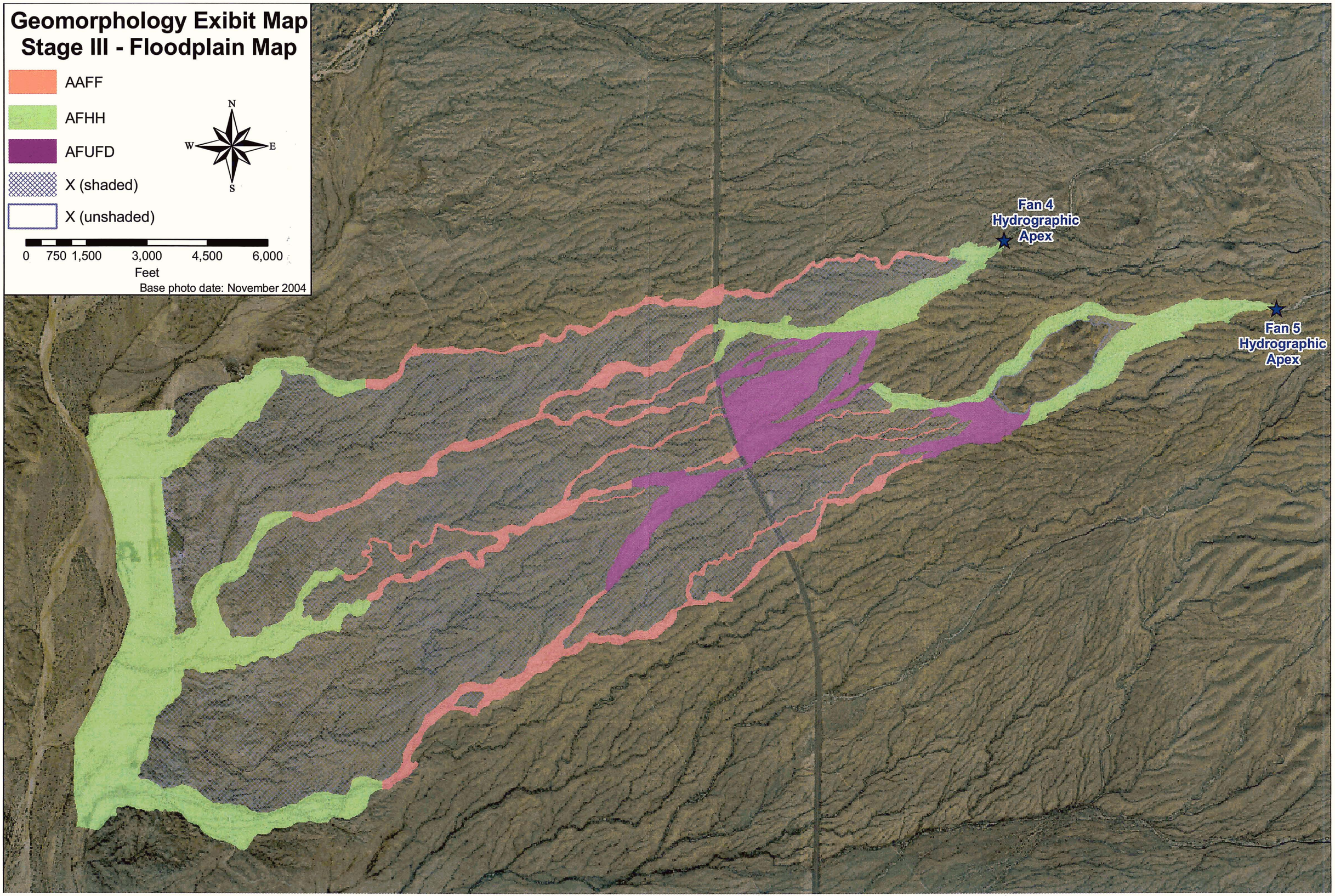
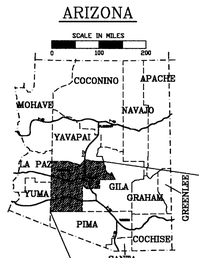


