NOT FEMA APPROVED

FLOOD INSURANCE STUDY

APPROXIMATE ZONE A DELINEATION

WHITE TANK MOUNTAIN FOOTHILLS ALLUVIAL FAN 39

TECHNICAL DATA NOTEBOOK

December 2007

Prepared For:
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, AZ 85009

Prepared By:
CMX, LLC
7740 North 16th Street, Suite 100
Phoenix, AZ 85020
Phone: 602.567.1900
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NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

February 27, 2009

Mr. Kevin Kammerzell, P.E.
Director, Water Resources
CMX, LLC
7740 North 16th Street, Suite 100
Phoenix, AZ 85020

IN REPLY REFER TO:
Case No.: 09-09-0371P
Community: Town of Buckeye, AZ
Community No.: 040039

316-AD

Dear Mr. Kammerzell:

This is in regard to your request received on December 1, 2008, 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:	White Tank Mountain Foothills Alluvial Fan 39, Approximate Floodplain Delineation Study
Flooding Source:	White Tank Mountain Foothills Alluvial Fan 39
FIRM Panel(s) Affected:	04013C1545 H and 1540 H

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the flat review and processing fee for requests of this type established by the current fee schedule. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register,* is enclosed for your information.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data/fee **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited for any request for which the requested data are not received within 90 days.

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). If you have specific questions concerning your request, please contact your case reviewer, Mr. Zhengang Wang, P.E., CFM, by e-mail at zhengang.wang@mapmodteam.com or by telephone at

(703) 960-8800, extension 3006, or the Revisions Coordinator for your State, Mounir Boudjemaa, M.S., by e-mail at mounir.boudjemaa@mapmodteam.com or by telephone at (703) 317-6295.

Sincerely,

Syed Qayum

Syed Qayum, CFM
National LOMR Technical Manager
Michael Baker Jr., Inc.

Enclosures

cc: Ms. Jeanine Guy
Town Manager
Town of Buckeye

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

Mr. Brian Cosson, C.F.M.
NFIP Coordinator
Arizona Department of Water Resources

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

Summary of Additional Data Required to Support a
Letter of Map Revision (LOMR)

Case No.: 09-09-0371P

Requester: Mr. Kevin Kammerzell, P.E.

Community: Town of Buckeye, AZ

Community No.: 040039

The issues listed below must be addressed before we can continue the review of your request.

1. Please provide a detailed description and information demonstrating how tributary flows below the apex of White Tank Mountain Fan Site 39 (Fan 39), as well as surface runoff from the fan surface itself, are accounted for in the hydrologic modeling used in the HEC-RAS analyses downstream of Sun Valley Parkway.

2. We determined that the submitted materials didn't provide sufficient documentation to support use of the peak discharges used in the flow corridors. Please use the full apex flow plus any tributary and local surface runoff in each of the flow corridors, revise the split flow modeling, and determine the flow splits. Alternatively, please provide justification for the used discharges.

3. The proposed floodplain delineation shows that the base (1-percent-annual-chance) flood (including any active alluvial fan flooding) is conveyed under Sun Valley Parkway without overtopping. However, the supporting document and calculation for culverts underneath Sun Valley Parkway were not submitted. Please submit the necessary hydraulic modeling for those culverts.

4. Two culverts are located underneath Sun Valley Parkway between the Central West and Southwest-North Corridors, but there are no flow corridors located downstream of these culverts. Please provide an explanation why these culverts were assumed not to convey flow across Sun Valley Parkway.

5. HEC-RAS modeling was used to map the floodplain downstream of Sun Valley Parkway. According to FEMA's Guidelines of Determination Flood Hazards on Alluvial Fan, dated February 23, 2000, riverine modeling techniques (including HEC-RAS) are not appropriate to define the base flood within the active alluvial fan areas. Please use a FEMA-accepted method to delineate the floodplain for the active alluvial fan areas on the downstream of Sun Valley Parkway.

6. In the Central Corridor, the HEC-RAS model shows that flow is not contained along the left end of Section RS 3.09. There is evidence in the aerial photographs that flow has recently broken out of the main channel at the potential split flow locations, Sections RS 3.09 and 3.16. Please map the breakout channels at Sections RS 3.09 and 3.16.

7. Southwest-North Leg includes the inset active fan area (Fan 14 as described in the Technical Data Notebook). In the area of Fan 14, please extend "active" designation to the full width of the floodplain. Alternatively, please provide documentation justifying the narrower active zone.

8. Please provide justification on how Sun Valley Parkway serves as a physical limit to alluvial fan flooding processes.

9. Please submit maps of the Fan 39 landform boundary and soil units.

10. The Technical Data Notebook text suggests an increase in fan stability at elevation 1,400 feet. Please provide justification and further guidance as to the elevation 1,400 feet for the floodplain delineation.

11. Please resubmit MT-2 Form 6 with the "unstable flow path flooding" box checked in Item A.2.f.

12. Please submit an annotated Flood Insurance Rate Map (FIRM), at the scale of the effective FIRM, which shows the base floodplain boundary delineations and how they tie into the boundary delineations shown on the effective FIRM.

Please send the required data directly to us at the address shown at the bottom of the first page. For identification purposes, please include the case number referenced above on all correspondence.

Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: February 21, 2008

To: Timothy S. Phillips, P.E., Chief Engineer and General Manager TSP 3/4/08

From: Kathryn Gross, CFM, Planning and Project Management Division

Subject: White Tank Alluvial Fan 39 Floodplain Delineation, performed by CMX

The floodplain study for White Tank Fan 39 is ready for use as the best available technical information. The study will be sent to FEMA shortly once the District and Town of Buckeye sign the FEMA forms.

The background on the study includes the following:

> The study was performed by CMX and was not under a District contract. CMX- and the developer to whom they are contracted- are stakeholders in the Buckeye/Sun Valley Area Drainage Master Study and Area Drainage Master Plan. The developers in the area were required to delineate the alluvial fan flood hazards impacting their properties when they chose not to wait for the District to perform the delineations as part of the Sun Valley Area Drainage Master Plan. This submittal represents the full delineation of White Tank Fan 39. The study includes approximately 1.5 square miles of Zone A Alluvial Fan Floodplains and Alluvial Fan Administrative Floodways. The delineation was performed using geomorphic methods. The District contracted with JEFuller Hydrology and Geomorphology to perform the reviews through an on-call contract.

Please concur and authorize below the use of this new study.

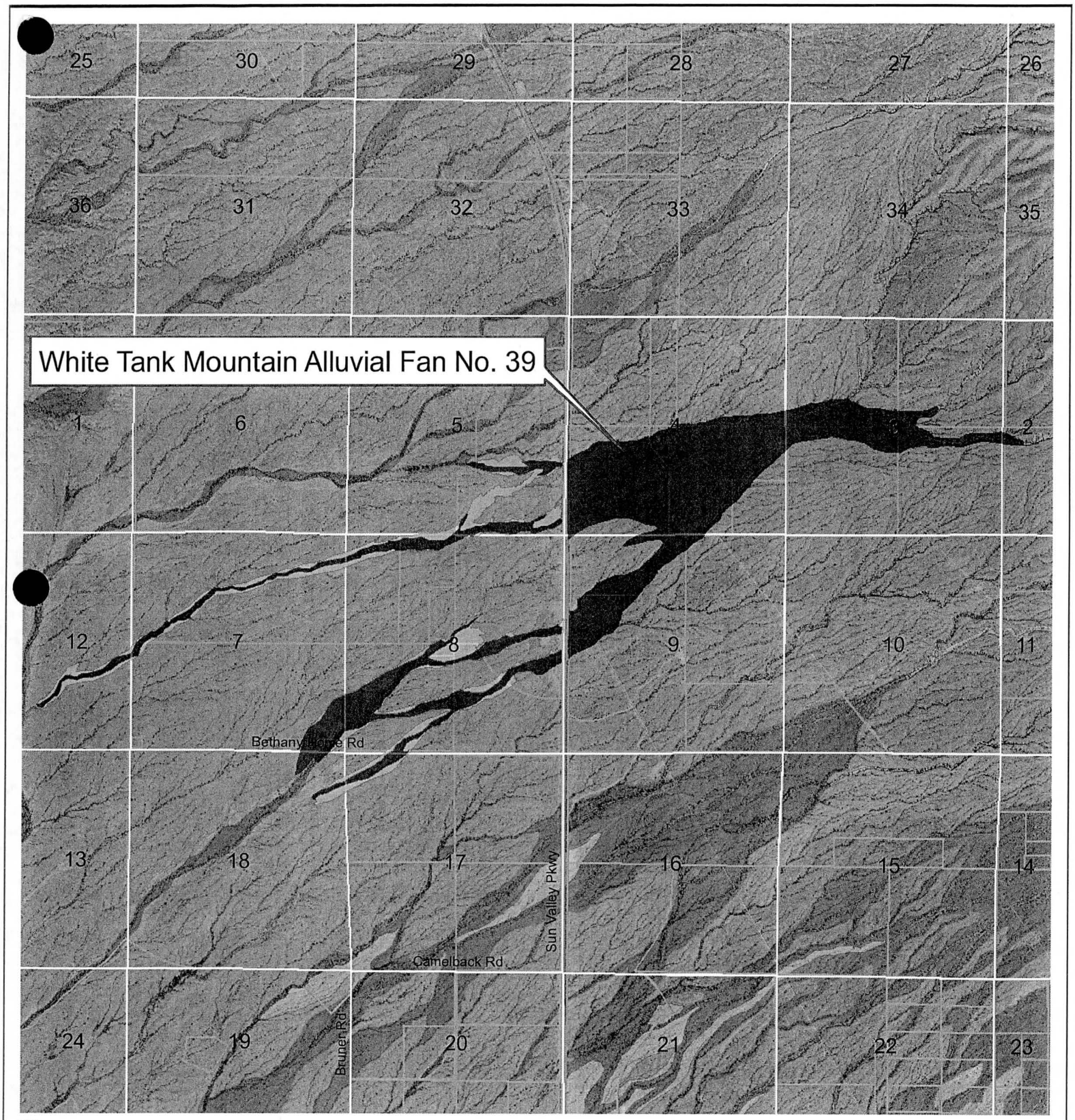
Lynn M. Thomas Principal Engineer, FMS Division Date: 2/25/08	3/4/08 Timothy S. Phillips, P.E. Date: Chief Engineer and General Manager
2/21/08 Floodplain Delineation Review Coordinator Date:	Valerie A. Swick 2/21/08 SVADMP/On-call Review Project Manager Date:
2/21/08 Flood Delineation Branch Manager Date:	FEB 21 2008 Planning Branch Manager Date:
2/25/08 FMS Division Manager	2.28.08 PPM Division Manager Date:
	Assistant Project Manager N/A Date:

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

File Copies: 1. _____ 2. _____	YES ☒ GIS Posted (Pending Floodplain Only) in process Date: N/A ☐ No County Permits in this area Date:

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

White Tank Mountain Alluvial Fan No. 39
Approximate Zone A Alluvial Fan Floodplains and Administrative Floodways



N
W E
S

Zone A - Alluvial Fan Floodplains are shown in light blue
Zone A - Alluvial Fan Administrative Floodways are shown in dark blue

Legend
- arterial
- street
- parcel

FLOOD INSURANCE STUDY

APPROXIMATE ZONE A DELINEATION

WHITE TANK MOUNTAIN FOOTHILLS ALLUVIAL FAN 39

TECHNICAL DATA NOTEBOOK

Prepared For:
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
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December 2007
CMX Project No. 6359.63

APPROXIMATE ZONE A DELINEATION
FOR
WHITE TANK MOUNTAIN FOOTHILLS
ALLUVIAL FAN 39

Registered Professional Engineer (Civil)
CERTIFICATE NO.
35050
KEVIN C.
KAMMERZELL
Date Signed
ARIZONA, U.S.A.

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1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this floodplain delineation study is to identify and delineate the 100-year floodplain for portions of the watershed tributary to White Tanks Wash in T2N, R4W and T2N, R5W of the Salt and Gila River Base and Meridian, Maricopa County, Arizona. This study focuses on delineation of Alluvial Fan #39 as originally identified by the USGS Water Resources Investigations Report #91-4171, Flood Hazards of Distributary Flow Areas in Southwestern Arizona (Hjalmarson, H.W. and S.P. Kemma, 1991) from the hydrographic apex of the alluvial fan to the White Tanks Wash a tributary to the Hassayampa River.

1.2 Authority for Study

CMX, LLC (CMX) was contracted by a consortium of private developers actively developing portions of land west of the White Tank Mountains. Most of the region has limited flood hazard mapping because of the limited development activity. Since 2000, several developments have been initiated on the western slope of the White Tank Mountains. To support the Flood Control District of Maricopa County (FCDMC), the developer consortium funded the study of the several washes and alluvial fan formations east of the Hassayampa River, north of Interstate 10, South of Wagner Wash, and west of the White Tank Mountains.

1.3 Location of Study Reach

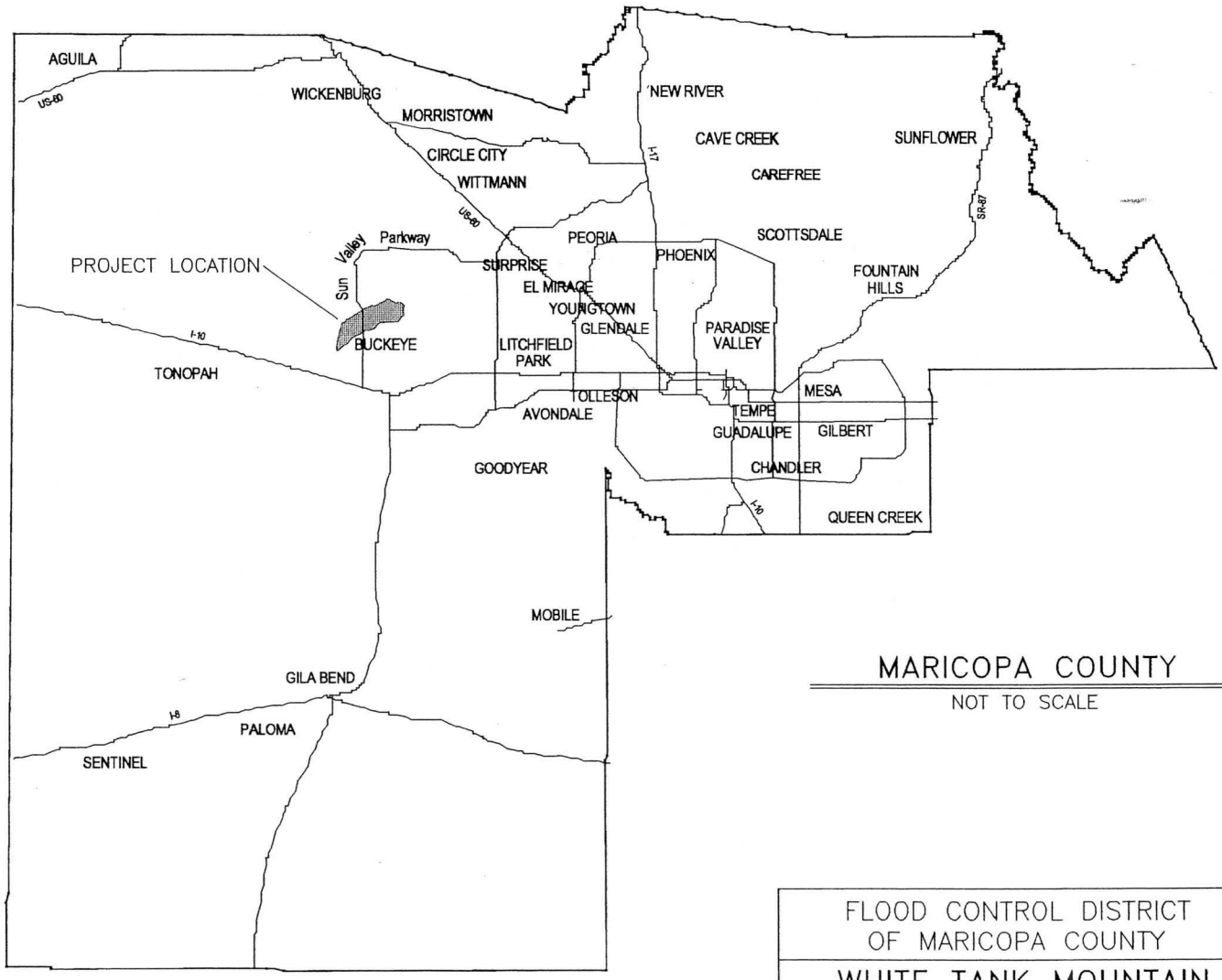
The study area lies in western Maricopa County, within the Town of Buckeye city limits. Alluvial Fan 39 has formed in the desert piedmont between the western slopes of the White Tank Mountains, and the base level discharge point White Tanks Wash. Specifically, the study area falls within a part of Township 2 North, Range 4 West, Sections 1-9 and 18, as well as Township 2 North, Range 5 West, Sections 1, 12, 13, and 24. This study encompasses approximately 5.3 square miles that will be delineated. The vicinity map, Figure 1, illustrates where the study area falls within Maricopa County.