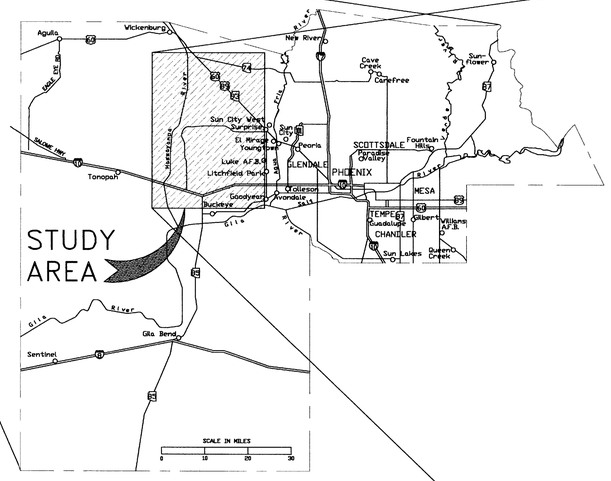
EXHIBIT C

HYDRAULICS STUDY WORK MAPS

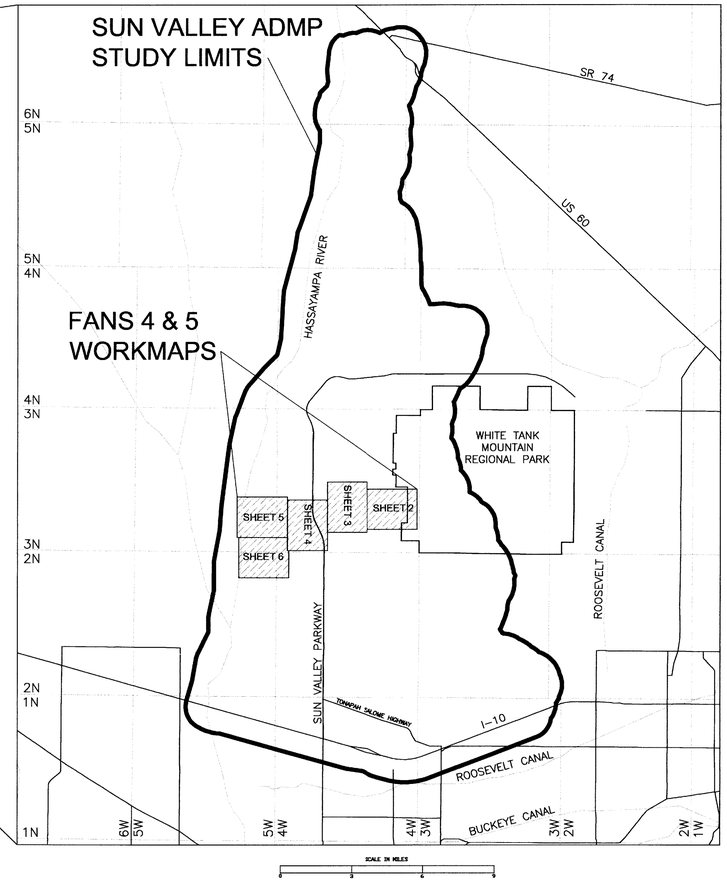
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE FLOODPLAIN DELINEATION STUDY OF THE WHITE TANK MOUNTAIN PIEDMONT FAN SITES 4 & 5 SUN VALLEY AREA DRAINAGE MASTER PLAN, FCD 2004C049





MARICOPA COUNTY



NOTES

1. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
2. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

STATEMENTS OF PROFESSIONAL REGISTRANT

THE FLOODPLAIN DELINEATIONS PRESENTED ON THE FOLLOWING SHEETS WERE PREPARED UNDER MY DIRECT SUPERVISION.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 26846
JONATHAN E. FULLER
Date Signed 11-7-06
ARIZONA, U.S.A.

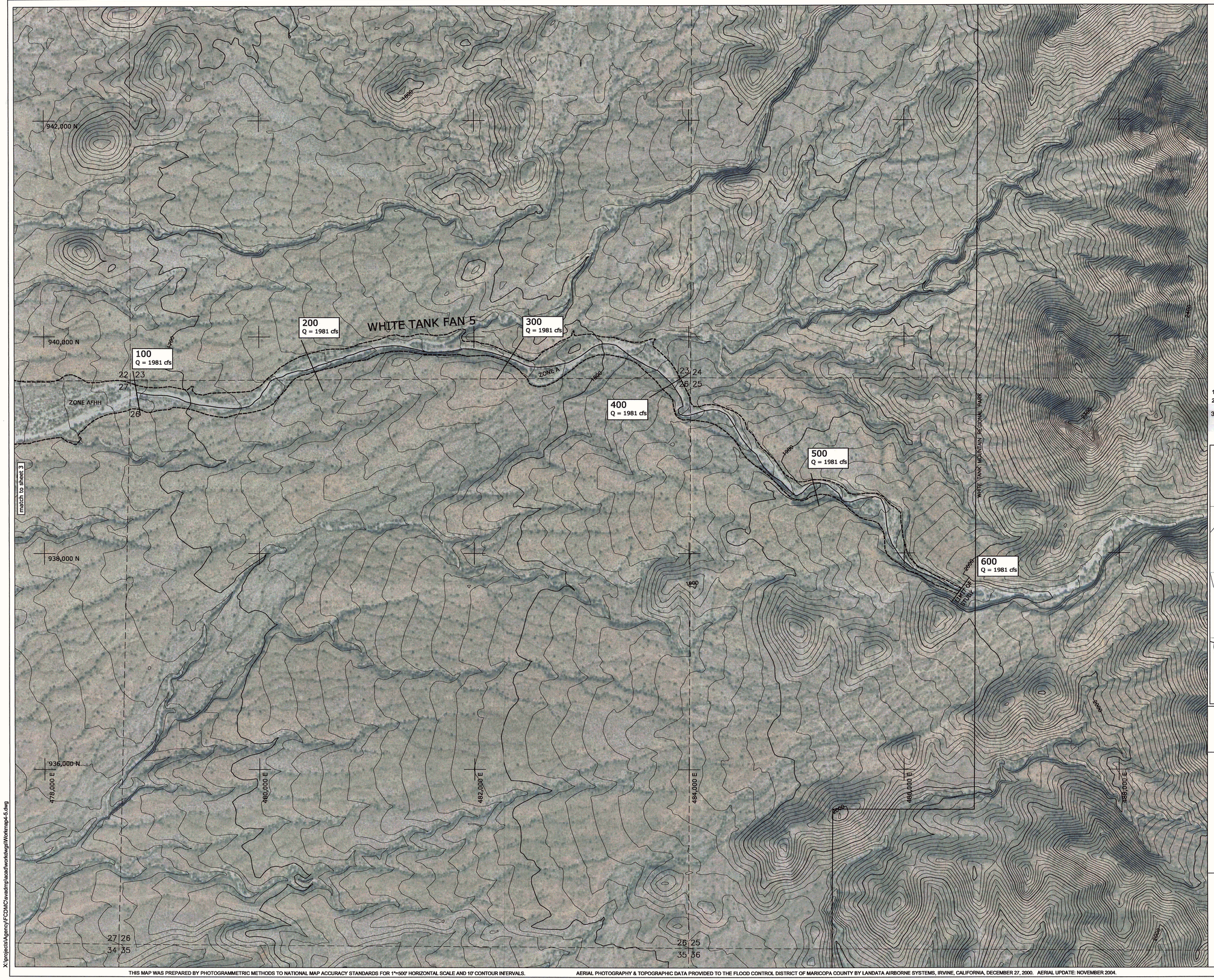
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

N

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-792-2124
FAX: 480-838-2193

INDEX SHEET

NOVEMBER, 2006



LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N / 648,800 E

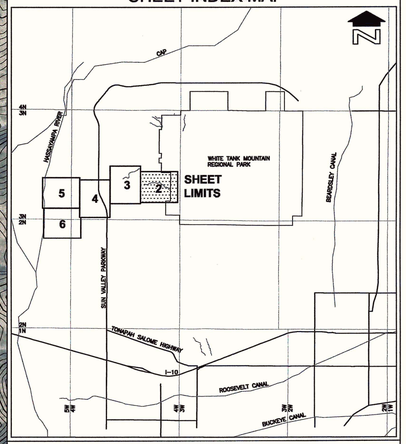
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26846 JONATHAN E. FULLER Date Signed 11-7-07 ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

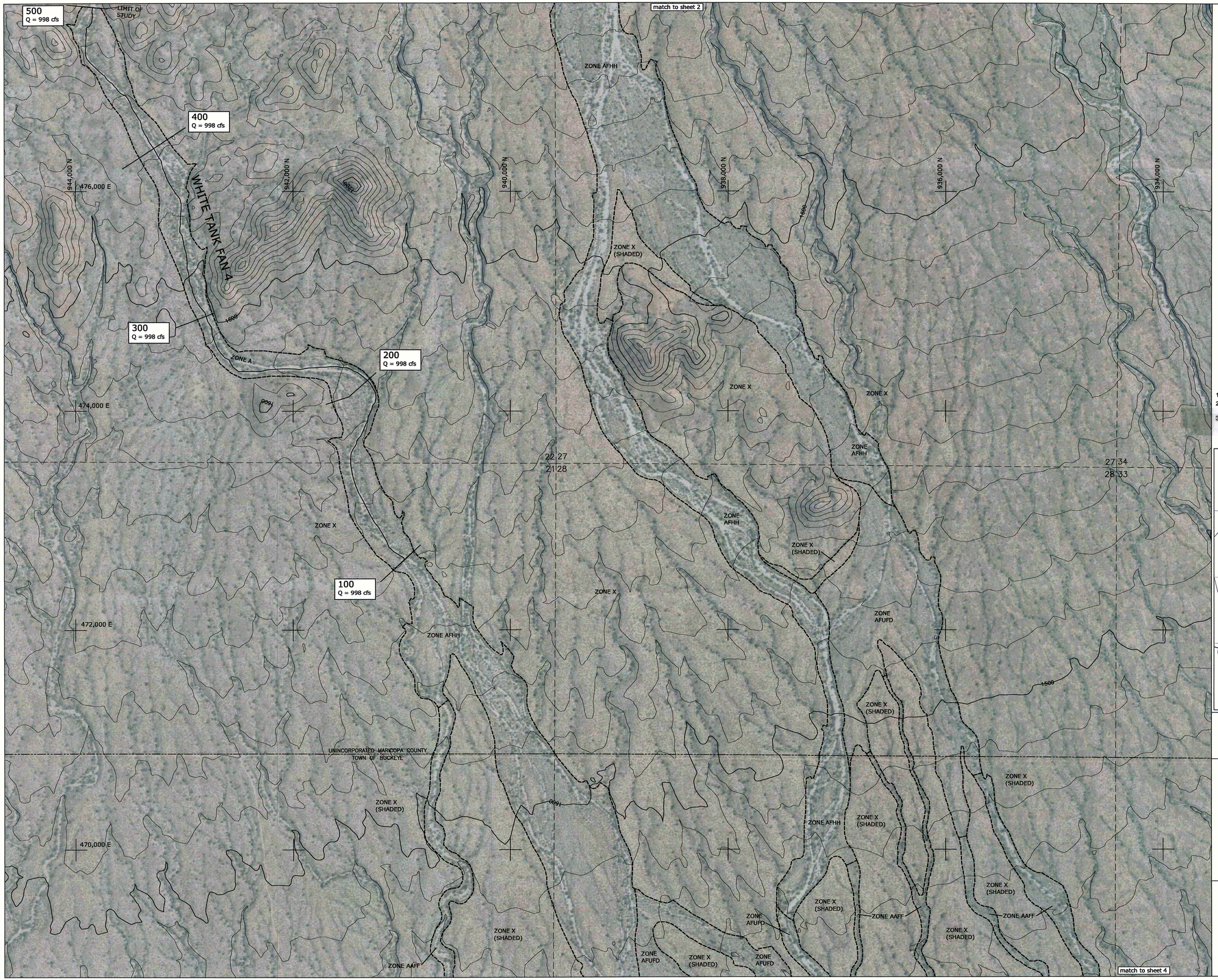
JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-752-2124
FAX: 480-839-2193