The Fan 39 study area lies on the piedmont surface between the White Tank Mountains and the White Tanks Wash. The storm water runoff affecting this area originates from the western slopes of the White Tank Mountains. Runoff from this mountainous terrain combines with runoff from the alluvial plain below. This runoff is conveyed across Fan 39 within a system of rivulets, and braided washes. These flows are carried in a southwesterly direction and collected in White Tanks Wash. White Tanks Wash discharges north of Interstate 10 into Flood Retarding Structure (FRS) No. 1 operated by the FCDMC. Flow intercepted by FRS No. 1 is discharged westward along the north side of Interstate 10 and is eventually conveyed into the Hassayampa River.

The climate in the study area is semi-arid desert with an average annual precipitation less than 10-inches. Annual rainfall amounts generally increase with elevation within watersheds near the study area. Precipitation is typically divided between two seasons with comparable rainfall amounts: summer and

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A DELINEATION STUDY



MARICOPA COUNTY

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANK MOUNTAIN ALLUVIAL FAN 39

APPROXIMATE ZONE "A" DELINEATION STUDY

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FIG 1: VICINITY MAP

winter. The 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 amounts over relatively large areas. A third source of significant precipitation is from dissipating tropical storm and or remnants of hurricanes. These storms generally occur in late September and early October. These dissipating storms generate moderate to high rainfall intensities which may last for many hours.

1.4 Methodology

This study has been prepared using approximate methods and incorporates procedures for assessment of piedmont flood hazards as outlined in the *Piedmont Flood Hazard Assessment Manual for Maricopa County* (Hjalmarson, 1998) and the *Guidelines and Specifications for Flood Hazard Mapping Partners* (FEMA, February 2002).

Downstream from the active portion of Alluvial Fan 39, riverine methodologies were used to approximate the flood hazard area extending to the effective White Tanks Wash Zone AE (See Figures 6.1, 6.2). The approximate delineation for this reach was supplemented by interpretation of geomorphic information from maps, aerial photographs, field observation, and review of regional studies prepared by others.

Several significant studies pertaining to the western slopes of the White Tank Mountains have been produced (or are in production) for areas in close proximity to Alluvial Fan 39. The following summarizes the focus of each report and general conclusions therein:

Arizona Geological Surveys

The Arizona Geological Survey in cooperation with the Arizona Department of Water Resources prepared several regional studies to identify surficial geologic and geomorphologic formations on the Western Slopes of the White Tank Mountains. The studies identified age of alluvial deposits through surface characteristics such as microbial formation of desert pavement, depth of dissection, calcic horizon development, and vegetation (See Figure 4).

The studies prepared by Field and Pearthree (1991, 1992) suggested that Holocene age deposits provide record of historic flows and could provide a map limit of probable flood hazard risk on the piedmont surface between the White Tank Mountains and the Hassayampa River.

White Tanks Wash Flood Insurance Study

This study entitled "White Tanks Wash Flood Insurance Study" was produced by Alpha Engineering in January 1994 under contract to the FCDMC. The study results were approved by the Federal Emergency Management Agency (FEMA) and represent the effective floodplain delineation for the White Tanks Wash which is considered the discharge point for all reaches of Alluvial Fan 39.

During the preparation of this report, hydrologic and hydraulic parameters were established for the 100-year, 6-hour and 100-year, 24-hour return interval and duration storm events.

For the study area, The White Tanks Wash and a stream designated as "Tributary No. 1" were studied by detailed methods. A flood hazard zone "AE" was designated for this wash and submitted to FEMA. The watersheds used to determine the flow in the washes extend across Fan 39 to the White Tank Mountains. The delineated portions of these washes serve as the western boundary of this approximate Zone A study.

Buckeye/Sun Valley Area Master Drainage Study

PBS&J, under contract with the Flood Control District of Maricopa County, has prepared an area drainage master study (ADMS –2005) for the Buckeye area with a focus on tributaries to the Buckeye Flood Retarding Structures (FRS). These FRS structures lie south of the White Tank Mountains and north of Interstate 10. PBS&J was contracted by the FCDMC to determine the baseline hydrology and hydraulics of the watersheds tributary to FRS #1, 2, and 3. Part of this study was to identify alluvial fan landforms and assess stability of the active and inactive fan formations in the study area to assist pending development in the identification of flood hazards in a largely unpopulated and subsequently unstudied (or limited study) area of Maricopa County.

In accordance with the FCDMC contract, the Buckeye/ Sun Valley ADMS provided the hydrologic information used for the Fan 39 approximate Zone A study. The 100-year, 24-hour peak flow rates were used to designate flow rates at the hydrographic apex of the Alluvial Fan 39 and other flow concentration points downstream. The 100-year, 6-hour was also considered, but found to produce lower peak flow rates at critical hydrologic points, namely at the fan apex. The flow paths within Fan 39 were then identified and named based on a system of "thalwegs" (see Figure 2 for thalweg names).

2.0 ADWR/ FEMA FORMS

This section includes Study Abstracts, for FEMA submittals documented in State Standard SSA1-97, and in the FEMA MT-2 forms (See forms at the back of the text).

3.0 SURVEY AND MAPPING INFORMATION

3.1 Field Survey Information

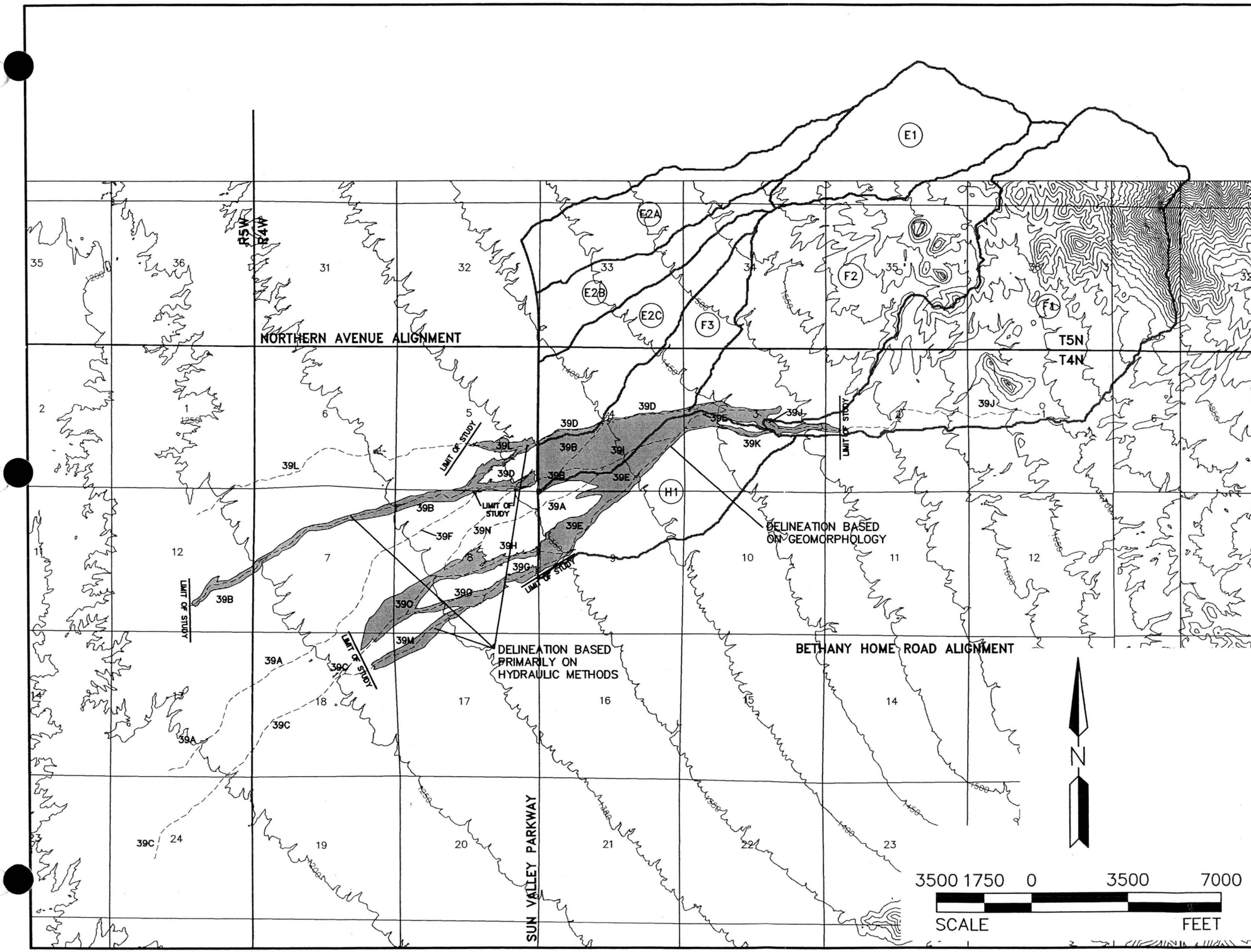
To estimate the Manning's roughness characteristics for representative cross sections, investigate the condition of existing culverts, and document potential flow splits/ junctions within the approximate Zone A study area field studies were executed by CMX. These field visits took place in the months of September and October of 2004 and February of 2005. During these visits geometric data of the wash corridors was verified with the use of hand-held GPS units, hand levels, and measuring tape.

3.2 Mapping

Ten-foot contour interval digital topographic mapping of the study area was provided by the FCDMC as part of this FIS contract, and was used for the approximate Zone A study area. Where available, more detailed topography was used to improve resolution of wash corridors and distributary flow areas. One-foot contour data was used to supplement the ten-foot mapping in the area surrounding Sun Valley Parkway's junction with Fan 39. Additional mapping was obtained for Sun Valley Parkway to detail pavement dimensions, culvert dimensions and overall configuration. The following table provides a summary of the topographic data used for this study:

WHITE TANK MOUNTAIN ALLUVIAL FAN 39 APPROXIMATE ZONE A STUDY
SUMMARY OF TOPOGRAPHIC DATA

Topographic ID, Type & Use	Source Organization	Source Date	Contact	Spatial Reference		
				Horizontal	Vertical	Notes
1-Foot Topographic Contour Data -Used for hydraulic analysis of Fan 39 (including flow splits) between the hydrographic apex and ½ mile downstream of Sun Valley Parkway	Kenney Aerial Mapping	2001	Kenney Aerial Mapping (602) 258-6471	State Plane NAD 83, (Arizona Central) International Foot	NGS Data. PID AJ3842, Designation -4DH1, Elevation 1287.30 per NGS Datum NAVD88	The benchmark used to establish the coordinate system for the property was a National Geodetic Survey Station ¾ " aluminum cap on a 14 foot stainless steel rod encased in a 1-inch PVC Sleeve enclosed in a 5-inch PVC pipe with a county logo access cover surrounded with a concrete collar flush with the ground.
ALTA/ACSM Land Title Survey Sun Valley South -Used as as-built data for the hydraulic analysis of Sun Valley Parkway's culverts	DEI Professional Services, LLC	April 2006	Jason Kack (602) 944-8605	State Plane NAD 83, (Arizona Central) International Foot	NGS Data. PID AJ3842, Designation -4DH1, Elevation 1287.30 per NGS Datum NAVD88	The benchmark used to establish the coordinate system for the property was a National Geodetic Survey Station ¾ " aluminum cap on a 14 foot stainless steel rod encased in a 1-inch PVC Sleeve enclosed in a 5-inch PVC pipe with a county logo access cover surrounded with a concrete collar flush
10-Foot Topographic Contour Data -Used for hydraulic analysis of Fan 39 from ½ mile downstream of Sun Valley Parkway to Effective Zone AE boundary for White Tanks Wash	Flood Control District of Maricopa County	December 2000	Eric Feldman (602 506-1501	State Plane NAD 83, (Arizona Central) International Foot	NAVD88	



LEGEND

ADMS DRAINAGE AREA BOUNDARIES

APPROXIMATE ZONE "A"

THALWEG AND LABEL — 39I

DRAINAGE LABEL — E1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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FIG 2: LOCATION MAP	1 of 1
CMX PROJ.	6359.63
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4.0 HYDROLOGY

4.1 Method Description

The study area for the Approximate Zone A Floodplain Delineation Study lies in western Maricopa County, near the town of Buckeye. Fan 39 has formed in the desert piedmont between the western slopes of the White Tank Mountains, and the base level discharge point, White Tanks Wash. The vicinity map, Figure 1, illustrates where the study area falls within Maricopa County and Figure 2 displays Fan 39's flow path names.

The study area falls within the Buckeye/ Sun Valley ADMS, which was prepared by PBS & J in 2005 under contract with the FCDMC. The focus of the ADMS was placed on tributaries to the Buckeye Flood Retarding Structures (FRS). These FRS structures lie south of the White Tank Mountains and north of Interstate 10. Through the ADMS PBS&J determined the baseline hydrology and hydraulics of the watersheds tributary to FRS #1, 2, and 3, of which Fan 39 is a part. Additionally, this study was designed to identify alluvial fan landforms and assess stability of the active and inactive fan formations in the study area to assist pending development in the identification of flood hazards in a largely unpopulated and subsequently unstudied (or limited study) area of Maricopa County.

As part of the Buckeye/ Sun Valley ADMS the peak 100-year, 24-hour peak flow at Fan 39's apex was determined. The peak apex flow is considered to be the total peak flow contained within Fan 39 between the apex and the western limit of this study, the approved White Tanks Wash Zone AE (See Figure 7, Appendix D). The 100-year, 6-hour storm was also considered, but found to produce lower peak flow rates at critical points within the Fan 39 watershed. Output from both the 100-year 6 and 24-hour models is provided in Appendix D.

The following information summarizes the hydrologic methodology utilized in the ADMS. Further explanation of the methodology may be found within the Buckeye/ Sun Valley ADMS final reports.

Hydrologic Method: US Army Corps of Engineers' HEC-1 Flood Hydrograph Package, June 1998, Version 4.1

Hydrologic Model:	Buckeye/ Sun Valley ADMS – May 2005
Initial Loss Rates:	Green and Ampt
Unit Hydrograph Procedure:	FCDMC S-Graph
Channel Routing Method:	Normal Depth
Land Use Data:	FCDMC GIS Data
Soil Data:	SUDA SCS Soil Survey (1972 & 1981)

A summary of the flows published in the Buckeye/ Sun Valley ADMS that were utilized within this Zone A study are shown in Table 3, page 8.

4.2 Parameter Estimation

Peak flow rates were estimated at concentration points defined by the Buckeye/Sun Valley ADMS. The following sections describe in general the methodologies used to define 100-year peak flow rates at targeted locations within Fan 39.