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDMC\sevadmp\acad\workdwgs\Workmap4-5.dwg



LEGEND

100-YR FLOODPLAIN
100-YR ADMINISTRATIVE FLOODWAY
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
EFFECTIVE 100-YR FLOODWAY
SECTION BOUNDARY
CROSS SECTION — 200 Q = 595 cfs
CORPORATE LIMITS — Corporate Limits
COUNTY BOUNDARY — County Boundary
STATE PLANE COORDINATES — 1,046,800 N / 648,800 E

ZONE DESIGNATIONS

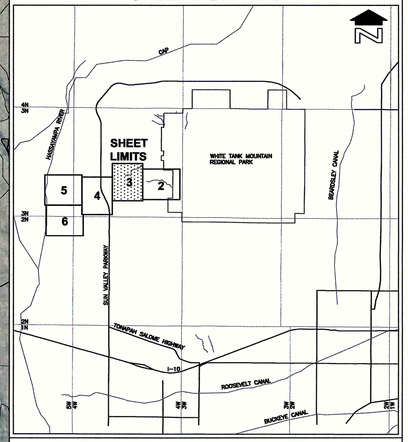
ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

N

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26845 JONATHAN E. FULLER Date Signed 7-13-07 ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-752-2126
FAX: 480-839-3193

SHEET 3 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDMC\sradmp\acad\work\dwg\Workmap4-5.dwg

LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N / 648,800 E

ZONE DESIGNATIONS

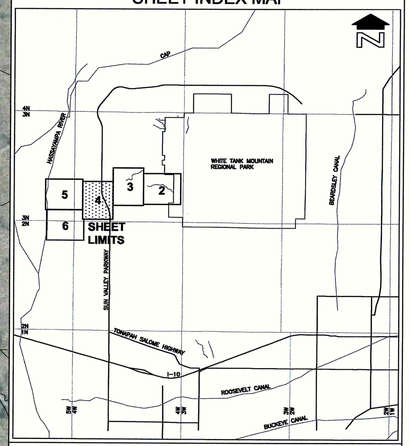
ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

N

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 16 6546 JONATHAN E. FULLER Date Signed 11-2-06 ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-752-6124
FAX: 480-839-2183

SHEET 4 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDMC\sevadmp\acad\workdwgs\Workmap4-5.dwg

LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N / 648,800 E

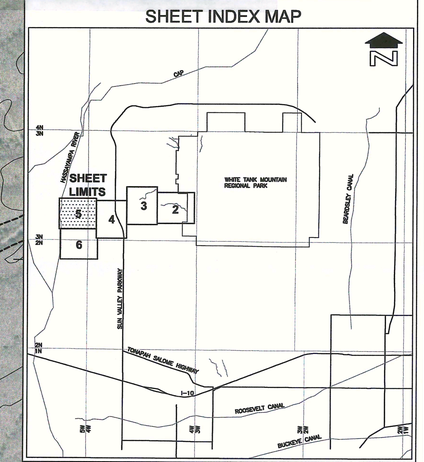
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 28846 JONATHAN E. FULLER Date Signed 11-7-06 ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-752-2124
FAX: 480-839-2183

SHEET 5 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCDMC\svadmp\lacad\workdwgs\Workmap4-5.dwg

LEGEND

100-YR FLOODPLAIN	
100-YR ADMINISTRATIVE FLOODWAY	
EFFECTIVE 100-YR FLOODPLAIN BOUNDARY	
EFFECTIVE 100-YR FLOODWAY	
SECTION BOUNDARY	
CROSS SECTION	200 Q = 595 cfs
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
STATE PLANE COORDINATES	1,046,800 N / 648,800 E

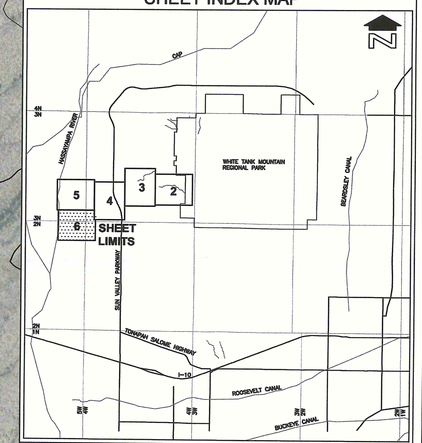
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

4 & 5

FCD 2004CO49
SUN VALLEY
AREA DRAINAGE MASTER PLAN
NOVEMBER, 2006

Registered Professional Engineer (Civil) CERTIFICATE NO. 26846 JONATHAN E. FULLER Date Signed 11-7-06 ARIZONA, U.S.A.

SCALE IN FEET
400' 0' 400' 800'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-752-6126
FAX: 480-839-2193

SHEET 6 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

X:\projects\Agency\FCD\MC\savdmp\acad\work\dwgs\Workmap4-5.dwg

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

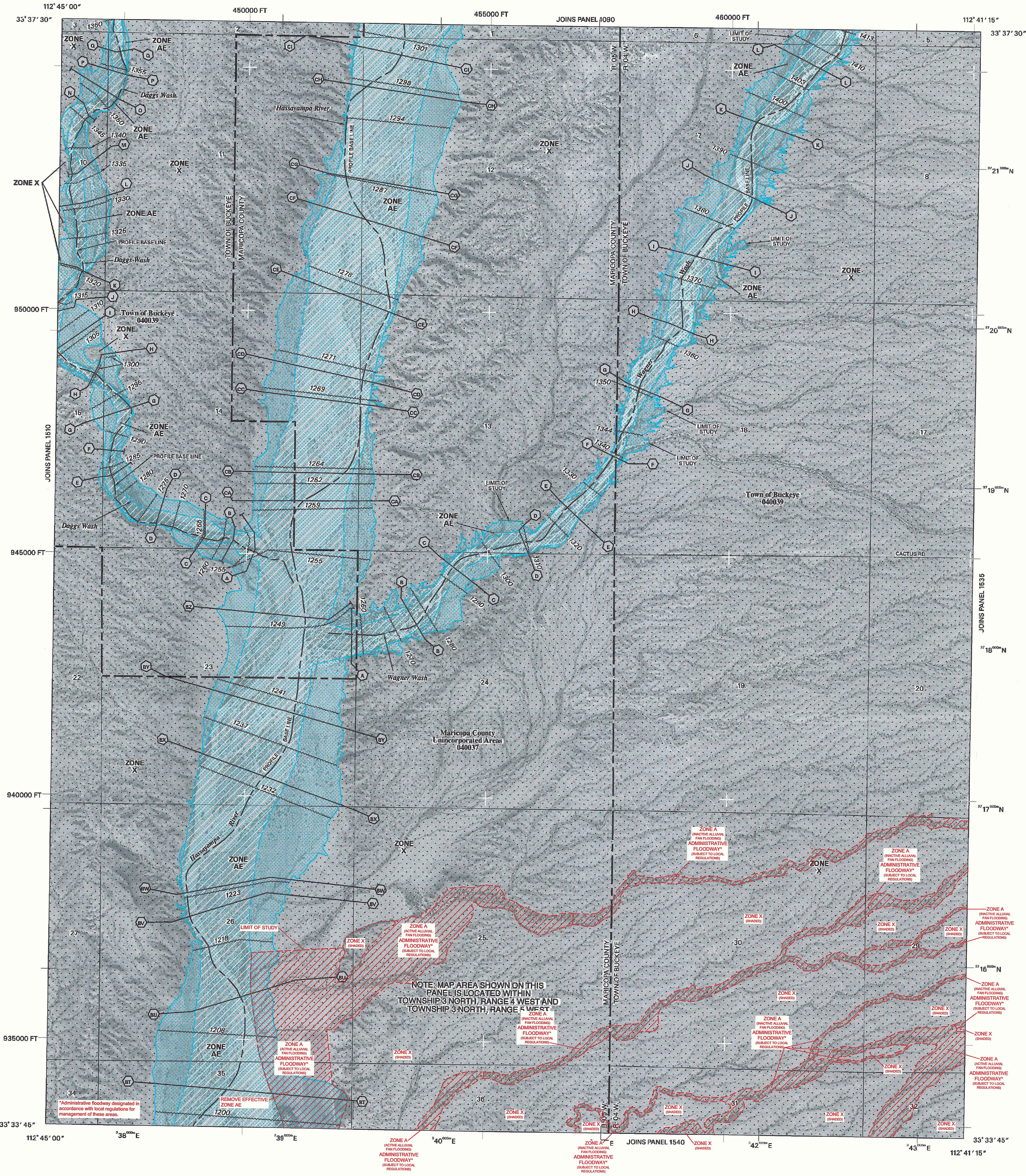
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.