4.2.1 Drainage Area Boundaries

Drainage area boundaries were delineated as part of the Buckeye/Sun Valley ADMS to define tributary areas to concentration points within the study limits. Drainage areas were selected to define flow rates at key points within the watershed tributary to Fan 39 and downstream wash corridors. Drainage areas were generally defined of similar size within the mountainous and piedmont surfaces of the project area.

4.2.2 Watershed Work Maps

The work maps used in the Fan 39 Zone A study are as follows:

FCDMC 10-ft contour interval digital topographic maps
Buckeye/ Sun Valley ADMS Watershed Hydrology Maps
FCDMC Approved Thalweg maps
Aerial photographic maps (Aerials Express, 2004)

The drainage area labels, concentration points, and routing reaches, were taken directly from the Buckeye/ Sun Valley ADMS.

4.2.3 Gage Data

There is no streamflow or rainfall gaging directly within the study area watershed. The following tables summarize proximal gages and significant recorded events (Wood Patel & Associates, 2001):

TABLE 1 PRECIPITATION AND STREAMFLOW GAGES NEAR STUDY AREA					
Sensor ID #	**Gage Name**	**Type**	**Operator**	**Installation Date**	**Elevation (ft)**
5200	Buckeye FRS #1	Precip. And Stage	FCDMC	7-26-83	1,095
5205	Buckeye FRS #2	Precip. And Stage	FCDMC	11-11-92	1,150
5280	Hassayampa @ I-10	Precip. And Stage	FCDMC	11-9-94	1,035
5430	White Tanks East Peak	Precip.	FCDMC	4-1-81	4,030
020126	Buckeye	Weather Station	NWS	3-1893	
028641	Tonopah	Weather Station	NWS	1951	
9517000	Hassayampa near Arlington	Streamflow	USGS	1961	825

TABLE 2 SIGNIFICANT RAINFALL EVENTS							
Station ID	**Years of Record**	**Max. 24 Hour Rainfall**		**Max. 6 Hour Rainfall**		**Max. 3 Hour Rainfall**	
		Depth (in)	**Date**	**Depth (in)**	**Date**	**Depth (in)**	**Date**
FCDMC Stations							
5200	15	3.15	8-14-1990	2.44	8-21-1988	2.20	8-14-1990
5205	6	1.26	11-15-1993	1.10	8-9-1997	1.02	
5280	4	1.89	8-9-1997	1.85	8-9-1997	1.77	
5430	17	N/A		N/A		2.32	
NWS Stations							
021026	102	4.90(1)	9-2-1894	–	–	–	–
028941	20	3.05(1)	9-5-1962	–	–	–	–
028941	20	3.00(2)	9-1-1984	–	–	–	–
Notes: – Maximum Daily – Daily							

Due to the limited number and relatively recent installation of precipitation gages, and the total absence of stage gages, direct calibration cannot be performed for Fan 39.

4.2.4 Statistical Parameters

No statistical analyses were performed as part of this study or the Buckeye/Sun Valley ADMP.

4.2.5 Precipitation

The synthetic precipitation event used to estimate the 100-year Precipitation data for the Buckeye/ Sun Valley ADMS was taken from

the NOAA Atlas 2 (Miller *et al*, 1973), Volume VIII, and corrected through the FCDMC's Depth-Duration-Frequency Development Procedure.

4.2.6 Physical Parameters

Physical parameters used in the Buckeye/ Sun Valley ADMS were not modified for the Fan 39 Zone A study. These physical parameters are discussed in greater detail within the final reports for the Buckeye/ Sun Valley ADMS.

As mentioned in Section 4.1 the ADMS utilized the Green and Ampt Method to estimate runoff losses. Loss parameters were determined in accordance with the FCDMC's Drainage Design Manual for Maricopa County, Volume I Hydrology. The FCDMC S-Graph Method was utilized as the unit hydrograph method due to the prevailing size of the watershed. Lag times for sub-basins were calculated using Normal Depth Methods.

Sun Valley Parkway, which extends north from Interstate 10 through the study area, is an elevated roadway with a raised median with median breaks approximately every half-mile. The Parkway is the only existing structure, which impedes flow through the study area. Concentration points have been established along it's alignment to identify flow at this critical structure (See Figure 9, Appendix E for culvert locations).

Soil Data was taken from the USDA SCS Soil Survey (1972 & 1981). The Buckeye/ Sun Valley ADMS utilized the normal depth method for channel routing. The ADMS used 10-foot contour interval topography to estimate the geometry and physical characteristics of channel cross-sections.

4.3 Problems Encountered During the Study

4.3.1 Special Problems and Solutions

The distributary and dynamic nature of Alluvial Fan 39 makes it difficult to assign flow rates to specific locations interior to the active portion of the alluvial fan. As such, geomorphic methods were used to determine the Zone A limits within the active portions of the fan.

4.3.2 Modeling Warning and Error Messages

No warning or error messages were found within the Buckeye/ Sun Valley ADMS HEC-1 model.

4.4 Calibration

No calibration was performed for the watersheds studied in the Buckeye/ Sun Valley ADMS. Limited precipitation data and lack of stage flow record for

White Tanks Wash or it's tributaries eliminates the opportunity to calibrate the model.

4.5 Final Results

4.5.1 Hydrologic Analysis Results

The following table summarizes the flow rates realized by the Buckeye/ Sun Valley ADMS (See Figure 7, Appendix D):

TABLE 3
HYDROLOGIC SUMMARY TABLE (PER WASH REACH)

Sun Valley Parkway Culvert Crossings
Transition from Alluvial Fan to Riverine Flow Condition (1)

HEC-RAS Reach	Upstream ADMS Concentration Point	Q_{100}	Percentage of Upstream Concentration Point's Peak Flow Conveyed in Reach
Northwest	F3R	500	17%
Northwest- South Branch	F3R	250	8%
Central West	F3R	1,000	33%
Southwest (2)	F3R	1,700	56%

Notes:
(1) - Peak flow values downstream of Sun Valley Parkway were determined by analyzing the capacity of the Holocene corridors downstream of the parkway.
(2) – Includes the *Southwest North Leg*, *Southwest South Leg*, and *Southwest South Leg South Branch* Reaches

4.5.2 Verification of Results

The Buckeye/Sun Valley ADMS indicates that no result verification, through measured, comparative, or statistical estimates, were conducted. The methodology utilized for the Fan 39 Zone A Study is comparable to the methodologies utilized for other alluvial fan approximate method - Zone A studies along the south and western slope of the White Tank Mountains.

5.0. HYDRAULICS

5.1 Method Description

In general, hydraulic analyses were prepared where riverine flow regime could be defined by topography and supported by geomorphic record for each water course. As described in detail in Section 6B of this report, the upper limits of Fan 39 were delineated by geomorphic methods to Sun Valley Parkway, which bisects the fan. Culverts exist at Sun Valley Parkway to convey storm flow to the downstream wash corridors. These culverts discharge flow into three

independent wash corridors. The corridors, deemed *Northwest*, *Central West*, and *Southwest*, convey flows from the active portion of Fan 39 (located upstream of Sun Valley Parkway) to the distal limits of the fan formation, White Tanks Wash. Downstream of Sun Valley Parkway the Holocene deposits mark the location of primary flow corridors for the riverine systems (see Figure 4). Cross sections cut through these surficial Holocene geology formations and overlying topography were employed for the normal depth flow calculations used to estimate the historic flow rate capacity of each wash corridor. The total combined flow rate estimated for all three of the primary wash corridors, below Sun Valley Parkway, exceeded the apex flow rate above the parkway, suggesting a defendable capacity analysis had been achieved. Hydraulic calculations are included in Appendix E.

Water surface profile calculations were performed for this approximate Zone A study to estimate the normal flow depth and top width at identified cross-sections in the study area. The peak flow used was extracted from the ADMS HEC-1 model as indicated in the previous section. Weighted Manning's roughness coefficients were calculated to characterize each reach within Fan 39. HEC-RAS version 3.1.3 was used to produce the hydraulic model. Flow split locations were verified through field studies, photo documentation, and topographic interpretation and a hydraulic analysis of these flow splits was performed. The hydraulic grade line of each diverging corridor and parent stream were estimated at various discharge rates. Energy grade line elevations between the parent stream and diverging corridors were iteratively balanced until the approximate sum of flow discharged into each diverging corridor equaled the parent stream flow rate and parent stream energy grade elevation.

5.2 Work Study Maps

The FCDMC provided the digital topographic maps as part of the contract to be used for the Fan 39 approximate Zone A delineation. The topographic contour interval of these maps is 10 feet. As mentioned in Section 3.2, two-foot contour interval topography was also obtained from the FCDMC for the portion of the study area immediate to the junction of Sun Valley Parkway and Fan 39

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

Manning's roughness coefficients (n-values) were determined for each HEC-RAS cross-section based on the technique outlined in the *Estimating Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona* manual (USGS 1991). Under this technique the following channel characteristics had to be estimated at each cross-section:

Channel Material
Degree of Irregularity
Effects of Obstruction
Vegetation

Variations in Channel Cross Section
Degree of Meandering

Field visits were used to collect data pertaining to the channel characteristics listed above. The methodology that the USGS proposes in the *Estimating Manning's Roughness Coefficients* text considers all of the mentioned channel characteristics to produce a weighted n-value (see Appendix E for a Manning's roughness coefficient summary table and individual calculation sheets).

5.3.2 Expansion and Contraction Coefficients

No expansion and contraction coefficients were applied as part of this approximate Zone A study.

5.4 Cross Section Description

Cross-section locations were chosen by proximity to concentration points identified in the hydrologic study and identified flow split/convergence locations. Between concentration points and flow split locations cross sections were spaced at a regular interval of approximately 300 linear feet for those areas falling between Sun Valley Parkway and ½ mile downstream of Sun Valley Parkway (those areas where detailed topography was utilized). A regular cross-section spacing of 2,000 feet was used downstream of the detailed topographic limits. Vertical data for cross-sections was established from the digital topographic data discussed in Section 3.1, and converted to a HEC-2 output file within Autodesk Land Desktop 2004. All cross-sections were cut from left to right, facing downstream. The HEC-2 output was imported into HEC-RAS v3.1.3. Where necessary to meet maximum number of data points for each cross section of 500 points, the Cross section point filter system was used through the HEC-RAS program.

Cross-section dimensions were verified during field visits through the use of hand-held GPS units, and measuring tape.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and Drop Analysis

Hydraulic models were executed in sub critical flow regime. No hydraulic jumps or drops were analyzed as part of this approximate Zone A study.

5.5.2 Bridges and Culverts

No bridges exist in the vicinity of the Zone A study area. There are a total of 9 culverts located along Sun Valley Parkway interior to the Fan 39 Zone A study area.

The distributary nature of flow transmitted from the alluvial fan formation east of the parkway provided limited opportunity to precisely define flows which discharge to the 9 culverts located within the limits of the study area. No hydraulic analyses were performed for these culverts, rather geomorphic methods were used downstream of the parkway to define flow parameters for the riverine drainage corridors downstream of the parkway.

5.5.3 Levees and Dikes

No levees or dikes were analyzed as part of this approximate Zone A study.

5.5.4 Islands and Flow Splits

Potential flow split locations were found by analyzing topographic, geologic and geomorphic maps, as well as aerial photos. In total, four split locations were investigated in field surveys for the western reaches of Fan 39. Field notes, site photos and aerial photos of these locations (*Northwest 1*, *Central West 1*, *Central West 2*, and *Southwest 1*) can be found in Appendix E.8. Hydraulic analysis for the four potential flow splits began by analyzing the capacity in the primary stream. In the case of the Central Reach, the primary stream was found to have more than adequate capacity to convey the estimated peak flow, Q_{100} = 1,000 cfs, in the vicinity of Central West Flow Splits 1 and 2 (See Section E.7). These results compliment the field surveys, during which no signs of significant breakouts were observed at either location. "Limit of Study" notes were added to the Annotated FIRM Panels (Figure 6) at each of these potential flow split locations to acknowledge that additional detailed analysis, which was outside the scope of this study, may be appropriate for these areas.

However, field visits and the hydraulic analysis did identify a lack of capacity in the vicinity of Northwest Flow Split 1 and Southwest Flow Split 1. HEC-RAS version 3.1.3 was employed to perform a flow split analysis by which the peak flow of each diverging corridor was determined.

Cross sections were cut adjacent to one another in the Northwest Reach, and the break-out corridor that diverges south, deemed the *Northwest Reach South Branch.* By iteratively dividing the 500 cfs peak flow contained in the upper corridor, and comparing the water surface elevation in the adjacent HEC-RAS cross-sections a balance was achieved. Specifically, balanced water surface elevations were found when 250 cfs was passed down both the Northwest Reach, and the Northwest Reach South Branch. This was the flow rate used to delineate each reach downstream of the flow split. Hydraulic analysis for these reaches is contained in Sections E.1 and E.2.

A similar hydraulic analysis was performed for the Southwest Flow Split 1 located at the divergence of Southwest, *South Leg Reach* and

the *Southwest, South Leg, South Branch* Reach. This analysis determined that 200 cfs and 650 cfs would flow down each diverging corridor, respectively.

5.5.5 Ineffective Flow Areas

The "ineffective flow area" modeling tool HEC-RAS features was utilized to block-out ineffective flow areas where appropriate within the hydraulic model.

5.5.6 Supercritical Flow

To conservatively estimate the inundation limits for the approximate Zone A study, a sub-critical flow regime was chosen for the HEC-RAS model. A subcritical flow regime assumes critical flow depth for reach segments where supercritical flows would be expected.

5.6 Floodway Modeling

No floodway modeling was performed as part of this approximate Zone A study.

5.7 Problems Encountered During the Study

5.7.1 Special Problems and Solutions

The dynamic, distributary nature of the flow paths within the active portions of Fan 39 created a hydraulically complex flow condition. Numerous flow splits and flow convergences were identified within the fans envelope. To better understand which corridors actually had seen flow recently, and could therefore be considered active alluvial elements, geologic and geomorphic maps were analyzed. The DGM-38 Geologic Map of the Wagner Wash Well 7.5' Quadrangle showed geologically recent Holocene deposits within most of Fan 39's envelope upstream of Sun Valley Parkway (Furgeson 2004). A narrowed, branching system of Holocene deposits occur downstream of Sun Valley Parkway.

In light of the geologic and geomorphic characteristics of the Zone A study area, different delineation approaches were taken upstream and downstream of Sun Valley Parkway. Upstream of the Parkway the flow patterns are too dynamic and complex to model individually, therefore a geomorphic analysis technique was utilized.

Downstream of Sun Valley Parkway flow patterns become better defined as wash corridors become more incised. As a result, a hydraulic model that analyzes individual riverine corridors became appropriate. With this technique the capacity of observed incised flow corridors (defined by topography and aerial photography) within Holocene formations were used to approximate the flow for the historic capacity of each corridor. Cross sections cut through these

surficial Holocene geology formations and overlying topography were employed for the normal depth flow calculations used to estimate the historic flow rate capacity of each wash corridor. The total combined flow rate estimated for all three of the primary wash corridors exceeded the apex flow rate above the parkway, suggesting a defendable capacity analysis had been achieved.

Potential break-out locations were found by analyzing topographic, geologic and geomorphic maps, as well as aerial photos. These locations were investigated and verified in field surveys. HEC-RAS version 3.1.3 was employed to perform a flow split analysis as described in section 5.5.4.

5.7.2 Modeling Warning and Error Messages

No modeling error messages were produced in the HEC-RAS output files.

5.8 Calibration

In the absence of any existing Fan 39 hydraulic studies, or gage data, preliminary results were compared to geologic and geomorphic records. Through this comparison a historic perspective was incorporated into the hydraulic model.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

The output for the hydraulic model is displayed in Appendix E. Floodplain delineations are included on the work maps in Appendix E.

5.9.2 Verification of Results

The approximate Zone A boundaries that were hydraulically determined in this study largely agrees with the geologic and geomorphic studies that have been conducted in the vicinity of Fan 39.