LEGEND FOR ANNOTATION

100-YEAR ADMINISTRATIVE FLOODWAY – – – – –

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC. 2006



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

~~~513~~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)——(A) Cross section line

(2)- - - -(2) Transect line

112° 07′ 08″, 33° 25′ 41″ — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.

42 76 000m E — 1000-meter Universal Transverse Mercator grid tick values zone 12.

875000 FT — 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)

X DV2313 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 — River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, December 3, 1993, September 30, 1995, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1530J

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1530 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	1530	J
MARICOPA COUNTY	040037	1530	J

(ANNOTATED 2006)

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1530J

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency
~~~

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

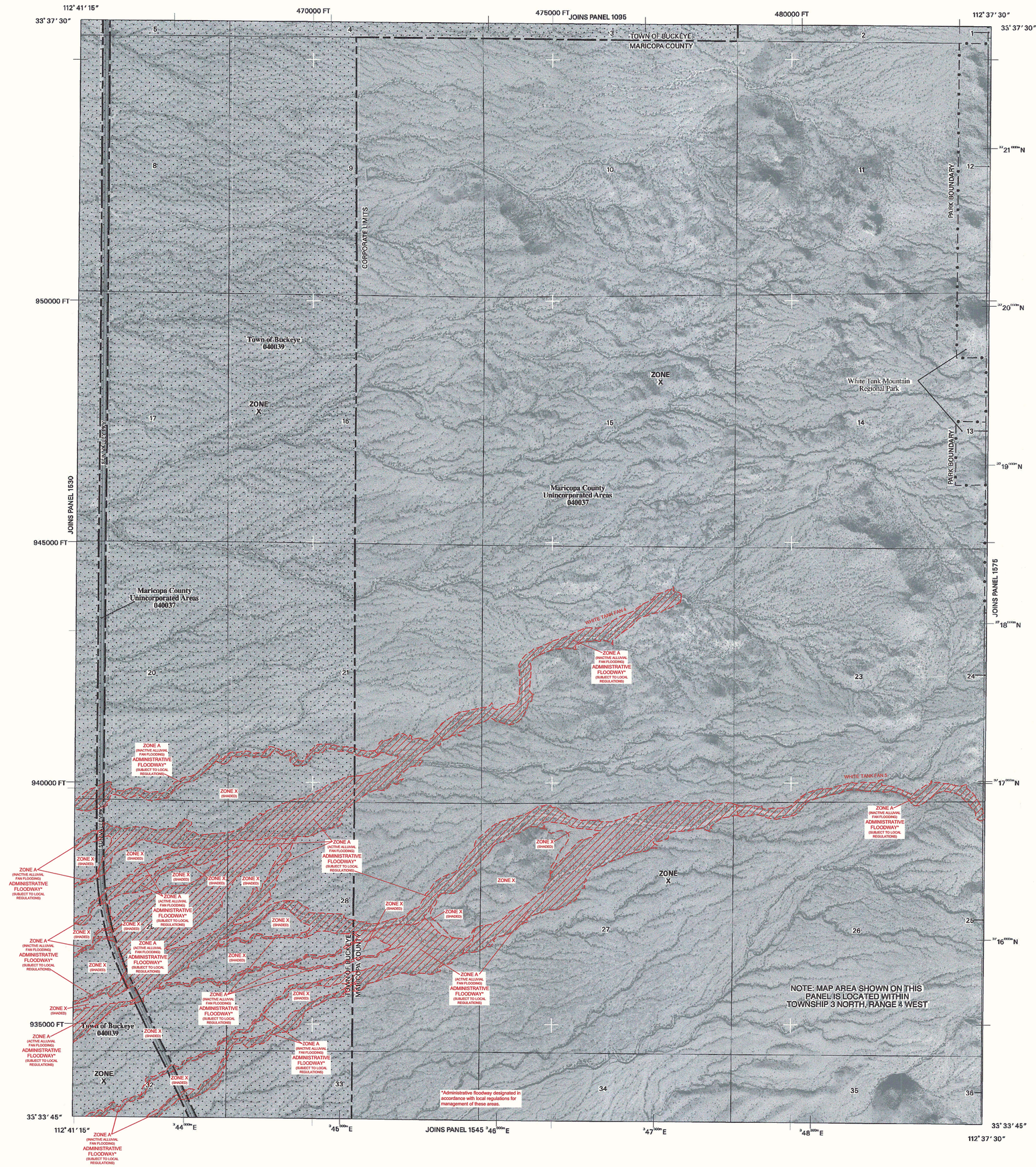
Contact the **FEMA Map Service Center** at **1-800-358-9616** for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/

LEGEND FOR ANNOTATION

100–YEAR ADMINISTRATIVE FLOODWAY - - - - -

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC. 2006



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)——(A)	Cross section line
(2)- - - -(2)	Transect line
112° 07′ 08″, 33° 25′ 41″	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.
76	1000-meter Universal Transverse Mercator grid tick values zone 12.
875000 FT	5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)
×DV2313	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• MILS	River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, December 3, 1993, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1535H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1535 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	1535	H
MARICOPA COUNTY	040037	1535	H

(ANNOTATED 2006)

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1535H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

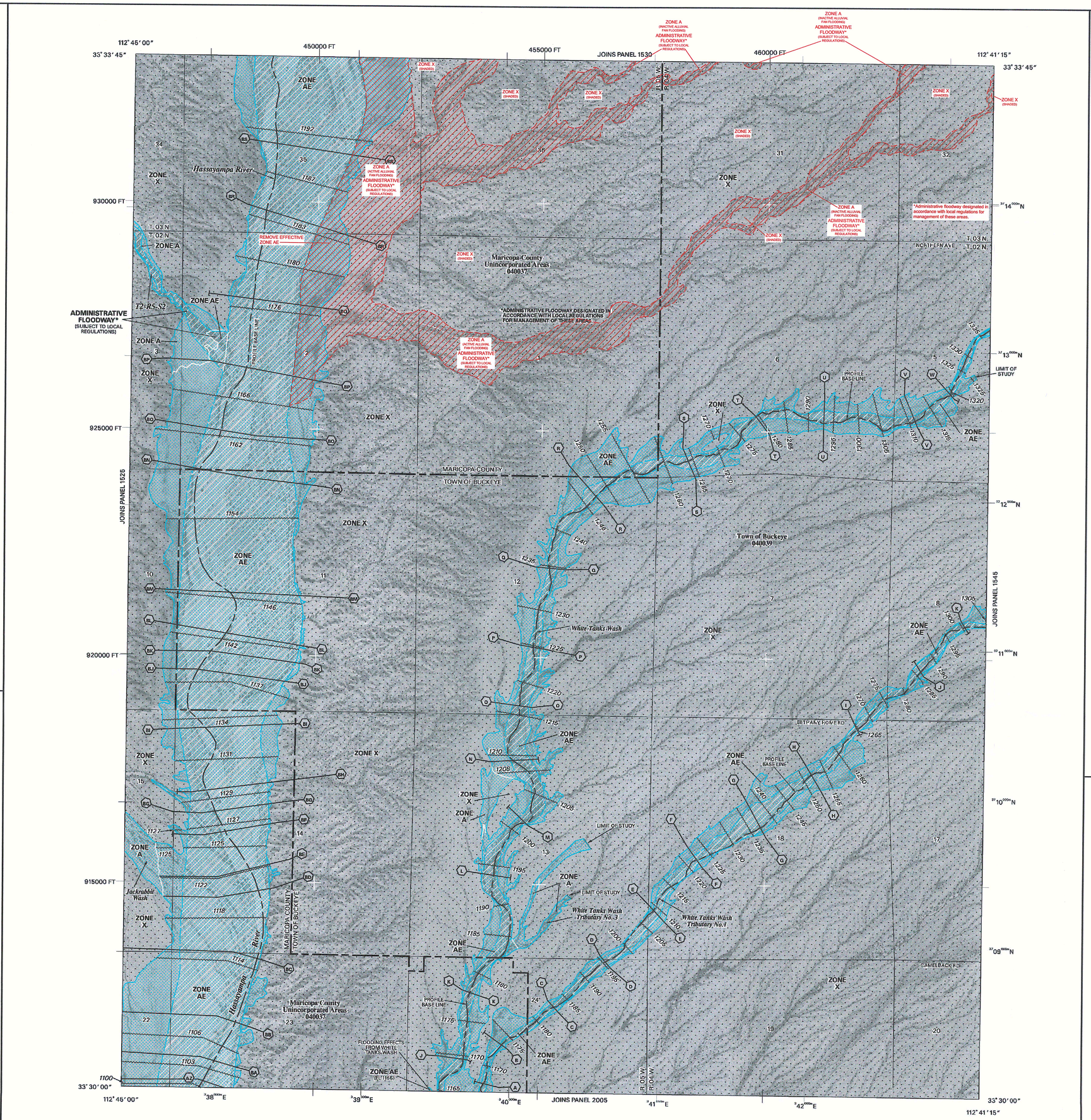
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.