6A.0 EROSION, AND SEDIMENT TRANSPORT

An erosion and sediment transport analysis performed by Ayres Associates (October, 2004) was completed for the FCDMC as part of the Buckeye Sun Valley ADMS contract. This analysis includes the watershed tributary to Fan 39. A copy of the report may be found in Appendix F. No additional erosion or sediment transport analysis was conducted as part of this approximate Zone A study. The analysis concludes the watershed does not produce a high volume of sediment annually (1.39 tons/acre/year). During a single 100-year, 24-hour return storm event the study concludes that the watershed will yield approximately 4 tons/acre.

6B.0 GEOMORPHOLOGY

This section of the Technical Data Notebook is included to provide description of the geomorphic methods and results used in this study to identify the 100-year flood hazards on the Fan 39 piedmont. As part of the Buckeye/ Sun Valley ADMS, Ayres Associates completed a Stage 1 and Stage 2 flood hazard assessment of the area surrounding Fan 39. This analysis is included as Appendix G. As part of this TDN, further analysis was completed to develop a detailed characterization of Fan 39's geomorphic conditions. The format of this analysis closely follows that which was produced under FCDMC contract for the approved Approximate Floodplain Delineation Study for White Tank Fan 36 (Wood/Patel, JE Fuller, 2001).

The outline of the presentation generally follows the *Piedmont Flood Hazard Assessment Manual (PFHAM)* (Hjalmarson, 1998) and the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners* (FEMA, February 2002). Since parts of the geomorphic assessment require consideration of hydrologic and hydraulic characteristics of the piedmont, some of the information presented in Section 4 and 5 maybe reiterated within this section.

6B.1 Previous Studies

In addition to Ayres Associates Stage 1 and Stage 2 flood hazard assessment, several other studies of the regional geomorphology and relative flood hazards have been conducted in and around the study area. These studies are: Hjalmarson and Kemna (1991), CH2M Hill (1992), Field & Pearthree (1991, 1992), Field (1994), and Hjalmarson (1994). All of these studies were conducted prior to the advent of the *PFHAM* or the *FEMA Guidelines.* Therefore, none of them present their analyses or results according to the 3 stage process. Moreover, with the exception of Field & Pearthree (1992), the previous studies do not cover the entire extent of the current study. The analysis is contained within this section (6B) has reviewed, reevaluated, refined, extended, and reformatted the information in the previous studies, as well as incorporated additional data into the current flood hazard assessment.

6B.2 Method Description

The flood hazard delineation for this study begins at the east boundary of Sec. 2, T2N, R4W about 0.5 miles upstream of the hydrographic apex. Downstream of the hydrographic apex, the delineation covers flood areas on the piedmont on both active and inactive alluvial fan surfaces for approximately 6 miles downstream to White Tanks Wash a tributary to the Buckeye Flood Retarding Structure No. 1. The western boundary of the study area extends to White Tanks Wash.

This section of Technical Data Notebook is dedicated to a description of the methods used to identify the type and extent of the flood hazard within the study area. The organization follows the general outline presented in the *PFHAM* and the *FEMA Guidelines.* Both of these documents describe a procedure that follows a three stage process: the first for piedmonts and the second for alluvial fans. In the *PFHAM,* which is applicable for use in Maricopa County, Arizona, the three stages are described as follows: 1) recognizing and

characterizing piedmont landforms, 2) identifying the active or unstable and inactive or stable areas of the piedmont, and 3) defining and characterizing the flood hazard. The *PFHAM* method is founded on an approach to alluvial fan flood hazard assessment outlined in the National Research Council's 1996 *Alluvial Fan Flooding* report. Both documents describe a three stage method used to identify alluvial fan flood hazards. The *PFHAM* broadens the approach to application to the entire piedmont.

The geomorphic analysis was the basis for the flood hazard delineation within the study area portions of the Site 39 piedmont downstream of the hydrographic apex and upstream of Sun Valley Parkway. Upstream of the hydrographic apex and downstream of Sun Valley Parkway, geomorphic methods were used to complement and refine conventional approximate normal-depth hydraulic methods which are described in Section 5 of this TDN.

6B.3 Description of Approach

The assessment of the 100-year flood hazard on the Site 39 piedmont generally follows the procedures outlined in the *PFHAM*. The *FEMA Guidelines* were also used to structure the analysis and presentation of results for this study. In particular, the geomorphic method for an approximate floodplain delineation discussed in the *FEMA Guidelines* served as the basis for identification of the 100-year flood hazard area in this study area. The following approach description was obtained from the Wood/Patel, JE Fuller report prepared for Site 36 (2001).

The first stage is the recognition and characterization of piedmont landforms. Data from published sources including topographic maps, NRCS soil surveys, geologic mapping, aerial photographs, and field observations are the basis for differentiating piedmont landforms which include mountains, inselbergs, alluvial fans, relict alluvial fans, pediments, and alluvial plains. Also identified for alluvial fan landforms are the location of the topographic and hydrographic apexes of the alluvial fan. The hydrographic apex is of particular interest because it is the location at which flow of water and sediment becomes unconfined and spreads out rapidly. Sudden expansion of flow causes deposition of sediment and uncertain flow path generation below this point. The complex hydraulics associated with this flow expansion and sediment deposition create significant uncertainties (unpredictability) that "cannot be set aside in the realistic assessment of the flood hazard" (FEMA, 2002) near the hydrographic apex and for some distance downstream.

The second stage is the identification of active and inactive areas of the piedmont. 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.

The second stage also identifies the portions of the piedmont subject to various types of flooding such as stable riverine flooding, active alluvial fan flooding, inactive alluvial fan flooding, and broad overland flow.

The second stage may be applied using a geomorphic approach on alluvial fans with little or no urbanization (Table I, FEMA, 2000). In the geomorphic approach, surface characteristics that indicate surface stability are assessed and compiled. Surface characteristics such as vegetation patterns, presence or absence of rock varnish and desert pavement, and degree of soil development provide important distinction to active landforms. Surfaces with well developed soils, rock varnish, and desert pavement, for example, have developed these features because they have not experienced significant inundation or erosion for thousands of years. Hence, it can be inferred that they will continue to remain free from flooding in the future. Similarly, areas strongly dissected by drainage channels are less likely to unpredictably change their location than channels with little to no lateral relief relative to adjacent landforms. Historical aerial photographs can also be examined to see if any movement of channel positions can be detected over the photographic record.

The third and final stage of the *PFHAM* method is to identify the areas subject to flooding for the 100-year flood event. Methods available for the third stage 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. This study combines conventional engineering techniques and geomorphic methods. Stable reaches with reasonably predictable peak discharges will be evaluated using normal depth hydraulic modeling in combination with field observations and aerial photo interpretation. The delineation of flood hazards within unstable areas will rely solely on geomorphic interpretation of the piedmont surface characteristics. Additionally, flood hazards in stable areas subject to flooding sources with unpredictable flow distributions were also delineated based on geomorphic interpretation. These areas lie within stable areas downstream of unstable areas.

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

The first stage of the assessment of the flood hazard on the piedmont was to distinguish the types of landforms on the piedmont using a variety of characteristics shown on soils maps, surficial geology maps, topographic maps, aerial photographs, and observed in the field (Wood/Patel, JE Fuller, 2001). Additionally, when alluvial fan landforms are identified, the location of the topographic and hydrographic apices requires identification. The topographic apex is the uppermost apex of the alluvial fan and may not be the location where sediment deposition begins at the present time. The hydrographic apex is the highest location on an active alluvial fan and the topographic apex is the highest point on the alluvial fan landform. On alluvial fans with entrenched channels at their head, the topographic apex can be located some distance upstream from the beginning of active alluvial fan flooding. The hydrographic apex is the highest point on an alluvial fan where flow is last confined (Hjalmarson, 1998).

The Fan 39 piedmont landform is an alluvial fan with a topographic apex near the northern edge of Section 36, T3N, R4W where flows are conveyed in an entrenched channel. Downstream of the topographic apex, the channel

remains confined within a reach through very old alluvial fan deposits. The wash widens as tributary washes join the primary incised channel conveying flow to the hydrographic apex of the fan. This location was also identified as an alluvial fan in previous studies (Hjalmarson and Kemna (1991), Field & Pearthree (1991, 1992), Field (1994), and Hjalmarson (1994)). To support this assessment, the following description of composition, morphology, location, and boundaries are presented in the following sections.

6B.4.1 Composition

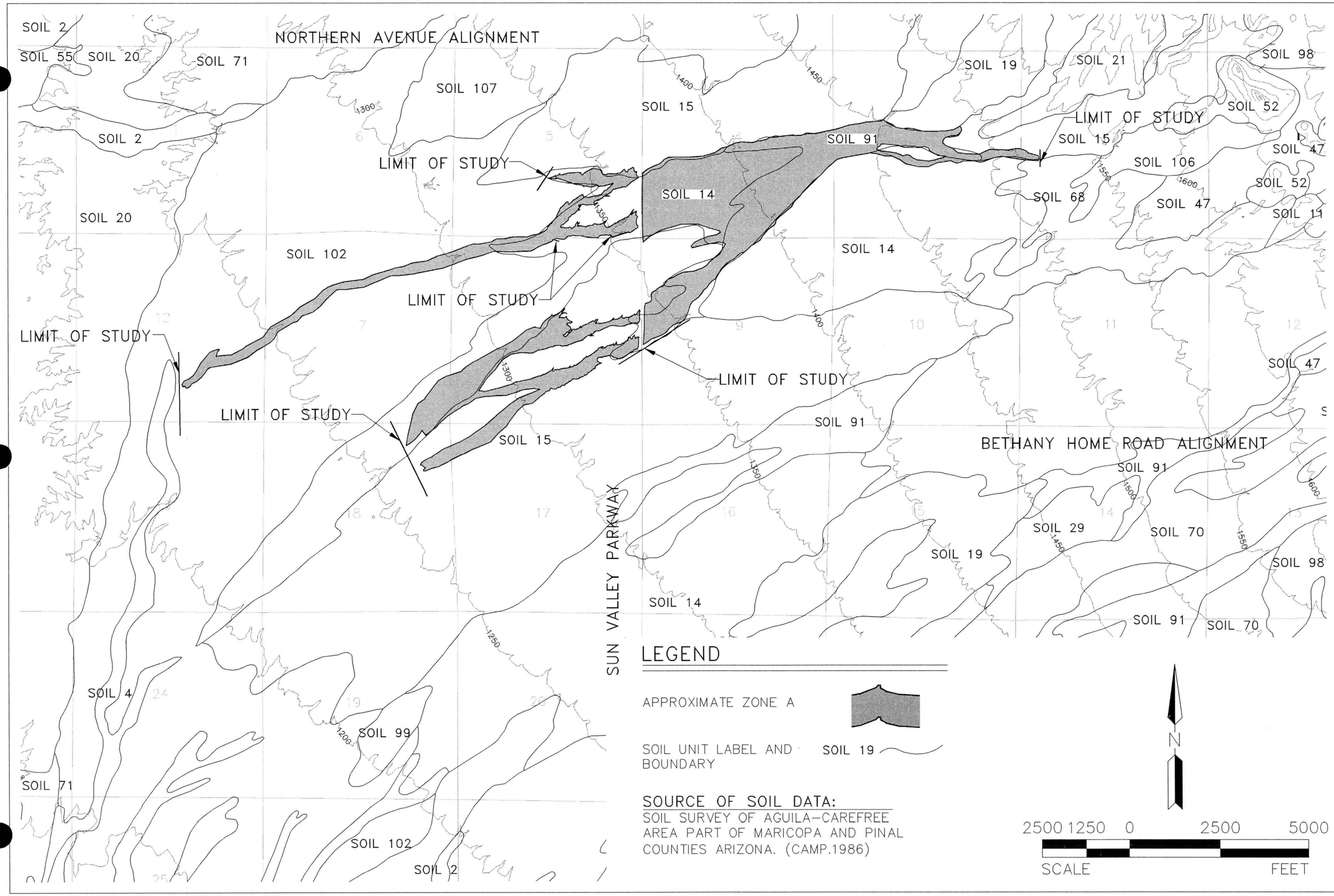
NRCS soils maps (Figure 3 adapted from Camp, 1986; Hartman, 1977) and surficial geology maps (Figure 4 adapted from Field and Pearthree, 1991) show that the western side of the White Tank Mountains is composed of alluvial sediments.

6B.4.2 Soils Data

Figure 3 shows the NRCS soil map units on the USGS topographic quadrangles. The soil polygons are from the *Soil Survey of Aguila-Carefree Area* (Camp, 1986) for the Site 39 study area. Table 4 gives a list and description of the soil units within the study area. In addition to showing the map unit boundaries and designations, Figure 3 shows 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 are: 1) drainageways, floodplains, and alluvial fans, 2) alluvial fan terraces, and 3) mountains and hillslopes. Copies of the complete soil unit descriptions for the study area from Camp (1986) are provided in the following pages.

The NRCS soils maps show the smoother, gentler portion of the lower piedmont north of Interstate 10 as an area of soils formed on recent alluvial fans and valley plains of the Antho-Valencia association separated by an island of old alluvial fans of the Gunsight-Rillito complex and the Coolidge-Laveen association (Wood/Patel, JE Fuller, 2001). The middle and upper piedmont upstream is shown as composed predominantly of fan terraces of the Gunsight-Rillito complex, and the Momoli-Carrizo and Denure-Momoli-Carrizo complexes.

Table 4 exhibits the relationship between the NRCS soil map units and the landforms for the Site 39 piedmont. 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.
The Antho, Carrizo, Maripo, and Valencia soil series represent the areas subject to flooding on alluvial fans, drainageways, floodplains and low stream terraces (Wood/Patel, JE Fuller, 2001). The Antho and Carrizo series in particular are identified as positioned on alluvial fans. However, the most active area of the Site 39 piedmont is mapped as unit 91 (Figure 3). Unit 91 is composed of Momoli and Carrizo soils. The Momoli series is described as being located on stream terraces



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WHITE TANK MTN ALLUVIAL FAN 39
APPROXIMATE ZONE "A" DELINEATION STUDY
MARICOPA COUNTY

FIG 3: SOIL CONSERVATION SERVICE SOILS MAP

CMX PROJ:	6359.63
DATE:	DEC. 2007
SCALE:	1"=2500'
DRAWN BY:	BC/AMS
CHECKED BY:	AT

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and fan terraces. The lower portions of the 91 polygon show numerous small narrow areas of older surfaces which appear to be in the process of being buried and eroded by water and sediment discharges from the Site 39 watershed. The NRCS reports that unit 91 is composed of 45% Momoli and 35% Carrizo soils along with 20% other soils including Mohall, Tremant, Gunsight, Chuckwalla, Denure, Oilman, and Maripo series. The Mohall, Tremant, Gunsight, and Chuckwalla soils are indicated as being located on higher terraces. The Denure soil is also associated with stream and fan terraces. The Gilman series is associated with floodplains and alluvial fans while the Maripo is found on floodplains and low terraces. Therefore, the area immediately downstream of the hydrographic apex mapped as unit 91 may transition from Carrizo, Gilman, and/or Maripo soils into the terrace soils of the other series found in unit 91. The older surfaces in the downstream portions of this area are being actively buried and eroded by floodwaters from the more active area upstream.

The soils of the Chuckwalla, Gunsight, Ebon, and Pinamt soil series are located on fan terraces. These soils are also more, well developed and have characteristics of much older surfaces such as enriched clay and/or carbonate horizons. On the lower piedmont the Coolidge and Laveen soils are found on areas of old alluvial fans and valley plains. These soils also exhibit signs of geologic age based on the accumulation of calcium carbonate.

The above description of the soils of the Site 39 piedmont is consistent with the common soil types for alluvial fans shown in Table 2.1 of the *PFHAM,* which shows typical relict fan soils.

TABLE 4
SOIL UNITS AND CHARACTERISTICS

SCS soils map units	Component Soil Series	Position/Landform	Important Characteristics
Antho-Carrizo Maripo complex, low precipitation (4)	Antho -35% Carrizo – 30% Maripo – 20%	- on floodplains, alluvial fans, arid drainageways - on floodplains, drainageways, alluvial fans, fan terraces and stream terraces - on floodplains and low stream terraces	- deep and well drained, moderately rapid permeability, available water capacity is moderate, runoff is slow, and moderate erosion hazard. - subject to occasional flooding; hazard due to water erosion is slight: channeling, deposition and streambank erosion occur during flooding - subject to rare periods of flooding
Carrizo very gravelly sand (14)	Carrizo	- on floodplains, drainageways, alluvial fans, fan terraces and stream terraces	- subject to occasional flooding; hazard due to water erosion is slight: channeling, deposition and streambank erosion occur during flooding
Carrizo-Gunsight complex (15)	Carrizo gravelly sandy loam - 50% Carrizo very gravelly sandy loam - 30%	- on floodplains, drainageways, alluvial fans, fan terraces and stream terraces	- subject to occasional flooding; hazard due to water erosion is slight: channeling, deposition and streambank erosion occur during flooding.
Chuckwalla-Gunsight complex (19)	Chuckwalla - 45% Gunsight - 35%	- on top of fan terraces - on side of fan terraces	- deep and well drained, usually covered by varnished desert pavement, moderate permeability, available water capacity is low. - deep and well drained, moderate permeability, available water capacity is low, runoff is slow, erosion hazard is slight.
Ebon-Gunsight-Cipriano association (47)	Ebon - 35% Gunsight - 20% Cipriano 20%	- on fan terraces and stream terraces - on fan terraces - on fan terraces	- yellowish red color, common thin clay films - deep and well drained, moderate permeability, available water capacity is low, runoff is slow, erosion hazard is slight - shallow soils, underlain by indurated duripan (caliche)
Gachado-Lomitas-Rock outcrop complex (52)	Gachado - 45% Lomitas - 20% Rock Outcrop – 20%	- on mountain slopes - on hill slopes	- shallow and well drained, formed in alluvium and colluvium, bedrock is at about 7 inches, moderately slow permeability, runoff is medium to rapid, and moderated erosion hazard. - shallow and well drained, formed in alluvium and colluvium, bedrock is at about 10 inches, moderate permeability, runoff is medium to rapid, and moderated erosion hazard. - rock outcrop consists primarily of exposed andesite, rhyolite, and tuff.
Gunsight-Cipriano complex (68)	Gunsight - 45% Cipriano - 40%	- on fan terraces - on fan terraces	- deep and well drained, moderate permeability, available water capacity is low, runoff is slow, and erosion hazard is slight. - very shallow and well drained, moderate permeability, available

TABLE 4
SOIL UNITS AND CHARACTERISTICS

SCS soils map units	Component Soil Series	Position/Landform	Important Characteristics
			water capacity is low, runoff is medium, and erosion hazard is slight.
Momoli-Carrizo complex (91)	Momoli - 45% Carrizo - 35%	- on stream terraces and fan terraces - on floodplains, drainageways, alluvial fans, fan terraces, and stream terraces	- deep and well drained, moderately rapid permeability, low available water capacity, runoff is slow, erosion hazard is slight. - subject to occasional flooding; hazard due to water erosion is slight: channeling, deposition and streambank erosion occur during flooding
Rillito gravely loam (102)		- on fan terraces	- deep and well drained, moderate permeability, available water capacity is moderate, runoff is slow, erosion hazard is slight
Sal-Cipriano complex (106)	Sal – 50% Cipriano – 30 %	- on fan terraces - on fan terraces	- shallow and well drained, typically mostly covered by varnished desert, moderately slow permeability, available water capacity is low, runoff is rapid, erosion hazard is slight - very shallow and well drained, moderate permeability, available water capacity is low, runoff is medium, and erosion hazard is slight.

NOTES:
From Soil Survey. Aguila-Carefree Area Parts of Maricopa and Pinal Counties Arizona (Camp. 1986)

6B.4.3 Surficial Geology

The following text is adapted from the Approximate Floodplain Delineation Study for White Tank Fan 36 (Wood/Patel, JE Fuller, 2001). This summary of surficial geology supplements the broad data described in the Ayres studies provided in Appendix G and provides more specific interpretation of geologic record to the Fan 39 piedmont.

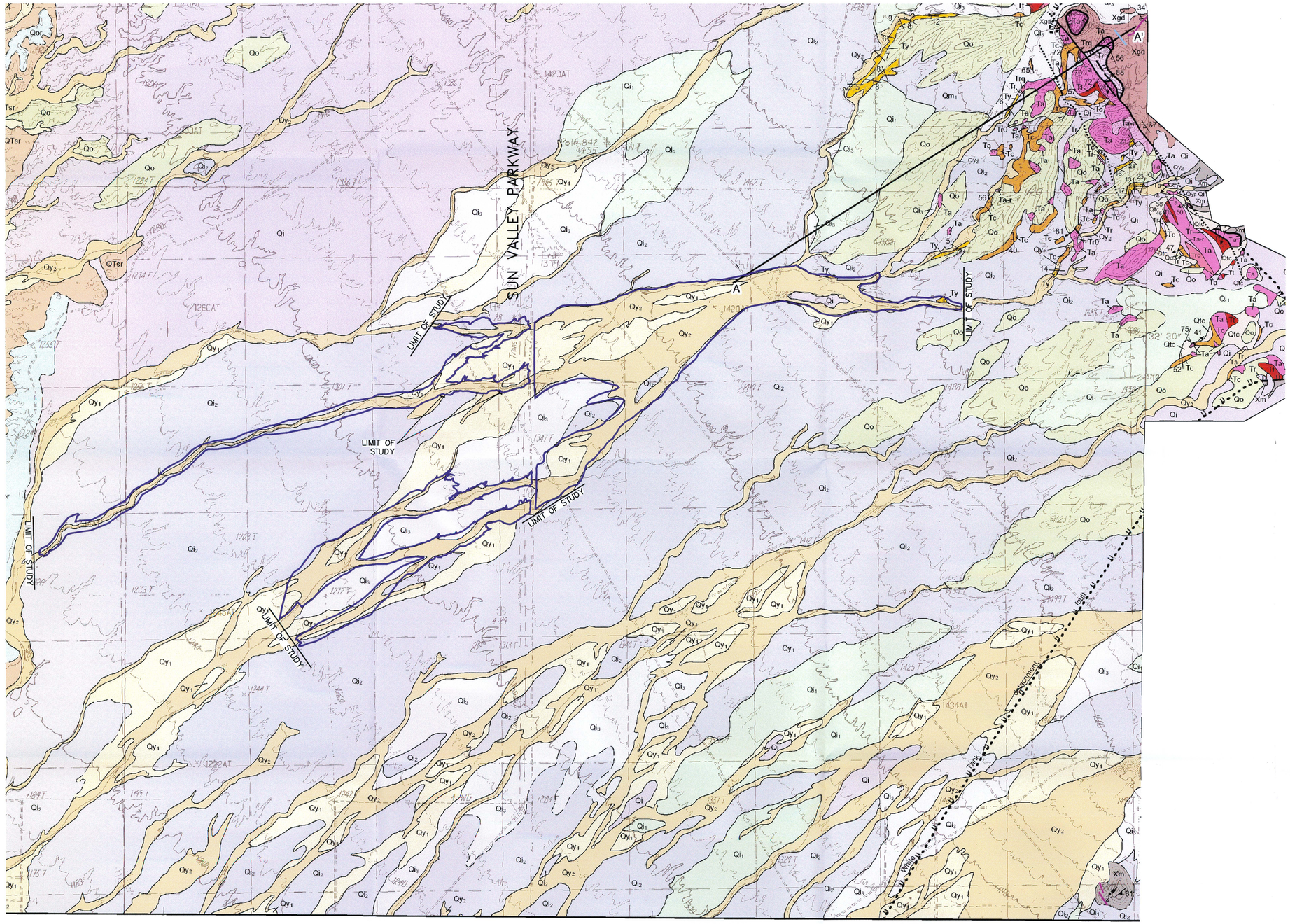
Figure 4 shows the surficial geology of the Fan 39 piedmont as mapped by the Arizona Geological Survey (AZGS) (adapted from Furgeson, *et al*, 2004). It shows the entire study area composed of alluvial fan of various ages as well as terraces and active stream channels.

Table 5 summarizes the significant distinguishing characteristics of each of the surficial geological units.

The Qy units (Qy_1 and Qy_2) shown in Table 5 are surfaces of Holocene age. That is, these surfaces have been experiencing active deposition and erosion during the last 10,000 years. The Qy_2 unit is the youngest unit. It is found on alluvial fans, low terraces, and active channels and covers a significant portion of the Site 39 piedmont downstream of the hydrographic apex. The Qi (Qi_1, Qi_2, and Qi_3) units are of Pleistocene age, that is, older than 10,000 years and younger than 250,000 years. The Qo units represent early Pleistocene to late Pliocene aged surfaces of relict alluvial fans between 100,000 and 1 million years old.

The surficial geology shows a general pattern of alluvial surfaces decreasing in age moving downslope from the White Tank Mountains. In addition to decreasing age, the extent of young alluvial deposits also increases. Field and Pearthree (1991) suggest that the location of active distributary flow areas on the alluvial fans has not shifted significantly since the Pleistocene. They also posit that the younger Qi_2, Qy_1 and Qy_2 surfaces in the middle and lower piedmont are primarily the product of the erosion of Qi_1 surfaces on the piedmont. In other words, the sediments being deposited on the lower piedmont are being eroded from older upstream piedmont surfaces, not the upper mountainous watersheds. The different sediment source areas may be responsible for the contrast in sediment size and surface texture between the most active areas of the alluvial fan east of Sun Valley Parkway downstream from the hydrographic apex, and the Qy_2 areas further downstream west of Sun Valley Parkway. The downstream Qy_2 areas are comprised of silts and sands and look more like overbank floodplain deposits compared with the much more gravelly deposits in the large Qy_2 area downstream of the hydrographic apex.

While the surficial geology provides greater detail than the NRCS soils maps, one can see the general agreement about the alluvial nature



LEGEND

APPROXIMATE ZONE "A" BOUNDARY

Qy_2	Late Holocene deposits in active stream channels, low terraces, and alluvial fans - 2,000 yrs
Qy_1	Late to early Holocene deposits on alluvial fans and terraces - 2,000 yrs
Qi_3	Late Pleistocene alluvial fan and terrace deposits - 15,000 yrs
Qi_2	Middle Pleistocene alluvial fan deposits - 250,000 yrs
Qi	Middle and late Pleistocene alluvial fan and terrace deposits, undifferentiated - 15,000 to 250,000 yrs
Qi_1	Middle to early Pleistocene alluvial fan deposits - Between 100,000 and 1,000,000 yrs
Qo	Early Pleistocene to late Pliocene alluvial fan deposits - 100,000 to 1,000,000 + yrs
Ty	Sandstone and conglomerate (middle to late Tertiary) - 1.8 to 33.7 million yrs
Ta	Andesite (middle Tertiary) - 23.8 to 33.7 million yrs
Tc	Conglomerate and breccia (middle Tertiary) - 23.8 to 33.7 million yrs
Tr0	Aphyric ryholite lava (middle Tertiary) - 23.8 to 33.7 million yrs

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WHITE TANK MTN ALLUVIAL FAN 39

APPROXIMATE ZONE "A" DELINEATION STUDY
MARICOPA COUNTY, ARIZONA

FIG 4: GEOLOGY MAP

CMX PROJ: 6359.63	DATE: DEC. 2007	SCALE: 1"=1300'
DESIGNED: AT	DRAWN: RB/AMS	APPROVED: KCK
REV:		

DWG. NO. 1

SHT. 1 OF 1

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and origin of the Site 39 piedmont. The distinguishing characteristics of the landforms shown in Figure 4 are described in Table 5 and the following sections. The advantage of the surficial geology data is that areas are distinguished by characteristics related to their age and stability. Both are important to assessment of the flood hazard of the piedmont and will be elaborated upon further in Stage 2 and 3.

TABLE 5
LANDFORMS BY SURFICIAL GEOLOGY

Landform	Unit	Name	Characteristics	SCS Soils Unit
Active alluvial fans, low terraces, and active channels	Qy_2	Late Holocene alluvial fans, low terraces, and active channels	composition: middle piedmont surfaces and active channels soil development: minimal to none: age: <2,000 years surficial features: typically undissected, smooth surfaces with a distribuary drainage network, some bar and swale topography in middle piedmont, no desert pavement or rock varnish association soil great groups: Torrifluvents and Torriorthents flooding potential: subject to occasional to frequent flooding	Antho (2, AL), Antho-Carrizo Maripo complex (3,4, AGB) Momoli-Carrizo complex (91), Antho-Valencia association (AM)
Active and Inactive alluvial fans and alluvial plains	Qy_1	Late to early Holocene alluvial fans and terraces	composition: sheetflood areas, terraces, and limited overbank areas which are occasionally flooded soil development: minimal age: 1,000 to 10,000 years surficial features: fine grained, locally shallow channels (incision <0.5 m), poorly developed desert pavement, light and incomplete brownish black rock varnish along base of surface cobbles soil great groups: Torrifluvents, Torriorthents, and Camborthids flooding potential: most areas not flooded at present, but general lack of topographic relief to adjacent active channels suggests potential for flooding through minor shifts in the present depositional patterns	Denure-Momoli-Carrizo complex (29,30), Gunsight Rillito (GYD, 70)
Inactive alluvial fan	Qi_3	Late Pleistocene alluvial fan and terrace deposits	composition: moderately old relict alluvial fan and terrace deposits soil development: weak to moderate, slight reddening, weak structure, and thin discontinuous carbonate coatings on clasts	Chuckwalla- Gunsight (19), Denure-Momoli-Carrizo complex (29), Gunsight- Rillito (GYD, 70)

TABLE 5 LANDFORMS BY SURFICIAL GEOLOGY				
Landform	**Unit**	**Name**	**Characteristics**	**SCS Soils Unit**
			age: isolated from deposition for <15,000 years surficial features: moderately dissected by active channels which are incised <1-3 m, broad flat interfluves with moderately to well preserved original gravel bar and swale topography, poorly to moderately developed desert pavement, incompletely varnished to very dark brown with reddish brown to more commonly dull orange undersides soil great groups: Camborthids and Haplargids flooding potential: restricted to active incised channels except for areas of low relief	
Inactive alluvial fan	Qi_2	Middle Pleistocene alluvial fans	composition: moderately old relict alluvial fan and terrace deposits soil development: weak to moderate, slight reddening, weak structure, and thin discontinuous carbonate coatings on clasts age: isolated from deposition for 10,000 to 250,000 years surficial features: moderately dissected by active channels which are incised <1-3 m, broad flat interfluves with moderately to well preserved original gravel bar and swale topography, poorly to moderately developed desert pavement, incompletely varnished to very dark brown with reddish brown to more commonly dull orange undersides soil great groups: Camborthids and Haplargids flooding potential: restricted to active incised channels except for areas of low relief	Chuckwalla- Gunsight (19), Denure-Momoli-Carrizo complex (29), Gunsight- Rillito (GYD, 70)
Inactive alluvial fan and relict fans	Qi	Middle to late Pleistocene alluvial fans	composition: old relict alluvial fan deposits soil development: moderate, reddened zones of clay accumulation, continuous carbonate coatings, locally weak carbonate cementation age: isolated from deposition for 150,000 to 300,000 years surficial features: strongly developed desert pavement with dark brown to black varnish with red coatings on undersides, well-developed tributary drainage networks, channels incised up to 3 m soil great groups: Haplargids and Calciorthids	Chuckwalla- Gunsight (19), Denure-Momoli-Carrizo complex (29), Ebon- Pinamt complex (48,49), Gunsight-Rillito (GYD, 70) Pinamt-Tremant complex (98), Coolidge-Laveen association (CV)

TABLE 5 LANDFORMS BY SURFICIAL GEOLOGY				
Landform	**Unit**	**Name**	**Characteristics**	**SCS Soils Unit**
			flooding potential: restricted to entrenched channels except for low relief areas on lower piedmont	
Inactive alluvial fan and relict afluvial fans	Qi_1	Middle to early Pleistocene alluvial fan and terrace deposits, Undifferentiated	composition: old relict alluvial fan deposits soil development: moderate to very strongly developed reddened zones of clay accumulation (argillic horizons), commonly over stage IV calcic horizons (caliche) age: isolated from deposition for 100,000 to 1,000,000 years surficial features: well developed desert pavement with completely varnished black with reddish brown undersides on broat flat and smooth interfluves, bar and swale topography absent or poorly preserved, channels incised I-6 m soil great groups: Haplargids flooding potential: restricted to entrenched channels	Chuckwalla- Gunsight (19), Gunsight-Rillito (GYD, 70), Pinamt-Tremant complex (98)
Relict alluvial fan	Qo	Early Pleistocene to late Pliocene alluvial fans	composition: very old relict alluvial fan deposits of poorly sorted subangular gravels soil development: abundant fragments of pedogenic carbonate, exposed brecciated laminar petrocalcic horizons, exposed stage IV to VI petrocalcic horizons age: isolated from deposition for>1,000,000 years surficial features: deeply dissected (10-15 m), well- rounded ridges, original surfaces rarely preserved soil great groups: Durorthids flooding potential: restricted to entrenched channels	Ebon-Gunsight alluvia Cipriano association (47), Ebon-Pinamt complex (48,49), Gunsight-Rillito (70)

NOTES:
Adapted from AZGS OFR 91-8 (Field and Pearthree, 1991) and AZGS OFR 91-10 (Field and Pearthree, 1992)

6 B.4.4 Morphology

According to the National Research Council definition (1996 – As referenced in Wood/Patel, JE Fuller 2001), "alluvial fans are landforms that have the shape of a fan, either partly or fully extended" The Site 39 study area shows the general form of a partially extended

fan (See Figure 5). The area of youngest sediments in Section 3 T4N, R4W (shown as Qy_2 on the surficial geology mapping (Figure 4) and as NRCS soil unit 91, Momoli-Carrizo complex (Figure 3)) exhibits a more obvious partly extended fan shape.

Topographic data also support the definition of a fan shaped landform. The topography for the site shows mostly nearly straight or slightly concave downstream shape down the piedmont. Contour crenulations show channels ranging from 1 to 2 feet in depth across large areas. The mild transverse relief suggests bifurcating channels, which are also evident in aerial photographs of the piedmont. Local areas of greater degree of incision are noted west of Sun Valley Parkway within the limits of the middle piedmont. Areas upstream of the hydrographic apex also show much greater degree of entrenchment than downstream of the hydrographic apex. These are all characteristics of an alluvial fan.

6B.4.5 Location

The NRCS definition also states that "alluvial fan landforms are located at a topographic break" The Site 39 alluvial fan begins as the main wash exits the mountains (Wood/Patel, JE Fuller, 2001). Downstream of the topographic apex, the channel remains confined within a reach through very old alluvial fan deposits. The wash widens as tributary washes join the primary incised channel conveying flow to the hydrographic apex of the fan.

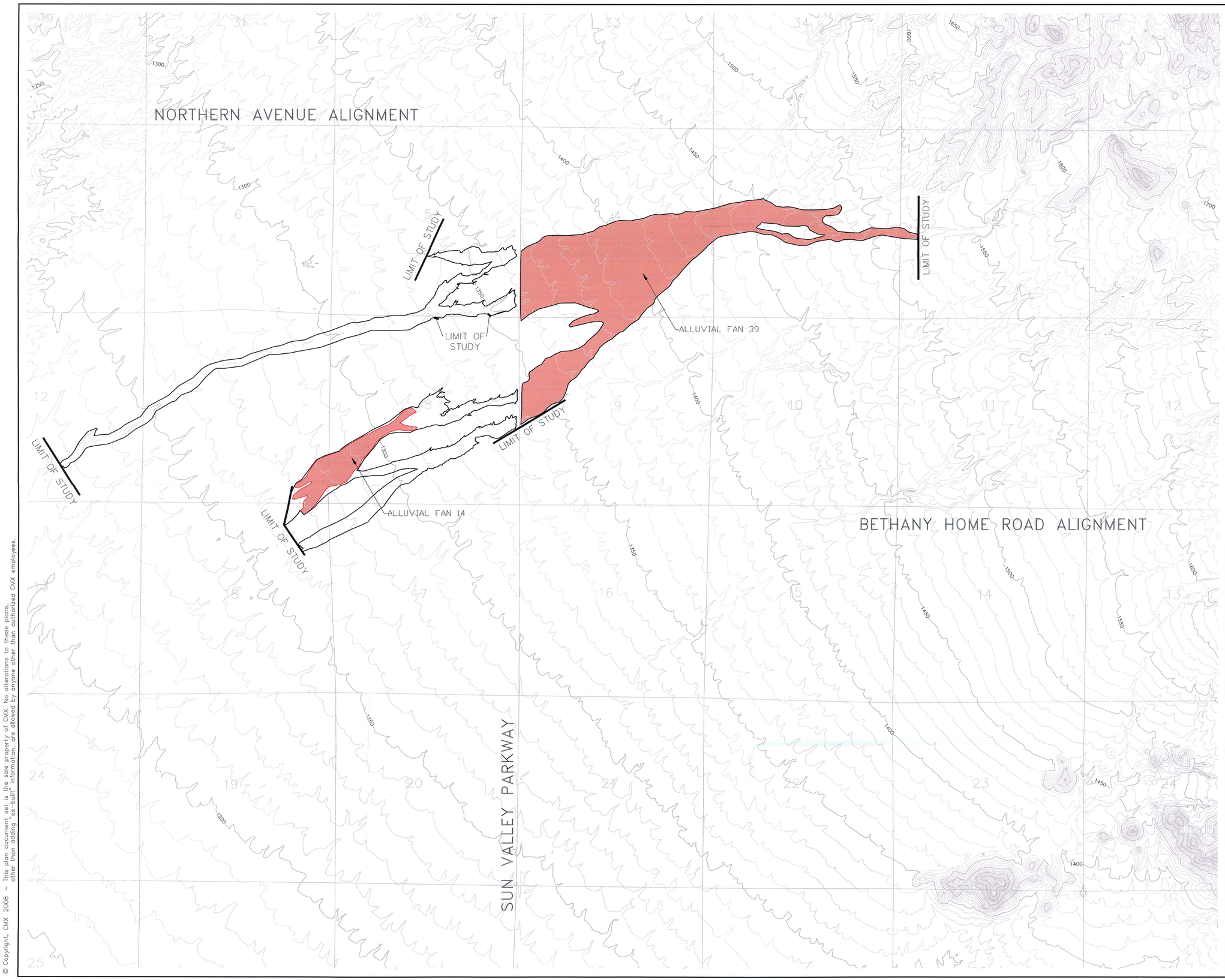
6B.4.6 Boundaries

The lateral and distal limits of the alluvial fan landform were determined from examination of the NRCS soil data, the AZGS surficial geology, recent and historical aerial photographs, and field studies performed by the FCDMC (Ayres Associates, 2004).

The toe or distal terminus of the larger alluvial fan landform is defined by the intersection of the long sloping piedmont plain with White Tanks Wash which runs parallel to the Hassayampa River. The toes of the existing active areas of the alluvial fan are addressed in Stage 2 (Section 6.6), but primarily terminate with Sun Valley Parkway. Pleistocene-aged surfaces bound the alluvial fan completely on all sides. The north and south lateral boundaries are defined by a series of fan terraces which diminish with age as they extend west.

6B.4.7 Conclusion

The soil survey and surficial geology data clearly show the piedmont to be composed of sedimentary deposits. The topographic maps also show that the landform is located at the base of a mountain front and has the shape of a partially extended fan. Therefore, it can be concluded that the Site 39 piedmont in the study area is an alluvial fan.



LEGEND

APPROXIMATE ZONE "A" BOUNDARY

UNSTABLE ACTIVE ALLUVIAL CONDITIONS

Source of geomorphic landform delineations:
Ayres Associates (September 13, 2004). Buckeye/Sun Valley ADMS Piedmont Landform Delineations (subtask 2.6.2). Technical Memorandum FDC 2002C027-t2.6.2 Prepared for the Flood Control District of Maricopa County.

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WHITE TANK MTN ALLUVIAL FAN 39

APPROXIMATE ZONE "A" DELINEATION STUDY
MARICOPA COUNTY, ARIZONA

FIG 5: GEOMORPHOLOGY MAP

CMX PROJ. 6359.63	CMX
DATE: JAN 2008	
SCALE: 1"=1200'	
DESIGNED: AJT / DRAWN: RB	APPROVED: KCK
REV.	DWG. NO. 1
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6B.5 Stage 2: Defining Active and Inactive Areas

In Stage 2, the objective is to define the active and inactive areas of the alluvial fan, and characterize the nature of flooding on different parts of the piedmont. Hjalmarson and Kemna (1991), and Appendix A of *Alluvial Fan Flooding* (NRCS, 1996) identify portions of Alluvial Fan 39 as being active as indicated by recent channel movement observed in historical aerial photographs (Wood/Patel, JE Fuller 2001).

6B.5.1 Introduction

The following description was obtained from the Approximate Floodplain Delineation Study for White Tank Fan 36 (Wood/Patel, JE Fuller, 2001). The physical characteristics of a landform surface provide clues as to its depositional history, stability, and its flood potential. If an area of the landform ceases to receive new deposits, its surface will begin to age. As it ages, the surface begins to develop physical and chemical characteristics indicative of its age. In an arid environment like the Site 39 piedmont, soils begin to develop distinctive characteristics. As the soil develops, its structure, color and content changes. Clay and calcium carbonate accumulate in the soil. Soils tend to become reddish in color due to the accumulation and weathering of clay. Accumulation of carbonate cements the soils together eventually developing a highly resistant character referred to colloquially as caliche.

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 is believed to form by the accumulation of windblown silt and clay between the gravels. 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 result in a mantle of closely packed gravels over a silt- and clay-rich soil layer (Dohrenwend, 1987; Vanden Dolder, 1992). The surface pebbles and cobbles, if they contain sufficient ferromagnesian minerals, will develop a dark black patina on their tops and an orange coating underneath known as *rock varnish*.

Surfaces free from new deposition will also begin to erode. As they erode, new tributary channel networks develop. These channels will also begin to entrench themselves into the surface creating a greater degree of relief between the channel bottoms and the ridges which separate them.

It takes thousands of years for many of these characteristics to develop. Therefore, surfaces that exhibit well developed soils, red color, significant carbonate development, desert pavements of strongly varnished gravels, and tributary drainage networks have been relatively free from flooding for thousands of years. As such, without

external disturbance, it can be reasonably anticipated that the flood hazard potential in the future will remain low.

The NRCS soils survey data and surficial geology mapping differentiate surfaces based on the types of characteristics discussed above. Therefore, these data also inform on the surface's age, stability, and flood potential. Young surfaces with little soil development are likely to continue to see water and sediment discharges. Older surfaces are much less likely to experience inundation by water and sediment in the future. Older surfaces with cemented soils and entrenched channels also tend to be stable. That is, the likelihood of the channel changing its location over time is greatly diminished. Conversely, areas with loose soil and little lateral relief are more susceptible to lateral changes in the channel's position.

6B.5.2 Overview of Flooding on Site 39 Piedmont

The approximately 2.5 mile long entrenched reach upstream of the hydrographic apex to the topographic apex is characterized by stable channel riverine flood hazards.

Downstream of the hydrographic apex, flood waters become unconfined and spread out over a fan shaped area. On the northern edge of the fan an entrenched channel is formed which conveys flow from the hydrographic apex to Sun Valley Parkway. The central and southern portion of the fan immediately downstream of the hydrographic apex show distributary flow conditions with minor rivulet channel formations which extend from the apex to approximately 3,000 feet downstream near contour elevation 1,400. At this location, channels begin to take on a more stable configuration as indicated by field investigations performed by the FCDMC Study Team (Appendix G) and surface geology documented by (AZGS Furgeson *et al*, 2004). Flows are transmitted west toward Sun Valley Parkway where flows are conveyed via culvert under the roadway and the geomorphic record of flow conditions is interrupted by the elevated roadway.

As indicated in Section 5.0 of this report, topographic analyses were prepared for the Holocene formations west of Sun Valley Parkway to estimate the maximum flow capacity for the incised channel formations which appear downstream of the Parkway. Downstream of Sun Valley Parkway, flood waters generally reorganize themselves into a series of parallel washes across more stable older surfaces. To determine the flood hazard within the stable surfaces, traditional hydraulic riverine analyses were prepared.

To determine the flow rate for the reorganized washes, a containment analysis technique was prepared for each of three primary washes. With this technique the capacity of observed incised flow corridors (defined by topography and aerial photography) within Holocene formations were used to approximate the flow historic capacity of each

corridor. Cross sections cut through these surficial Holocene geology formations and overlying topography were employed for the normal depth flow calculations used to estimate the historic flow rate capacity of each wash corridor. The total combined flow rate estimated for all three of the primary wash corridors exceeded the apex flow rate above the parkway, suggesting a defendable capacity analysis had been achieved.

Field studies prepared by the FCDMC (Ayres, 2004) indicate conditionally unstable surfaces within a wide section of Holocene aged depositions on the southwestern leg of the alluvial fan. Here the width of the distributary and unstable nature of flow in this location results in random flow direction across the Holocene limits. This region is considered an inset alluvial fan, Alluvial Fan 14.

Much of the lower piedmont is characterized by several prominent washes, which connect to the through flow channels coming from the upper and middle piedmont. Islands of older sediments are also located between these flooding areas.

Field and Pearthree (1991) suggested that the younger sediments on the lower piedmont originate from the erosion of older surfaces in the middle piedmont. During more frequent runoff events, water and sediment both originate from areas of the middle and lower piedmont. Only the largest runoff events translate significant flood water and sediment across the entire broad alluvial area immediately downstream of the hydrographic apex. The high infiltration rates of this broad area of young gravels transmits more frequent runoff into the subsurface before it can pass onto the lower piedmont. Evidence of significant transmission losses can be seen in the field by the lines of flotsam that stop within channels on the active fan. Moreover, the size of surface sediments generally decreases moving down piedmont. Smaller sediment sizes mean lower infiltration rates.

6B.5.3 Identification of Active Areas

The Site 39 piedmont is mostly an eroding landform. Although aggradation occurs in several localized areas covering a limited area of the total landform, these aggradational areas represent an important part of the overall water and sediment discharge system of the Site 39 piedmont.

They are located:

1) at and immediately downstream of the hydrologic apex, and
2) at an inset active fan area in the middle piedmont (Fan 14)

The limits of the active areas of the Site 39 alluvial fan, and Fan 14 are shown in Figure 5. These areas were identified through the use of NRCS soils surveys, AZGS surficial geology mapping, historical aerial photographs, interpretation of contour maps, and field observations.

The relationship of each of these types of evidence to the limits of active and inactive areas is discussed below.

NRCS Soil Survey - Camp (1986)

The NRCS soils maps (Figure 3) for the area show Antho and Carrizo soils series as major soils within the areas identified here as active or unstable areas. This designation is consistent with the information presented in the *PFHAM*. These soils are poorly developed and exhibit little sign of age such as clay or carbonate accumulation.

AZGS Surficial Geology—Furgeson *et al* (2004)

The AZGS surficial geology mapping of the White Tank piedmont differentiated areas based primarily on their relative age. The relative topographic position, surface characteristics such as desert pavement and rock varnish, and the degree of soil development were the primary criteria used to distinguish the relative ages of the surfaces. The AZGS delineated the youngest areas of the piedmont as Qy_2, Late Holocene alluvial fans, low terraces, and active stream channels. The Qy_2 areas shown in Figure 4 include both the active alluvial fan areas identified in this study as well as the broad areas of overland flow which are considered stable areas in this study. Those areas are discussed in the identification of inactive areas below.

Field and Pearthree (1991 in Wood/Patel, JE Fuller, 2001) suggest that the overall morphology of the active area immediately downstream of the hydrographic apex has not changed significantly since the late Pleistocene. They suggest that the active areas further down the piedmont result from deposition of sediment eroded from Pleistocene surfaces on the piedmont.

Interpretation of Topography

Contour crenulations indicate cuts or incised flow paths in the ground surface. Incision usually indicates stability as stormwater flow over this portion of land is hungry for sediment and less likely to deposit sediment. Hence, surfaces shown on the topographic map as highly crenulated tend to be stable surfaces. In contrast, smooth contour lines indicate very little incision. When smooth contour lines show a concave shape or bow downstream, this is a good indication of an active area of deposition.

The topographic contours of the Site 39 piedmont show highly crenulated yet fan shaped contours just downstream of the topographic apex with a significant incised channel conveying flow through the formation. Downstream from there, between the topographic and hydrographic apexes, the contour lines remain quite crenulated indicating a continuing area of incised channels and an eroded landform. Immediately downstream of the hydrographic apex, an area of stippled pattern shows an expanding gravel bed of the

wash. The area between the 1,470 foot and 1,400 foot contour shows relatively smooth slightly concave downstream contours. The northern border of the concave formation shows an incised wash corridor suggesting flows transmitted, carrying limited sediment, have entrenched a preferred flow corridor through the hydrographic apex of the alluvial fan.

From the 1,400 foot contour elevation crenulations are observed in the landform with a slightly concave shape indicating transition from sediment deposition in larger flow events to scouring conditions in the lower piedmont. This portion of the landform appears more susceptible to sheet flow conditions as the crenulated formations show limited capacity to convey storm water. Downstream of this location the unstable, uncertain distribution of flood water and sediment begins to reorganize itself into a series of parallel channels moving down the piedmont. Downstream from this area the contours become much and more parallel to one another and the degree of crenulation decreases.

Vegetation

While saguaro cacti can be found in portions of the upper unstable area, the area exhibits a generally scattered appearance of vegetation downstream of the hydrographic apex. This is in contrast to the linearly aligned riparian vegetation seen in aerial photographs elsewhere on the piedmont. The riparian vegetation helps create as well as indicate the stability of large portions of the middle and lower piedmont within the study limits.

6B.5.4 Identification of Inactive areas

Along with the active areas of the alluvial fan, Figure 5 also shows the limits of the inactive areas of the alluvial fan. Estimates of active alluvial fan landforms prepared by Ayres (Appendix G) suggest that large portions of the middle and lower piedmont have been and are likely to continue to be stable with respect to flooding in the future.

In particular, the inactive areas are on fan and/or stream terrace soils (series Chuckwalla, Gunsight, Mornoli, Denure, Ebon, Tremant, Coolidge and Laveen), on units identified as Qy_1 or older on the surficial geology, and having a variety of characteristics associated with inactive (or stable) areas in the *PFHAM* These characteristics include many of the same ones used by the NRCS and AZGS in the soils and geology mapping, such as, areas of desert pavement, desert varnish, tributary drainage patterns, reddened soils, carbonate accumulation in the soils, and incision of channels relative to the adjacent interfluve areas. Large tree vegetation, like palo verde, mesquite, and ironwood, within these areas are found predominantly along existing washes.

6B.5.5 Inactive areas still subject to flooding

The soils data, surficial geology, topographic contours, and historical aerial photographs indicate that large areas of the piedmont are subject to flooding, but that the nature of that flooding is within stable through flow channels or broad overland flow areas across wide stable areas (Wood Patel, JE Fuller, 2001).

Within some of the through flow channel corridors, some channel changes can be observed in the historical aerial photo record. However, these channel changes are confined within the corridors. These corridors are bounded by higher, generally older geomorphic surfaces. Channel changes occurring within these corridors may be considered analogous to changes in a braided riverine channel. That is, while channel changes do occur during floods, the limits of the flooding for large discharges are similar. Local velocities will vary between floods, but flood waters will be confined to the same overall channel. Additionally, the degree of flood hazard varies spatially within these corridors and between floods.

Within the broad overland flow areas small channels do exist. As described in Wood/Patel, JE Fuller (2001), the distribution of flow in these very small channels (widths less than 10 feet, depths less than 2 feet) undoubtedly varies from flood to flood. The most important aspect of these small channels is that they are stable. That is, the channels are not moving from one location to another during floods. Another important consideration is that while these channels lie within broader areas of overland flow, the flood hazard within the channels themselves is greater, being more frequent, deeper, and having higher velocities than the overbank/interfluve areas subject to overland flow.

Downstream of the active area, where flow is transmitted by culvert under Sun Valley Parkway, floodwater recollects and enters stable throughflow channels, which flow through the middle piedmont and onto the lower piedmont.

6B.5.6 Types of flooding and locations on the piedmont

Based on the evaluation of active and inactive areas on the Site 39 piedmont, the following locations and types of flood hazards were defined.

Active alluvial fan areas

Active alluvial fan flooding on the Site 39 piedmont is limited to a large area between the hydrographic apex and Sun Valley Parkway, and the inset Fan 14 area west of Sun Valley Parkway on the middle piedmont in Section 8, T2N, R4W. These areas represent significant flood and sediment hazards. 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.

Flooding along stable channels

From the topographic to the hydrographic apexes, flooding occurs in a stable confined channel. Downstream of the active fan area flood waters concentrate into a series of parallel channels across older stable geomorphic surfaces. These channels have been stable for a significant amount time 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. To determine the flow rate for the reorganized washes, a containment analysis technique was prepared for each of three primary washes. With this technique the capacity of observed incised flow corridors (defined by topography and aerial photography) within Holocene formations were used to approximate the flow historic capacity of each corridor. Based on these estimated flow rates an approximate riverine analysis was completed for the portions of Fan 39, and inset Fan 14, west of Sun Valley Parkway. The Zone A boundaries afforded by this hydraulic analysis were refined and confirmed by comparison to the geologic and geomorphic features identified in the area.

6B.5.7 Summary of active and inactive areas

Figure 5 shows the limits of the active and inactive areas of the Site 39 piedmont which form an important foundation in the evaluation of the 100-year flood hazard in Stage 3. The most active area of the Site 39 piedmont is an area about 1 square mile in extent downstream of the hydrographic apex and an inset unstable area, Fan 14, located within the middle piedmont surface. Upstream of the hydrographic apex flooding is limited to the entrenched channel. The middle piedmont is characterized by stable throughflow channels which recollect flood waters exiting the active area upstream.

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. The results of the 100-year floodplain are shown on Figures 8, Appendix E and the Stage 3 — 100-year Floodplain Map (Figure 9). The following is a more detailed description of the methods and rationale used in the identification and delineation of the various flood hazard zones shown in Figure 6.

6B.6.1 Flood Hazard Zones

The following table (Table 6) lists and describes the flood hazard zones identified and shown in Figure 9. These zones have been newly

defined for use in the delineation of piedmont flood hazards in Maricopa County, Arizona by the Flood Control District of Maricopa County. These new regulations were approved the Maricopa County Board of Supervisors on November 1, 2000. The resulting flood hazard map is similar in nature to the one shown in Example 4 in Appendix 1 of the *FEMA Guidelines* (2000).

TABLE 6
FLOOD HAZARD ZONES MAPPED

Zone Name	Local Community Zone Designation	Description
Zone A	Zone A	Approximate 100-year floodplain; riverine reaches upstream of hydrologic apex and downstream of Sun Valley Parkway
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 overland flow 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 overland flow 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 I foot; or drainage area less than I square mile
X (unshaded)	X (unshaded)	Areas outside the 500-year floodplain; shown only on rocky hills

Specifically, the unstable areas from Stage 2 have been used to identify the location of the Zone A - Administrative Floodway Active Alluvial Fan (Local Community Zones AFHH and AFUFD). The AFHH (active alluvial fan) zone lies within the unstable area. The AFUFD (uncertain flow distribution) zone encompasses the remainder of the unstable area as well as an additional buffer area along the downstream edge of the unstable area identified in Stage 2. This buffer area was determined by use of the soils, surficial geology data, interpretation of recent and historical aerial photographs, and engineering judgment.

Emanating from the AFUFD zone are Zone A Administrative Floodway Inactive Alluvial Fan (Local Community Zone AAFF) corridors which traverse the inactive (or stable) portions of the alluvial fan landform. These areas represent the primary through flow channels that convey the majority of the sediment and water discharges from the Site 39 drainage basin as evidenced by the NRCS soils data, the AZGS surficial geology data, and by interpretation of geomorphic features as shown in color aerial photographs and field observations. These through flow channel corridors can be considered similar to riverine floodways in that they are areas reserved for conveyance of the 100-year flood. Although these floodway corridors do not necessarily contain the entire limits of the 100-year flood across the middle and lower piedmont under the existing condition, they are adequate in size and continuity to convey floodwaters across the piedmont if flood water were restricted to them. Reservation of these corridors will allow for engineered flood protection and mitigation within other flood prone but stable areas of the inactive alluvial fan.

Flood prone areas in inactive areas outside the alluvial fan floodways are identified as Zone Inactive Alluvial Fan (Local Community Zone AFZA). The through flow channel corridors (Local Community Zone AAFF) would maintain major storm water and sediment conveyance. The areas designated as Local Community Zone AFZA would be subject to overbank flow and local runoff. Engineering would be required to mitigate overland flow and overbank flow during major events in areas shown as zone AFZA. Development within these areas would be allowed given an adequately engineered site specific evaluation of the flood hazard and flood mitigation measures. The AFZA zone is generally characterized by overland flow and flooding within relatively small stable channels. These small channels may either represent small distributary drainages connected to the primary floodways, small local drainages, or various paths where broad overland flow recollects as it flows down the piedmont in an effort to reorganize itself. Consequently, the magnitude and frequency of flood hazards within the AFZA zone should not be considered equal at every location.

Local drainages and small channels periodically connected to the larger system by wide overland flow need to be identified and considered in any site specific design to mitigate flood hazards. The use of large scale aerial photographs, detailed topography, and the data from this study are highly recommended in the evaluation of site specific flood hazards within the AFZA zones identified in this study. Although the surfaces included in the AFZA areas are considered to be stable, they may be connected to and influenced by the larger distributary system on the Site 39 piedmont. As such, the structure of the existing distributary network ought to be considered when evaluating and designing mitigation of flood related hazards at any particular site.

Also included in the AFZA zone are larger islands of stable often older geomorphic surfaces. Islands smaller than 10 acres were not separated from the surrounding zone.

Between many of the AAFF and AFZA areas are large islands of old stable geomorphic surfaces. These areas have been given a flood hazard zone of Zone X (shaded). 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).

6B.6.2 Verification of Results

Figure 4 shows the relationship of the Field and Pearthree surficial geology mapping to the Stage 3 flood hazard evaluation.

In general, everything shown by Field and Pearthree as being geologically recent (less than 2,000 years old) is included within the boundary of the approximate Zone A delineation.

Overall, the 100-year flood hazard assessment of the Site 39 piedmont and alluvial fan is 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.

7.0 DRAFT FIS

7.1 Summary of Discharges

TABLE 7
SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area	100-Year Peak Discharge
	(mi^2)	(cfs)
Concentration Point F3R (See Fig. 7) *APEX FLOW*	5.31	3,030
Concentration Point E4RB (See Fig. 7)	6.05	3,032

7.2 Floodway Data

No floodway modeling was performed as part of this approximate Zone A study. However, administrative floodways have been designated as seen on the annotated FIRM panels contained in the pockets at the end of Section 7. These administrative floodways are intended to provide continuity of throughflow for runoff and sediment flows within Fan 39. The local community will have the management responsibility for these floodways

7.3 Annotated Flood Insurance Rate Maps

The flood hazard study area for Fan 39 is covered by two FIRM panels in unincorporated Maricopa County, Arizona. Figure 6.1 and 6.2 (located at the end of Section 7) illustrate the boundaries for the new approximate Zone A boundary along with the existing flood hazard zones in the area.

7.4 Flood Profiles

No flood profiles are provided with this approximate method Zone A study.

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
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
040039	Town of Buckeye, Maricopa County	AZ	04013C	1540H	09/30/05
040039	Town of Buckeye, Maricopa County	AZ	04013C	1545H	09/30/05

2. Flooding Source: White Tank Mountain Foothills Alluvial Fan 39

3. Project Name/Identifier: White Tank Mountain Foothills Alluvial Fan 39, Approximate Floodplain Delineation Study

4. FEMA zone designations affected: X (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, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/fhm/frm_fees.shtm **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: Kevin Kammerzell	Company: CMX	
Mailing Address: 7740 N. 16th Street Phoenix, AZ 85020	Daytime Telephone No.: (602) 567-1900	Fax No.: (602) 567-1901
	E-Mail Address: kkammerzell@cmxinc.com	
Signature of Requester (required):		Date:

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: Tim Phillips, FCDMC General Manager and Chief Engineer		Telephone No.: 602 506-1501
Community Name: Maricopa County, AZ	Community Official's Signature (required):	Date:

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: Kevin Kammerzell	License No.: AZ 35050	Expiration Date: 06/09
Company Name: CMX, L.L.C.	Telephone No.: (602) 567-1900	Fax No.: (602) 567-1901
Signature:		Date: September 21, 2006

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.
35050
KEVIN C.
KAMMERZELL
Date Signed 9-21-07
ARIZONA, U.S.A.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☑ Yes Fee amount: $_____

☐ No, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/fhm/frm_fees.shtm **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: Kevin Kammerzell	Company: CMX	
Mailing Address: 7740 N. 16th Street Phoenix, AZ 85020	Daytime Telephone No.: (602) 567-1900	Fax No.: (602) 567-1901
	E-Mail Address: kkammerzell@cmxinc.com	
Signature of Requester (required):		Date:

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, Public Works Director		Telephone No.: 623 3496815
Community Name: Town of Buckeye, AZ	Community Official's Signature (required):	Date:

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: Kevin Kammerzell	License No.: AZ 35050	Expiration Date: 06/09
Company Name: CMX, L.L.C.	Telephone No.: (602) 567-1900	Fax No.: (602) 567-1901
Signature:		Date: September 21, 2006

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.
35050
KEVIN C.
KAMMERZELL
Date Signed 10-26-06
Expires 6/30/07
ARIZONA, U.S.A.

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 Mountain Foothills Alluvial Fan 39 (Hjalmarson and Kemna, 1992)
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 [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/fhm/en_modl.shtm.

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.

B. HYDRAULICS

1. Reach to be Revised

	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 Items 2,3, & 4 n/a- Zone A Study [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/fhm/frm_soft.shtm. 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:FAN 39 ZONE A	Floodway File Name:
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/fhm/en_modl.shtm.

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

ALLUVIAL FAN FLOODING FORM

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

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Flooding Source: White Tank Mountain Foothills Alluvial Fan 39 (Hjalmarson and Kemna, 1992)
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:
   USGS, Site Study, and Geomorphology

   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): 15,000 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

   e. Is there geomorphic evidence of past avulsions during the Holocene epoch? ☑ Yes ☐ No

   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):

   ☐ 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 hydrologic 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

Study Documentation Abstract for FEMA Submittals	Initial Study	X	Restudy		CLOMR		LOMR		Other	

Section 2.1: Study Documentation Abstract for FEMA Submittals

2.1.1	Date Study Accepted	
2.1.2	Study Contractor Contact(s) Address Phone Internal Reference Number	CMX, L.L.C. Aubrey Thomas, EIT and Kevin Kammerzell, P.E. 7740 North 16th Street, Suite 100 Phoenix, Arizona 85020 (602) 567-1900 7128
2.1.3	FEMA Technical Review Contractor Contact(s) Address Phone Internal Reference Number	
2.1.4	FEMA Regional Reviewer Phone	
2.1.5	State Technical Reviewer Phone	Arizona Department of Water Resources (602) 417-2400
2.1.6	Local Technical Reviewer Phone	Kathryn Gross, PE Flood Control District of Maricopa County 2801 West Durango Street Phoenix, AZ 85009 (602) 506-1501
2.1.7	Reach Description	Alluvial Fan 39 – Tributary to White Tanks Wash
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	Wagner Wash Well Quadrangle Original Photo Date: 1984 Map Edited: 1988

2.1.9	Unique Conditions and Problems	Alluvial Fan Drainage Conditions
2.1.10	Coordination of Q's Discharges (Agency, Date, Comments)	Flow rates were obtained from the Buckeye/Sun Valley Area Drainage Master Study hydrology prepared by the Flood Control District of Maricopa County, 2006 as the best available hydrologic data for the study area.

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.

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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.

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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/

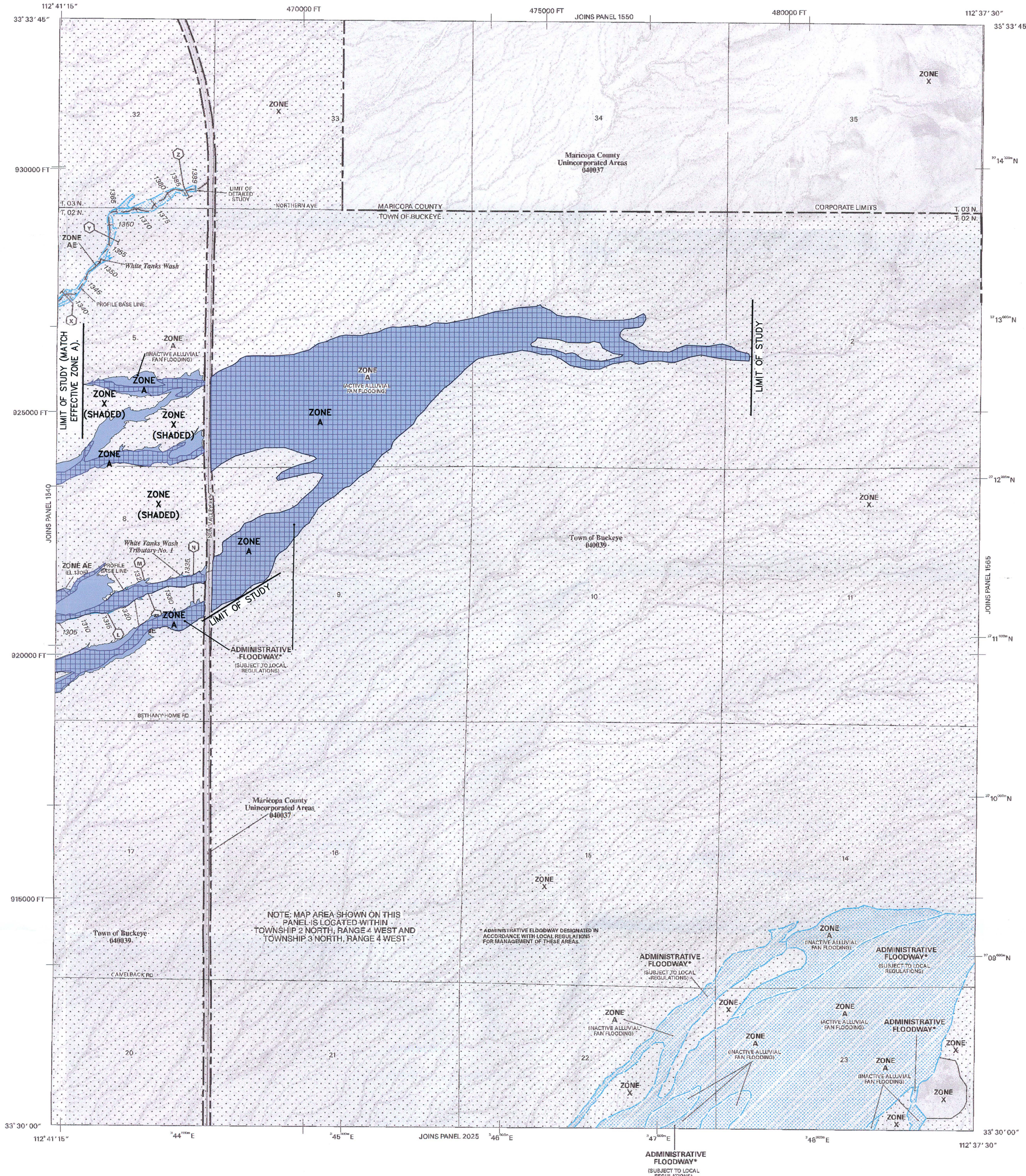
LEGEND

ZONE A– ACTIVE ALLUVIAL FAN ADMINISTRATIVE FLOODWAY (1)

ZONE A– INACTIVE ALLUVIAL FAN

NOTE:

1. AS DETERMINED BY ACTIVE ALLUVIAL FAN LIMITS
2. EFFECTIVE ZONE A LIMITS BORDERING NORTHWEST LEG OF ALLUVIAL FAN 39 WERE TAKEN FROM APPROVED <u>SUN VALLEY ADMP/FAN 6 TDN</u> (J.E. FULLER, NOVEMBER 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
4276000 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.

1200 600 0 1200 2400
SCALE FEET

NFIP
PANEL 1545H
NATIONAL FLOOD INSURANCE PROGRAM

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

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

7740 N. 16TH ST. STE. 100
PHOENIX, AZ 85020
PHONE: (602) 567-1900
FAX: (602) 567-1901
www.cmxinc.com
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WHITE TANK MOUNTAIN ALLUVIAL FAN 39
FLOOD CONTROL DISTRICT MARICOPA COUNTY
BUCKEYE, ARIZONA

FIG 6.1: ANNOTATED FEMA MAP

CMX PROJ: 6359-62	DATE: DEC. 2007	SCALE: 1"=1200'
DESIGNED: AJT	DRAWN: JAR	APPROVED: KCK
REV.		

DWG. NO. 1
SHT. 1 OF 2

X:\6300\6359-63\Water Resources\W-Exhibits\Drainage Report\TDN EX\Sub-Update\F6.1-6359-63-FEMA.dwg 01-02-2008 - 12:52pm

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NOTES TO USERS

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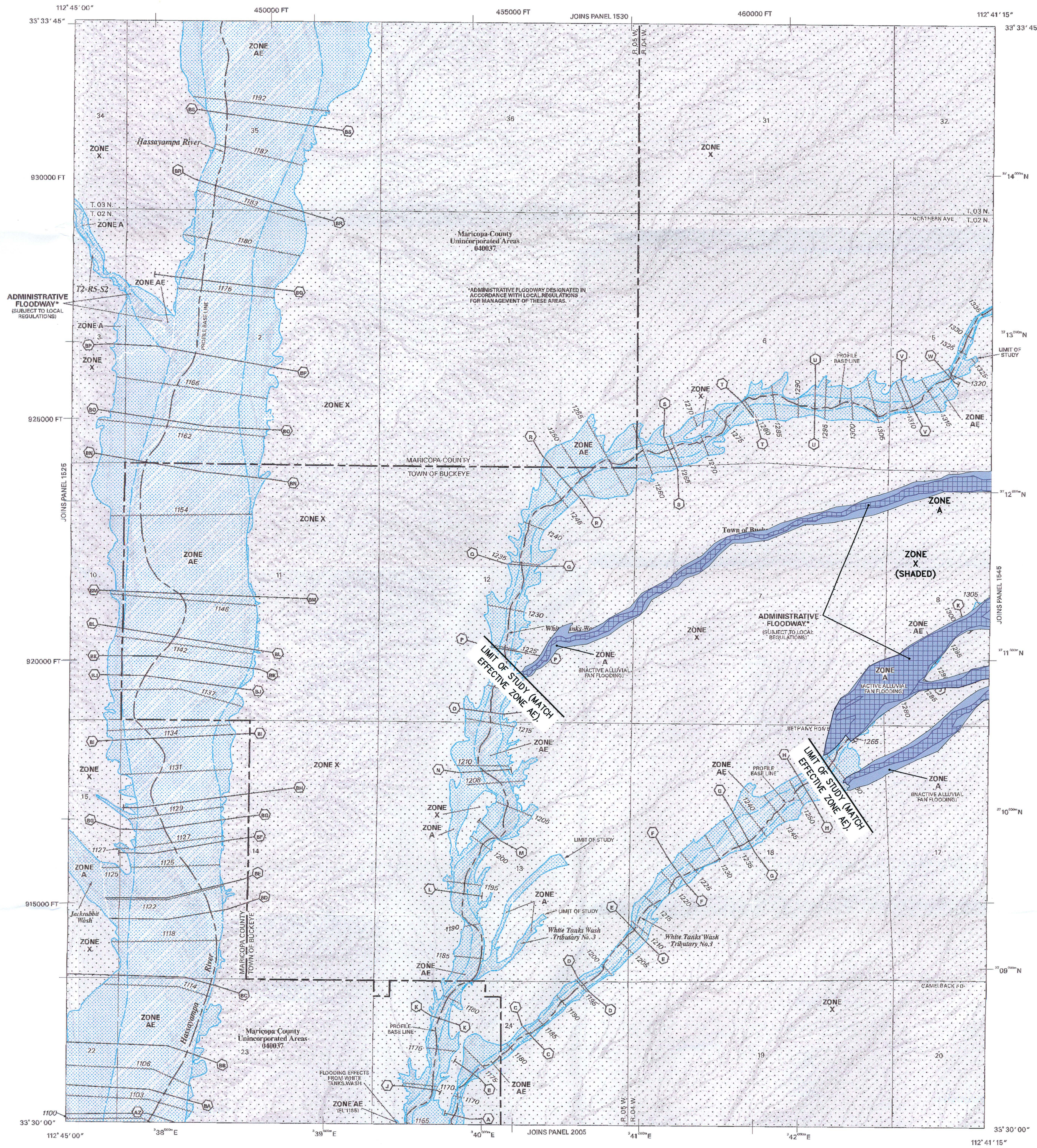
LEGEND

ZONE A– ACTIVE ALLUVIAL FAN ADMINISTRATIVE FLOODWAY (1)

ZONE A– INACTIVE ALLUVIAL FAN

NOTE

1. AS DETERMINED BY ACTIVE ALLUVIAL FAN LIMITS



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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FLOODWAY AREAS IN ZONE AE

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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.
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OTHERWISE PROTECTED AREAS (OPAs)

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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
⁴²76ᵐᵉ 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.

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1200 600 0 1200 2400
SCALE 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

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

WHITE TANK MOUNTAIN ALLUVIAL FAN 39
FLOOD CONTROL DISTRICT MARICOPA COUNTY
BUCKEYE, ARIZONA

FIG 6.2: ANNOTATED FEMA MAP

CMX
7740 N. 16TH ST. STE. 100
PHOENIX, AZ 85020
PHONE: (602) 567-1900
FAX: (602) 567-1901
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CMX PROJ:6359-63	DATE: DEC. 2007	SCALE: 1"=1200'
DESIGNED: AJT	DRAWN: JAR/AMS	APPROVED: KCK
REV.		

DWG. NO. 2
SHT. 2 OF 2

X:\6300\6359-63\Water Resources\W-Exhibits\Drainage Report\TDN EX\Sub-Update\F6.2-6359-63-FEMA.dwg 01-02-2008 - 1:06pm

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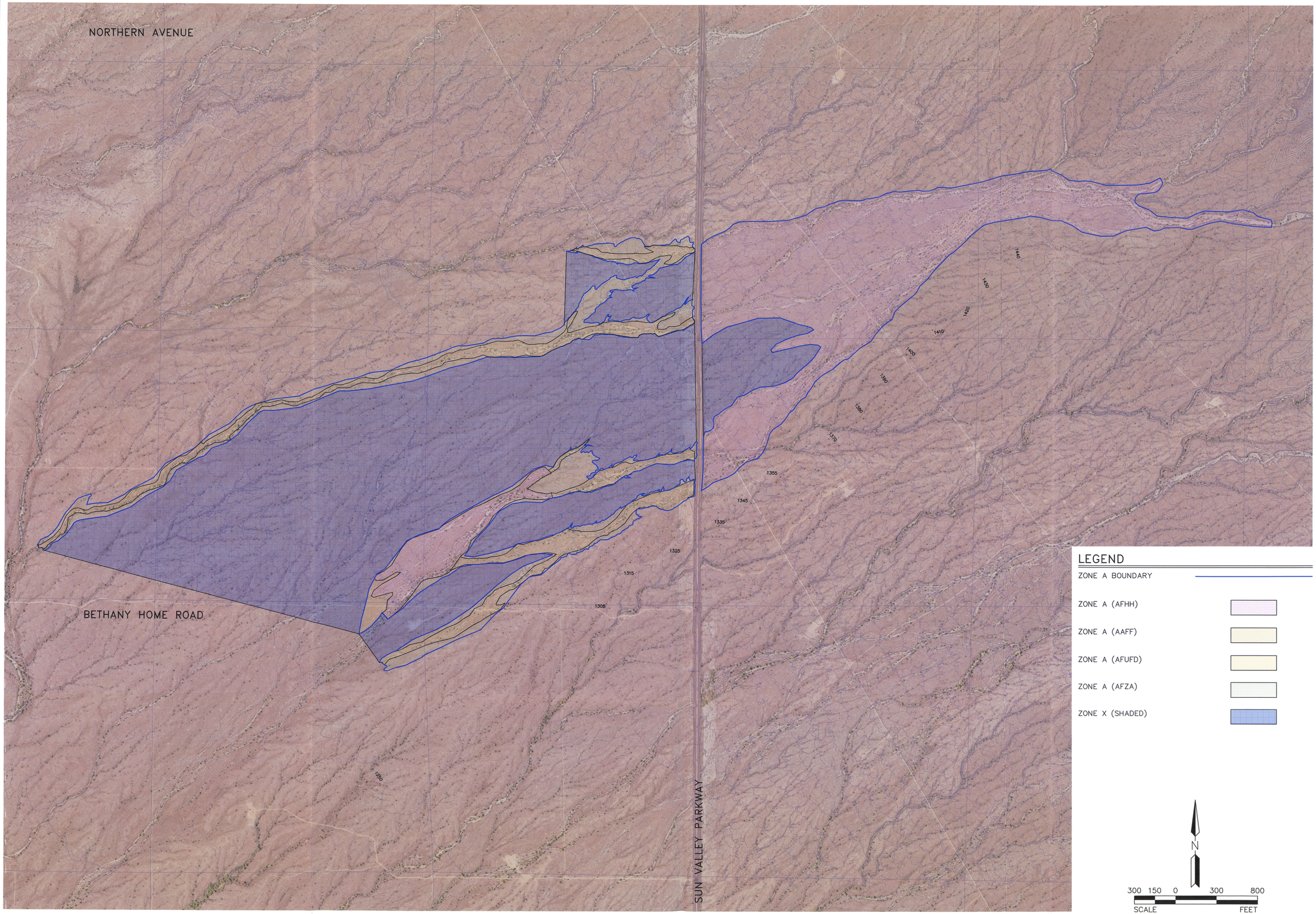

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7740 N. 16TH ST. STE. 100
PHOENIX, AZ 85020
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WHITE TANK MTN ALLUVIAL FAN 39

APPROXIMATE ZONE "A" DELINEATION STUDY
MARICOPA COUNTY

FIG 9: STAGE 3 – FLOODPLAIN MAP

CMX PROJ: 6359.63	DATE: DEC 2007	SCALE: 1"=800'
DESIGNED: AT	DRAWN: BC/AMS	APPROVED: KCK
REV.		

DWG. NO. 1

SHT. 1 OF 1

X:\6300\6359-63\Water Resources\W-Exhibits\Drainage Report\TDN EX\Sub-Update\FB-6359.63-STAGE3-EX.dwg 01-03-2008 - B:01am

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