LEGEND FOR ANNOTATION

100-YEAR ADMINISTRATIVE FLOODWAY

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC. 2006



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

~~~513~~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)———(A) Cross section line

(2)- - - -(2) Transect line

112°07'08", 33°25'41" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.

$^{42}76^{000m}$E 1000-meter Universal Transverse Mercator grid tick values zone 12.

875000 FT 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)

×DV2313 Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, December 3, 1993, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1540H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1540 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	1540	H
MARICOPA COUNTY	040037	1540	H

(ANNOTATED 2006)

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1540H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency
~~~

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

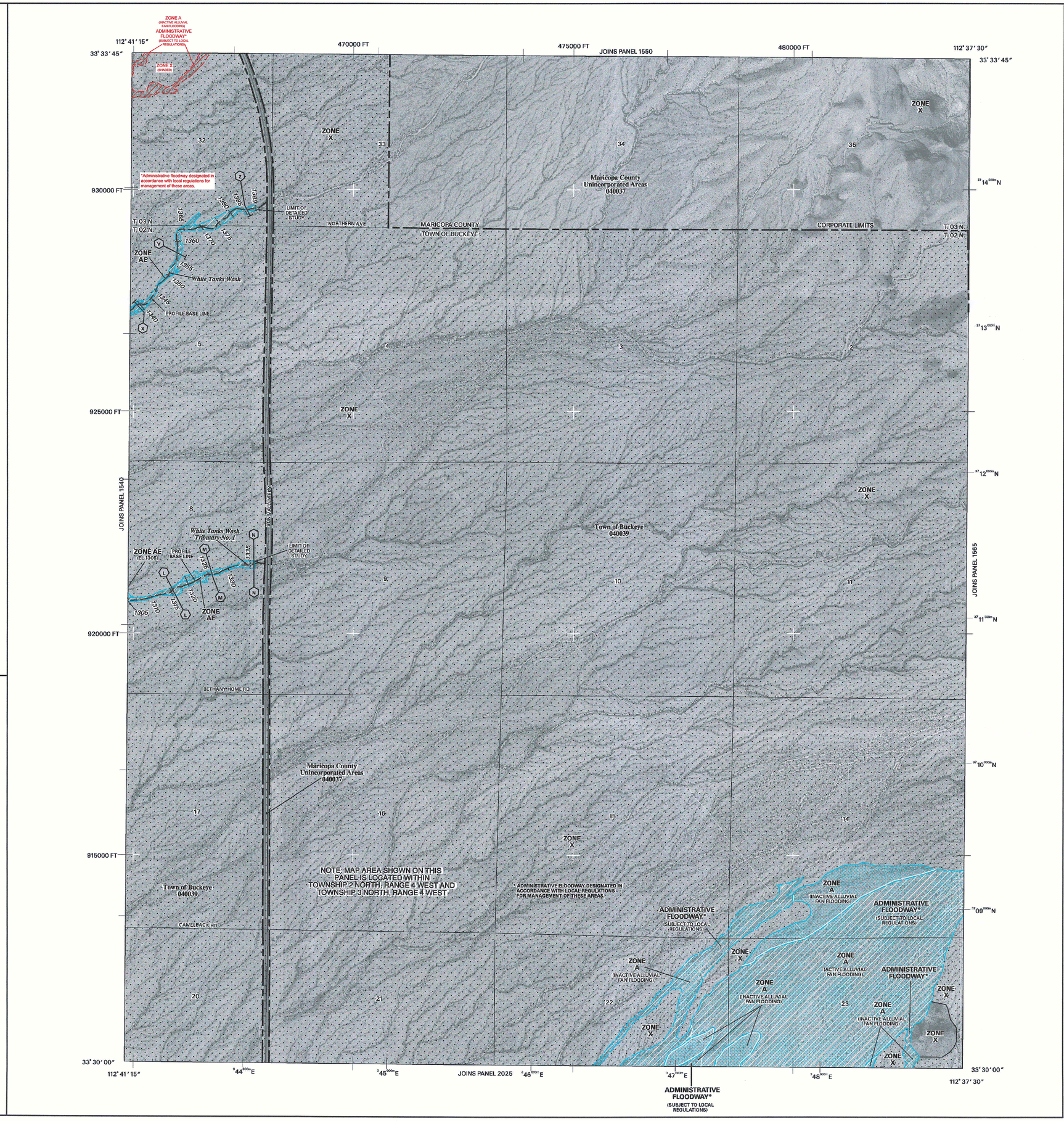
Contact the **FEMA Map Service Center** at **1-800-358-9616** for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

LEGEND FOR ANNOTATION

100-YEAR ADMINISTRATIVE FLOODWAY

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC. — 2006



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)——(A)	Cross section line
(2)- - - -(2)	Transect line
112° 07′ 08″, 33° 25′ 41″	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.
4 76000m E	1000-meter Universal Transverse Mercator grid tick values, zone 12.
875000 FT	5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)
× DV2313	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 16, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, December 3, 1993, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1545H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1545 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	1545	H
MARICOPA COUNTY	040037	1545	H

(ANNOTATED 2006)

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1545H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency