JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

Floodplain Delineation Study for a portion of the Agua Fria River

Agua Fria River from 1800 feet upstream (north) of Camelback Road Bridge to 1700 feet upstream (north) of Indian School Road Bridge

Maricopa County, Arizona

Prepared for:

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Prepared by:

JE Fuller Hydrology & Geomorphology, Inc.
1 W. Deer Valley Road, #101
Phoenix, AZ 85027

FCD Contract No. 2007C051
Assignment #10

June 2011

U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

March 16, 2012

Frank Brown, P.E., CFM
Senior Civil Engineer
Flood Control District Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

RE: Floodplain Delineations in Support of Levee Certification Packages for Agua Fria River Levees with IDs #8, 11, 16 and 18

Dear Mr. Brown:

This letter is in reference to your submittal of a Technical Data Notebook prepared by Stanley Consultants, Inc. and WEST Consultants, Inc. to update the floodplain delineations along the Agua Fria River, generally from the Salt/Gila River to New River in August 2011. The study was submitted in support of the Provisionally Accredited Agua Fria River Levees (IDs 8, 11, 16 and 18) that were determined to meet the levee certification requirements outlined in the Code of Federal Regulation, Title 44, Section 65.10 (44 CFR 65.10).

We have completed our review and have approved the submitted data. The revised floodplain delineations for the Agua Fria River will be incorporated into a future Physical Map Revision (PMR) for Maricopa County.

If you have any questions regarding this matter, please contact me, either by telephone at (510) 627-7274, or by email at robert.bezek@fema.dhs.gov.

Sincerely,

Robert J. Bezek, CFM
Regional Engineer
Mitigation Division

cc: Brian Cosson, AZ DWR, NFIP State Coordinator
Scott Buchanan, Stanley Consultants, Inc.
Brian T. Wahlin, WEST Consultants, Inc.
Charlie McClendon, City Manager, City of Avondale
Sue McDermott, Floodplain Administrator, City of Avondale
Charles Andrews, Senior Project Manager, City of Avondale
David Cavazos, City Manager, City of Phoenix
Hasan Mushtaq, Floodplain Administrator, City of Phoenix

U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

November 23, 2011

Frank Brown, P.E., CFM
Senior Civil Engineer
Flood Control District Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Dear Mr. Brown:

This correspondence is in reference to the June 23, 2011, and August 25, 2011, letters and data submissions to the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding certification of the city of Avondale, the city of Phoenix, and Maricopa County portions of the Agua Fria River Levee System in order to meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10). The submitted data has been approved, and the levees are considered accredited. The pertinent information regarding the specific levees is listed below.

Identifier:	Agua Fria Levee System (Levee ID Nos. 8, 11, 16, and 18)
Flooding Source:	Agua Fria River
September 30, 2005 Effective FIRM panels affected:	04013C1620H, 04013C2080J, 04013C2085G & 04013C2090H
December 3, 2010 Preliminary FIRM panels affected:	04013C1695L, 04013C2155L, 04013C2160L & 04013C2165L

In support of the Agua Fria Levee System segment certifications the following information was submitted:

1. A report prepared by West Consultants, Inc., "Agua Fria River FEMA Levee Certification Package for Levee ID #8."
2. A report prepared by JE Fuller Hydrology & Geomorphology, Inc., "Certification Report for Camelback Ranch Levee South (ID #11) – Camelback Road to 3600 feet south along the east bank of the Agua Fria River – Maricopa County, Arizona."
3. A report prepared by West Consultants, Inc., "Agua Fria River FEMA Levee Certification Package for Levee ID #16."
4. A report prepared by West Consultants, Inc., "Agua Fria River FEMA Levee Certification Package for Levee ID #18."

The Technical Data Notebooks prepared by JE Fuller Hydrology & Geomorphology, Inc. and West Consultants, Inc., were reviewed to verify 44 CFR 65.10 compliance. The following is a summary of the review:

1. Freeboard: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(1).
2. Closures: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(2).
3. Embankment Protection: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(3).
4. Embankment and Foundation Stability: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(4).
5. Settlement: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(5).
6. Maintenance Plans and Criteria: Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(d).

All of the above documentation and data, along with the previously submitted documentation, have been reviewed and based on receipt of this information the Agua Fria River Levee System (Levee ID Nos. 8, 11, 16 and 18) as shown on the attached Agua Fria River Levee System Map, meets the minimum certification criteria outlined in 44 CFR 65.10. Therefore, we plan to continue to accredit this levee system on the new Digital Flood Insurance Rate Map (FIRM) as providing protection from the 1-percent-annual-chance (base) flood. The area protected from the base flood by this levee will continue to be mapped as a shaded Zone X and a note will be placed in that area warning of the flood risk that still exists.

Please be advised that levee systems and the estimated level of protection provided by these systems can and do change with time. Future map updates may require the levee system to be certified again at the time of update. Also, design, construction, operation, and/or maintenance documents may be requested at any time. Deviations from the documentation and data submitted to FEMA could result in the levee system no longer being mapped as providing protection from the base flood on future FIRMs. If at any point additional information is provided to FEMA that shows the levee system no longer meets certification criteria as outlined in 44 CFR 65.10, we will contact the levee owner and community about the possibility of de-accrediting the levee system.

Even though we have mapped the referenced levees as providing protection from the 1-percent-annual-chance flood, it is important to note that levees are only designed to provide a specific level of protection. They can be overtopped or fail in larger flood events. Levee systems require regular maintenance and periodic upgrades to retain their level of protection. When levees do fail, they fail catastrophically, and damage may be more significant than if the levee was not there. Therefore, we encourage you to annually discuss the status and condition of your levees with your governing body. Additionally, it is highly recommended that you consider this risk in your local emergency management plans, including creating evacuation plans for this area.

Everyone should understand the risk to life and property that resides behind levees—risk that even the best flood-control system can not completely eliminate. For this reason, FEMA encourages people to understand their risk. The National Flood Insurance Program (NFIP) was created to reduce flood damages by identifying flood risks, encouraging sound community floodplain management practices, and

providing flood insurance to lessen the financial impact of flooding. Through the NFIP, property owners in participating communities are able to purchase flood insurance that will insure against flood losses. We hope that you will encourage property owners to purchase flood insurance.

If you have additional questions regarding this matter, please contact me, either by telephone at (510) 627-7274, or by email at robert.bezek@fema.dhs.gov.

Sincerely,

Robert J. Bezek, CFM
Regional Engineer
Mitigation Division

Enclosure:
Agua Fria River Levee System Map

Copies Furnished (w/out enclosures):
Brian Cosson, AZ DWR, NFIP Coordinator
Tony Freiman, AMEC Earth & Environmental, Inc.
Steve Nowaczyk, Ninyo and Moore
Jon T. Ahern, JE Fuller Hydrology & Geomorphology, Inc.
Scott Buchanan, Stanley Consultants, Inc.
Brian T. Wahlin, WEST Consultants, Inc.
Charlie McClendon, City Manager, City of Avondale
Sue McDermott, Floodplain Administrator, City of Avondale
David Cavazos, City Manager, City of Phoenix
Hasan Mushtaq, Floodplain Administrator, City of Phoenix

Flood Control District
of Maricopa County

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

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December 22, 2011

Thomas W. Smith, P.E.
Engineering Technical Services Group
FEMA PTS Contractor
Michael Baker, Jr., Inc.
3601 Eisenhower Avenue
Alexandria, VA 22304

Subject: Floodplains Review for Agua Fria River Levees, Data Request

Dear Mr. Smith:

The Federal Emergency Management Agency, via Sarah Houghland, P.E., CFM, at BakerAECOM, has requested the digital floodplain information, recent aerial photographs and recent topographic mapping (contours and DTM) for the lower Agua Fria River. Enclosed is a DVD disk with the requested data in the appropriate format files. The District does not require a signed Public Records request for this data, because this data is in support of documents previously submitted to FEMA for levee accreditation. The data disk contains the data described in the attached File Inventory Report.

It is important to note that the topographic information has not been edge-matched for this project, therefore a map, from the interior Drainage Report (ID#8&16), listing the data sources for the contours is sent to assist you in loading/viewing the correct shape file, depending on which floodplain area you are reviewing.

If you have questions concerning this information, please call me at 602-506-4617.

Sincerely,

Frank Edward Brown

Frank Edward Brown, P.E., CFM
Senior Civil Engineer, Mitigation Planning & Technical Programs Branch,
Floodplain Management and Services Division

C: Bob Bezek, FEMA Region IX
Sarah Houghland, BakerAECOM

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August 25, 2011

Robert J. Bezek, CFM
Regional Engineer
U.S. Department of Homeland Security
Mitigation Division, FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: Floodplain Delineations in support of Levee Certification Packages for Agua Fria River Levees, PAL ID#8-11-16-18

Dear Mr. Bezek:

This letter is in response to the Provisionally Accredited Levee (PAL) agreements which the District, the City of Avondale and the City of Phoenix entered into with the Federal Emergency Management Agency in June 2009 for the Agua Fria River Levees, generally between the New River and the Salt / Gila River. The Levee Certification Reports for each of PAL ID#8, ID#11, ID#16, and ID #18 were submitted in June 2011.

Provided in this submittal is an update to the Agua Fria River Floodplain work maps from the Salt / Gila River to New River. As discussed with you, the District directed Stanley Consultants to correct some graphic presentation items on the new work maps, and added the Zone AH delineations prepared by WEST Consultants for the interior drainage analysis. The work maps also depict the floodplain delineation adjacent to PAL ID#11 prepared by JE Fuller. On August 4 we met with the City of Avondale to coordinate some floodplain issues for proper depiction of certain areas on the work maps.

Submitted are 1 hard copy Agua Fria River Floodplain Re-Delineation Technical Data Notebook, 2 hard copy Interior Drainage Reports (one for each river side), work maps and annotated FIRM Panels. As stated in past conversations and stated in a one page TDN addendum, the HEC-RAS models are unchanged and are the same as the June 2011 submittal. The enclosed disks contain PDF format files of the submitted data along with the HEC-RAS models previously submitted.

Shipped are one box with the reports and disks and one tube with the floodplain / floodway work maps. Please replace the previously submitted information with this update information. A minor update is made to the levee certification reports to document the revised reference report dates.

FEMA now has all applicable information to begin review of the Agua Fria River levees. We ask that FEMA agree with the District that these Agua Fria River Levees are in full compliance with 44CFR §65.10 to provide protection from flooding during from the 1 percent annual chance flood, and request that all four of these levees be moved from Provisionally Accredited to Accredited status on the FIRM Panels.

If you have questions concerning this submittal, please call me at 602-506-4617.

Sincerely,

Frank Edward Brown

Frank Edward Brown, P.E., CFM
Senior Civil Engineer, Mitigation Planning & Technical Programs Branch,
Floodplain Management and Services Division

Cc: Sarah Houghland, Michael Baker Corporation (1 CD/DVD disk for each report, and 1 roll of floodplain work maps)
Brian Cosson, ADWR, NFIP Coordinator
Jon T. Ahern, JE Fuller Hydrology & Geomorphology, Inc.
Scott Buchanan, Stanley Consultants, Inc.
Brian T. Wahlin, WEST Consultants, Inc.
Charlie McClendon, City Manager, City of Avondale
Wayne Janis, Floodplain Administrator, City of Avondale
Sue McDermott, City Engineer, City of Avondale
Charles Andrews, Senior Project Manager, Engineering Dept., City of Avondale
David Cavazos, City Manager, City of Phoenix
Hasan Mushtaq, Floodplain Administrator, City of Phoenix

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Phoenix, Arizona 85009
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June 23, 2011

Ed Curtis, P.E., CFM
Senior Civil Engineer
Risk Analysis Branch, FEMA Region IX
U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: Levee Certification Packages for Agua Fria River Levees, PAL ID#8-11-16-18

Dear Mr. Curtis:

This letter is in response to the Provisionally Accredited Levee (PAL) agreements (attached) which Maricopa County, the City of Avondale and the City of Phoenix entered into with the Federal Emergency Management Agency in June 2009 for the Agua Fria River Levees, generally between the New River and the Salt / Gila River. The submittal package is separate Levee Certification Reports for each of PAL ID#8, ID#11, ID#16, and ID #18, dated June 2011.

In addition, we are providing an update to the Agua Fria River floodplain and floodway with new BFE's from the Salt / Gila River to New River, based on recent topographic mapping. The Agua Fria River Floodplain Re-Delineation Technical Data Notebook is being sent to you on disk (only), along with the HEC-RAS models. As recently agreed, Maricopa County will correct some graphic presentation items on the new work maps, add Zone AH delineations prepared by others for the new interior drainage analysis and submit a paper TDN with updated disks and updated work maps by July 18, 2011. The HEC-RAS models will be unchanged with this update.

You are receiving two boxes with the reports and disks and one tube with the floodplain / floodway work maps. As previously agreed, you are receiving the survey disks with sealed report scan without a paper copy of each survey report.

We ask that FEMA agree with Maricopa County that these Agua Fria River Levees are in full compliance with 44CFR §65.10 to provide protection from flooding during from the 1 percent annual chance flood, and request that all four of these levees be moved from Provisionally Accredited to Accredited status on the FIRM Panels.

If you have questions concerning this submittal, please call me at 602-506-4617.

Sincerely,

Frank Edward Brown

Frank Edward Brown, P.E., CFM
Senior Civil Engineer, Mitigation Planning & Technical Programs Branch,
Floodplain Management and Services Division

Cc: Sarah Houghland, Michael Baker Corporation (1 CD/DVD disk for each levee report, and 1 roll of floodplain work maps)
Brian Cosson, AZ DWR, NFIP Coordinator
Tony Freiman, AMEC Earth & Environmental, Inc.
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Wayne Janis, Floodplain Administrator, City of Avondale
David Cavazos, City Manager, City of Phoenix
Hasan Mushtaq, Floodplain Administrator, City of Phoenix

Floodplain Delineation Study for a portion of the Agua Fria River

Agua Fria River from 1800 feet upstream (north) of Camelback Road Bridge to 1700 feet upstream (north) of Indian School Road Bridge

Maricopa County, Arizona

Prepared for:

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Registered Professional Engineer (Civil)
CERTIFICATE NO.
34141
JON T.
AHERN
Date Signed 6/22/2011
ARIZONA, U. S. A.
Expires 09/30/2011

Prepared by:

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

1 West Deer Valley Road, Suite 101
Phoenix, AZ 85027

June 2011

This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by JE Fuller Hydrology & Geomorphology, Inc., shall be without liability to JE Fuller Hydrology & Geomorphology, Inc.

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1. Introduction

1.1 Purpose

The Flood Control District of Maricopa County (District) retained JE Fuller Hydrology & Geomorphology (JE Fuller) to redelineate a section of the Agua Fria River based upon revised topography and the presence of a provisionally accredited levee (Camelback Levee).

1.2 Authority

Study team contact information is presented below:

Flood Control District of Maricopa County

Address: 2801 W. Durango Street
Phoenix, AZ 85009
Phone: (602) 506-1501
Project Manager: Frank Brown P.E., CFM

JE Fuller Hydrology & Geomorphology, Inc.

Address: 1 W. Deer Valley Rd, Suite 101
Phoenix, Arizona 85027
Phone: (623) 889-01688
Project Manager: Jon Ahern, P.E., CFM

1.3 Site Location and Description

The study area location and vicinity is provided in **Figure 1-1**. The main focus of this study is the reach of the Agua Fria River starting north of Camelback Road stretching south for an approximate length of 3600 ft. This segment of the Agua Fria River contains a provisionally accredited levee along the eastern bank. The levee is located adjacent to a large mining pit which stretches from approximately 500 ft from the Camelback Road Bridge to approximately 1650 ft north of Indian School Road Bridge. The study reach extends from the confluence of Agua Fria River and New River at the north to a location 1700 ft north of Indian School road. A sand and gravel mining pit has lowered the channel bottom elevation by approximately 7 to 10 ft in this reach. Smaller mining pits are located in the overbanks on the eastern side of the Camelback Ranch Levee South with residential areas located further east. In addition, there are also a few large mining pits located on the western side of the channel with significant high ground separating the main channel and these mining pits. At the southern end of the study reach, an access road to the western pits lowers the effective ground elevation influencing the hydraulic separation resulting from the high ground allowing main channel flow to enter into the overbank mining pit. At the northern end of the study reach, there is another large in-stream mining pit located between the Agua Fria and New River Confluence and the Camelback Road Bridge.

The land use area behind the levee (levee's dry-side) includes high density residential and commercial gravel mining activities.

The study reach of the Agua Fria River Creek is located on FEMA Flood Insurance Rate Map (FIRM) panel numbers 04013C1620H, 04013C2080J, 04013C2085G and 04013C1615K, Effective September 30, 2005. **Figure 1-2** provides the FEMA Effective Flood Insurance Rate Map (FIRM). **Section 2** of this report provides the required FEMA forms.

1.4 Methodology

1.4.1 Hydrology

The flow rates utilized in this study are obtained from the effective FIS study. The 100-year peak discharge was applied based on the 100-year discharge of 54,400 cfs from the effective FIS HEC-2 model. No new hydrology was developed for this LOMR application.

1.4.2 Hydraulics and Floodplain Delineation

The effective FIS HEC-2 model was supplied to JE Fuller by FEMA. Since significant change was evident in the cross-sectional geometry based upon newly obtained topographic data, the effective FIS model was not used as a base for the submitted delineation and only a current conditions model, reflecting the current floodplains, will be submitted for review by FEMA.

Analysis was conducted for the 100-year, 24-hour storm event with two profiles, one for the floodplain and the other for floodway (with encroachments).

Studies are currently underway (as of June 2011) to revise the FEMA floodplains downstream of this segment of Agua Fria River using the original FIS hydrologic and same, current topographic data. The report is submitted under separate cover, *Agua Fria River Floodplain Re-Delineation, from Salt/Gila River to New River, Letter of Map Revision, FCD 2007C053, June 2011.*

1.5 Summary of Results

Section 5 provides the current conditions discussion with a summary of results and **Appendix E** provides the hydraulic analyses supporting documentation.

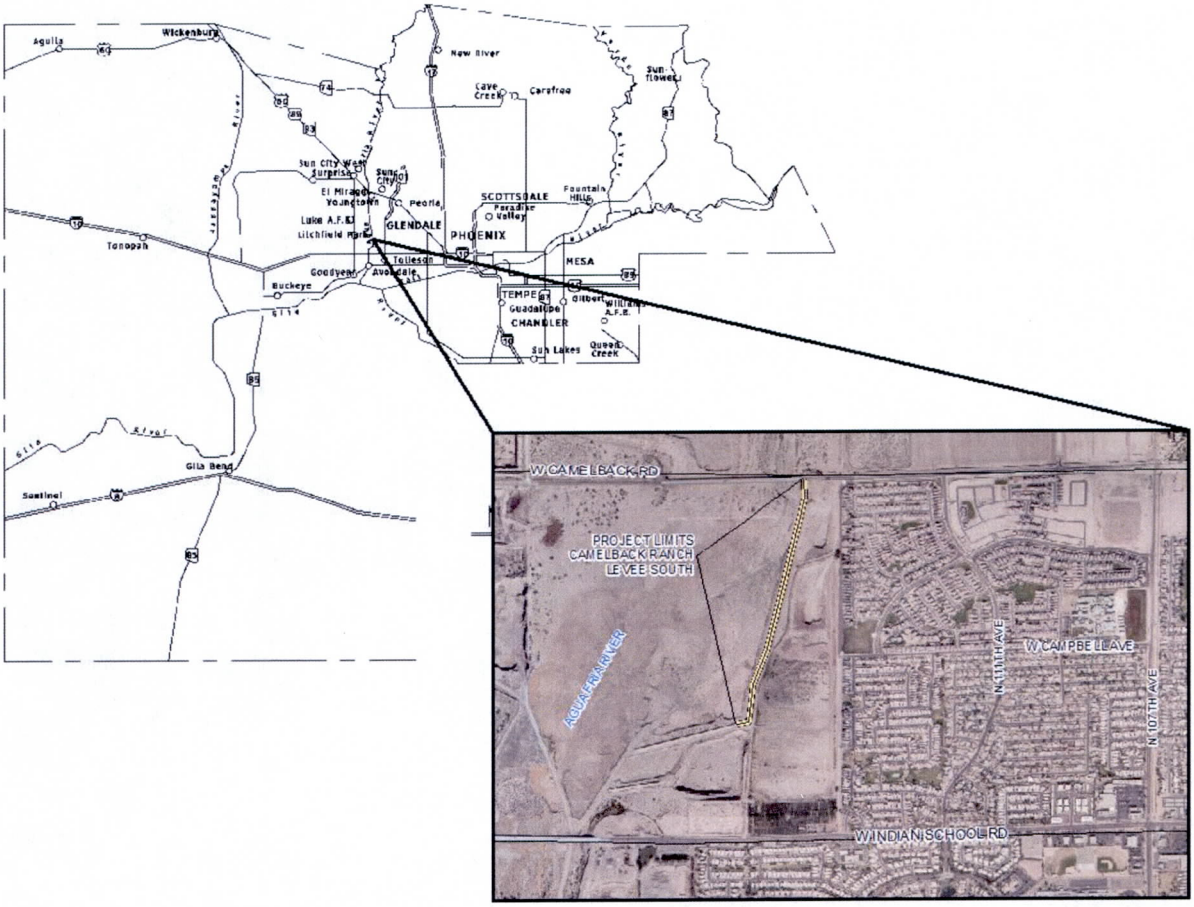
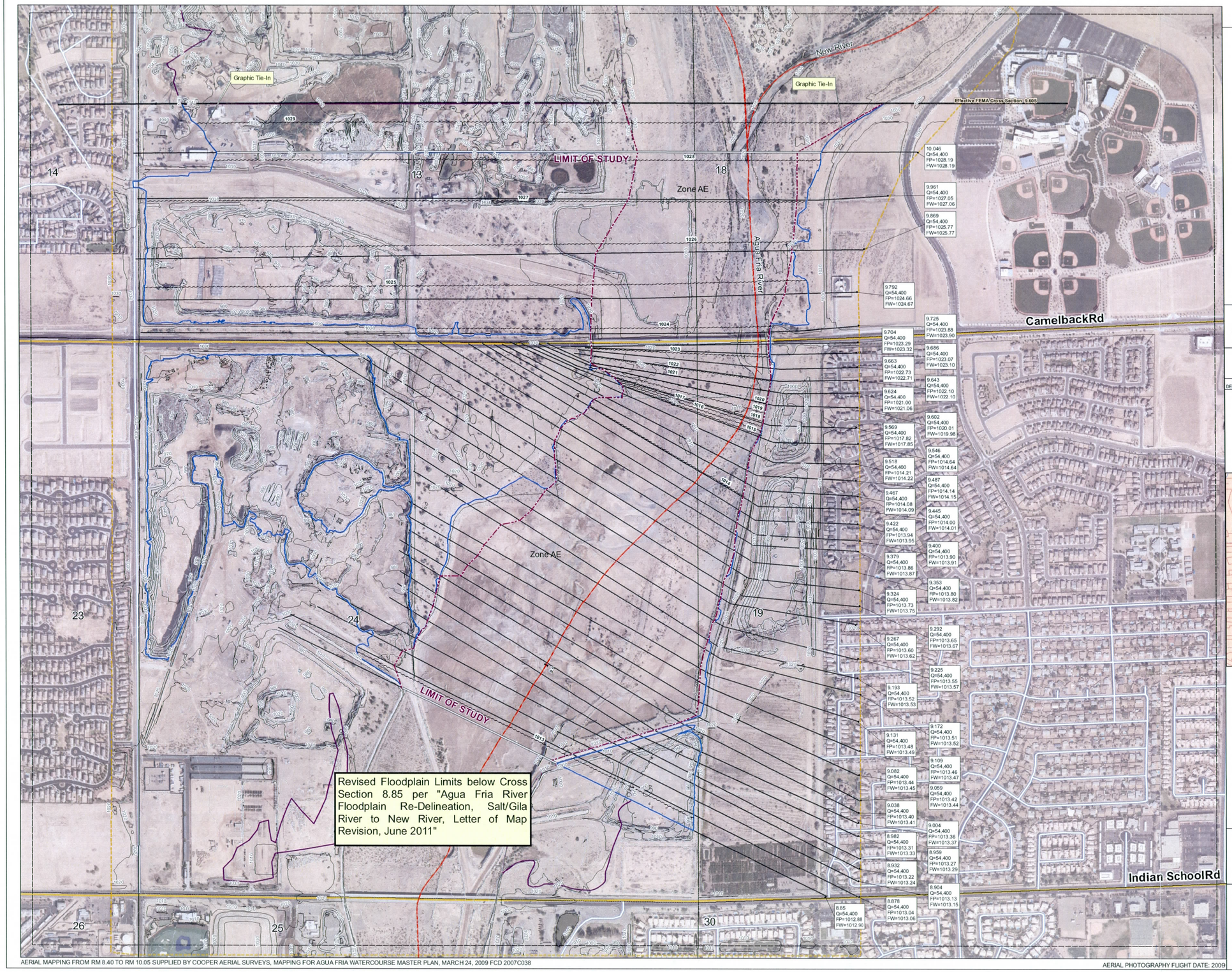


Figure 1-1. Vicinity and Location Maps.



AERIAL MAPPING FROM RM 8.40 TO RM 10.05 SUPPLIED BY COOPER AERIAL SURVEYS, MAPPING FOR AGUA FRIA WATERCOURSE MASTER PLAN, MARCH 24, 2009 FCD 2007C038

AERIAL PHOTOGRAPHY FLIGHT DATE: 2009

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR FLOODWAY
- 500-YR FLOODPLAIN
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY BOUNDARY
- BASE FLOOD ELEATION — 1020
- HYDRAULIC BASE LINE WITH RIVER MILE — 9.0
- SECTION BOUNDARY
- CROSS SECTION — 9.602 Q = 54,400 FP = 1019.98 FW = 1020.01
- ZONE DESIGNATION — ZONE AE
- CORPORATE LIMITS — CORPORATE LIMITS
- ELEVATION REFERENCE MARK
- TOPOGRAPHIC BOUNDARY

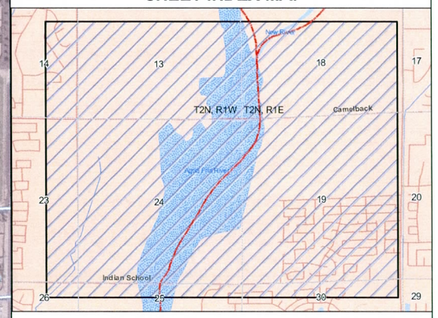
NOTES

1. THE PORTIONS OF AGUA FRIA RIVER BEING STUDIED ARE LOCATED WITHIN SECTIONS 13 AND 24 OF TOWNSHIP 0201, RANGE 0104 AS WELL AS SECTIONS 18 AND 19 OF TOWNSHIP 0201, RANGE 0102 OF THE SALT RIVER BASELINE AND MERIDIAN.
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

ELEVATION REFERENCE MARKS

STATION DESIGNATION	NAD 83 EASTING (FEET)	NAD 83 NORTHING (FEET)	NAVD 88 ELEVATION (FEET)	DESCRIPTION

SHEET INDEX MAP



FLOODPLAIN DELINEATION STUDY FOR A PORTION OF AGUA FRIA RIVER

FLOODPLAIN WORK MAP

MARICOPA COUNTY, ARIZONA

JUNE, 2011

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC

Flood Control District of Maricopa County

400 200 0 400 800
Feet

CONTOUR INTERVAL = 2 FEET

FIGURE E-3

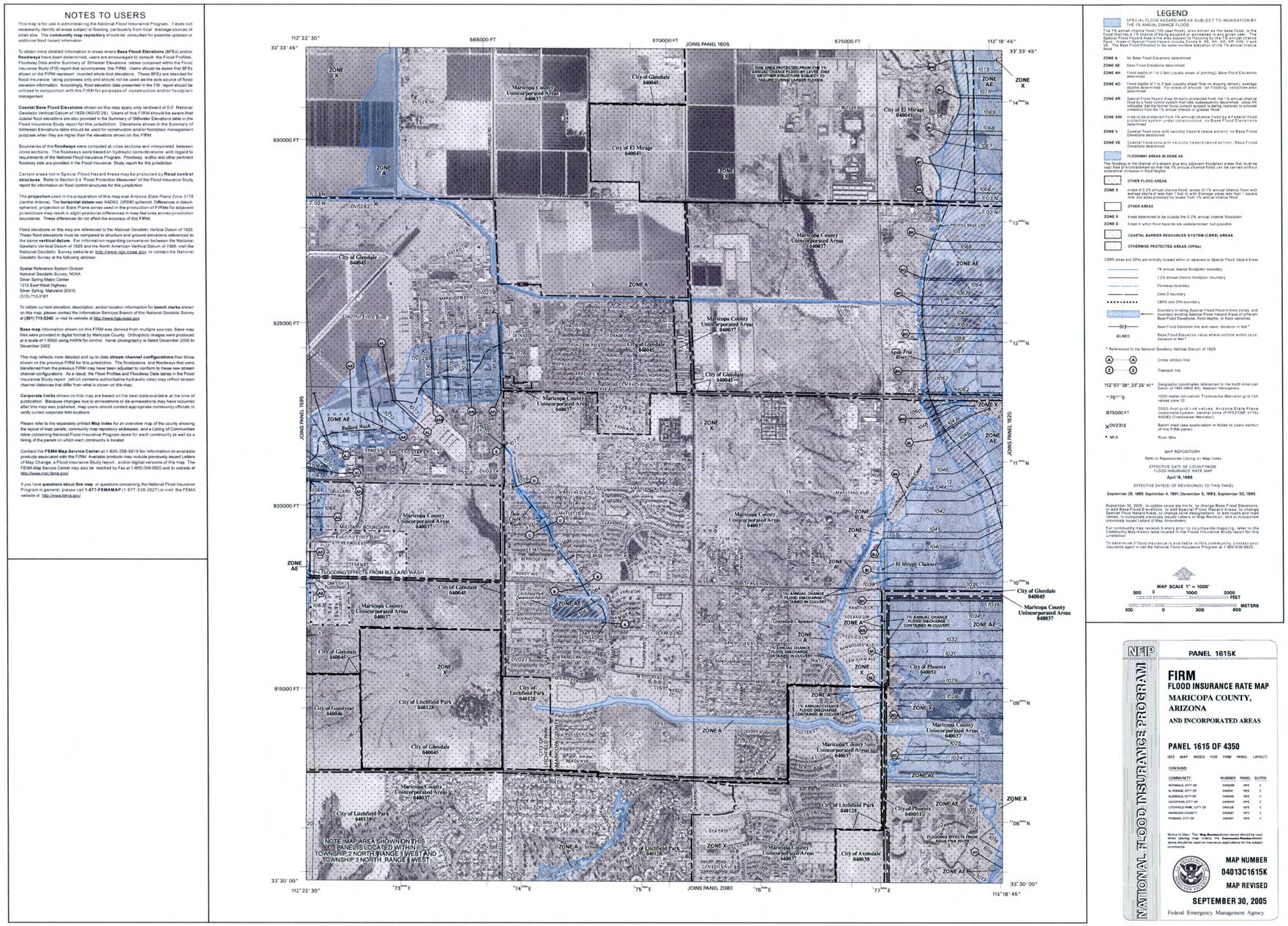


Figure 1-2. Effective FEMA Flood Insurance Rate Map.

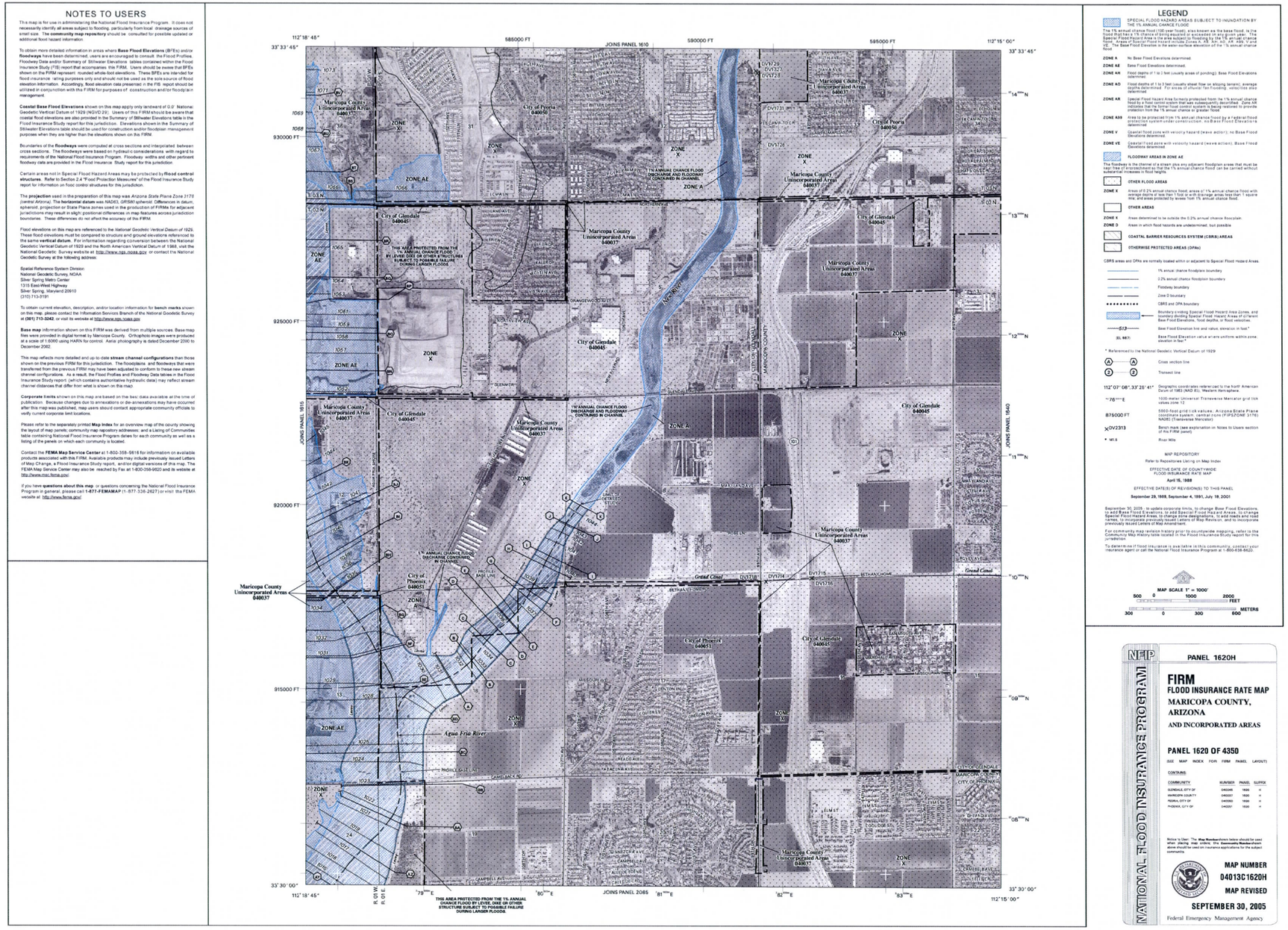


Figure 1-3. Effective FEMA Flood Insurance Rate Map (contd.).

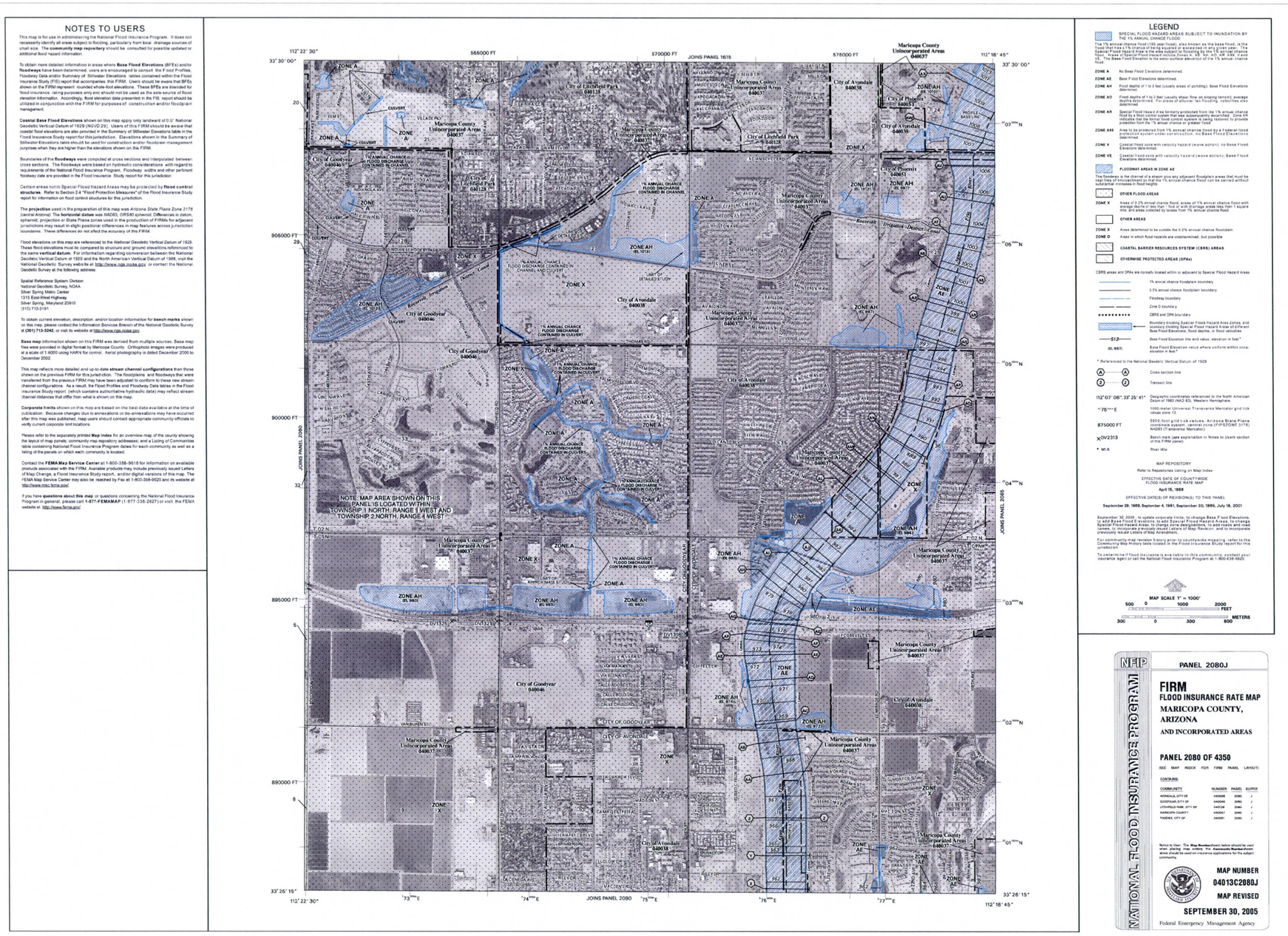


Figure 1-4. Effective FEMA Flood Insurance Rate Map (contd.)

Figure 1-5. Effective FEMA Flood Insurance Rate Map (contd.)

2. FEMA Forms

2.1 Study Documentation Abstract for FEMA Submittals

Study Documentation Abstract for FEMA Submittals		Initial Study		Restudy		CLOMR		LOMR	X
2.1.1	Date Study Accepted								
2.1.2	Study Contractor Contact Address Phone Internal Reference Name.	Jon Ahern, P.E., CFM JE Fuller Hydrology and Geomorphology, Inc. 1 West Deer Valley Road, Ste. 101 Phoenix, Arizona 85027 (623) 889-0166 Ext 306 Camelback Levee FDS							
2.1.3	FEMA Technical Review Contractor Contact Address Phone Internal Reference No.	FEMA Production and Technical Services Contractor 355 Union Blvd., Suite 200 Lakewood, CO 80228 (720) 514-1116							
2.1.4	FEMA Regional Reviewer Phone	Not Applicable							
2.1.5	State Technical Reviewer Phone	Not Applicable							
2.1.6	Local Technical Reviewer Phone	Frank Brown, P.E., CFM, Flood Control District of Maricopa County, (602) 506-1501							
2.1.7	Reach Description	Agua Fria River from 1800 feet upstream (north) of Camelback Road Bridge to 1700 feet upstream (north) of Indian School Road.							
2.1.8	USGS Quad Sheet Original Photo Date Latest Photo Revision Date	El Mirage and Tolleson Quadrangle							
2.1.9	Unique Conditions and Problems	Existing PAL levee downstream of Camelback Road Bridge							
2.1.10	Coordination of Q's Discharges (Agency, Date, Comments)								

2.2 FEMA Forms

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 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 it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). 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.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-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 DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

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

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
040037 040051	Maricopa County Unincorporated Areas City of Phoenix	AZ	04013C	1620H	09/30/2005
		AZ	04013C	2080J	09/30/2005
		AZ	04013C	2085G	09/30/2005
		AZ	04013C	1615K	09/30/2005

2. a. Flooding Source: Agua Fria River
   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH) ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)
3. Project Name/Identifier: ***Floodplain Delineation Study for a Portion of the Agua Fria River***
4. FEMA zone designations affected: AE and AH (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 ☐ Base Map Changes
   ☐ Coastal Analysis ☐ Hydraulic Analysis ☐ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☒ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☒ New Topographic Data ☐ 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 structures (check all that apply)

Structures: ☐ Channelization ☒ Levee/Floodwall ☐ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

MT-2 Form 3 for the Camelback Ranch Levee South is not included with this LOMR submittal. Refer to Certification Report for Camelback Ranch Levee South (ID#11), Camelback Road to 3600 feet south along the east bank of the Agua Fria River, Maricopa County, Arizona, June 2011 under separate cover.

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

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

☒ No, Attach Explanation. Part of Levee Cert. Submittal

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/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: Jon Ahern P.E., CFM	Company: JE Fuller Hydrology and Geomorphology, Inc.	
Mailing Address: 1 West Deer Valley Road, Suite 101 Phoenix, AZ 85027	Daytime Telephone No.: 623-889-0166 Ext 306	Fax No.: 480-839-2193
	E-Mail Address: jon.ahern@jefuller.com	
Signature of Requester (required):	Date: 06-23-2011	

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 requirements for when fill is 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. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. 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: Frank Brown P.E., CFM	Community Name: Maricopa County Uninc. Areas	
Mailing Address: 2801 W. Durango Street Phoenix, AZ 85009	Daytime Telephone No.: 602-506-1501	Fax No.:
	E-Mail Address:	
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 data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. 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: Jon Ahern P.E., CFM	License No.: 34141	Expiration Date: 09-30-2011
Company Name: JE Fuller Hydrology and Geomorphology, Inc.	Telephone No: 623-889-0166 x306	Fax No.: 480-839-2193
Signature:	Date: 06-23-2011	E-Mail Address: jon.ahern@jefuller.com

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

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 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, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). 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.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.
PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).
ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.
DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Agua Fria River
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 B) ☐ 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.)	Effective/FIS (cfs)	Revised (cfs)

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

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model → Specify Model: _____
☐ 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.

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

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☐ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation..

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit*	1,700 feet North of Indian School Road	Effective STA 8.325 (Revised 8.850)	***	1012.88
Upstream Limit*	Confluence. of Agua Fria River and New River	Effective STA 9.519 (Revised 10.046)		1028.19

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS ***Lower Agua Fria currently under study. Starting conditions used from current study

3. Pre-Submittal Review of Hydraulic Models*
DHS-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. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4.

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
Existing or Pre-Project Conditions Model	File Name: Agua Fria.DAT	Plan Name: Agua Fria.DAT	File Name:	Plan Name:	1929
Revised or Post-Project Conditions Model	File Name: AguaFriaRiver_CBRLS.prj	Plan Name: Camelback Ranch Levee South (Profile 1)	File Name: AguaFriaRiver_CBRLS.prj	Plan Name: Camelback Ranch Levee South (Profile 2)	1988
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A **certified topographic work 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.).

☐ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: Agua Fria Watercourse Master Plan (2009)
Source: Supplied by the Flood Control District of Maricopa County Date: 2009
Accuracy: 2-foot

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**, at the same scale as the original, 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 on revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

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

   a. 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 compared to pre-project conditions.
      - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☐ Yes ☒ No
      If Yes, please attach **proof of property owner notification and acceptance (if available)**. Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

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 established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

3. Survey and Mapping Information

3.1 Field Survey Information

No field survey information was used as part of this study.

3.2 Mapping

Electronic terrain data of 2-ft-accuracy, aerial mapping used for modeling Agua Fria River and Camelback Levee was provided as mass points and breaklines by the Flood Control District of Maricopa County. Terrain data included mass points, breaklines, and spot elevations are based on the following control:

- Horizontal Control: North American Datum 1983 (NAD 83), Arizona State Plane – Central Zone.
- Vertical Control: North American Vertical Datum 1988 (NAVD 88).

Cooper Aerial Surveys provided the topography under the project name Agua Fria Watercourse Master Plan, dated March 24, 2009 per FCD contract number 2007C038. Topographic mapping limits are shown in **Figure 3-1.**

The HEC-2 models (Effective FEMA), discussed in **Section 5** were based on NGVD 29. A conversion in needed to compare the NAVD 88 FCD topography with the NGVD 29 model. The conversion factor was determined by comparing local benchmarks, survey control within the project area and the datum shift using the American Vertical Datum Conversion Utility software. The final data shift was determined to be equivalent to the original FIS Study (CVL 1995).

NGVD 29 = NAVD 88 – 2.06 feet.

This conversion is consistent with the floodplain delineation study downstream of this segment of Agua Fria River using the same hydrologic and topographic datum. The report is submitted under separate cover, *Agua Fria River Floodplain Re-Delineation, from Salt/Gila River to New River, Letter of Map Revision, FCD 2007C053, June 2011.*

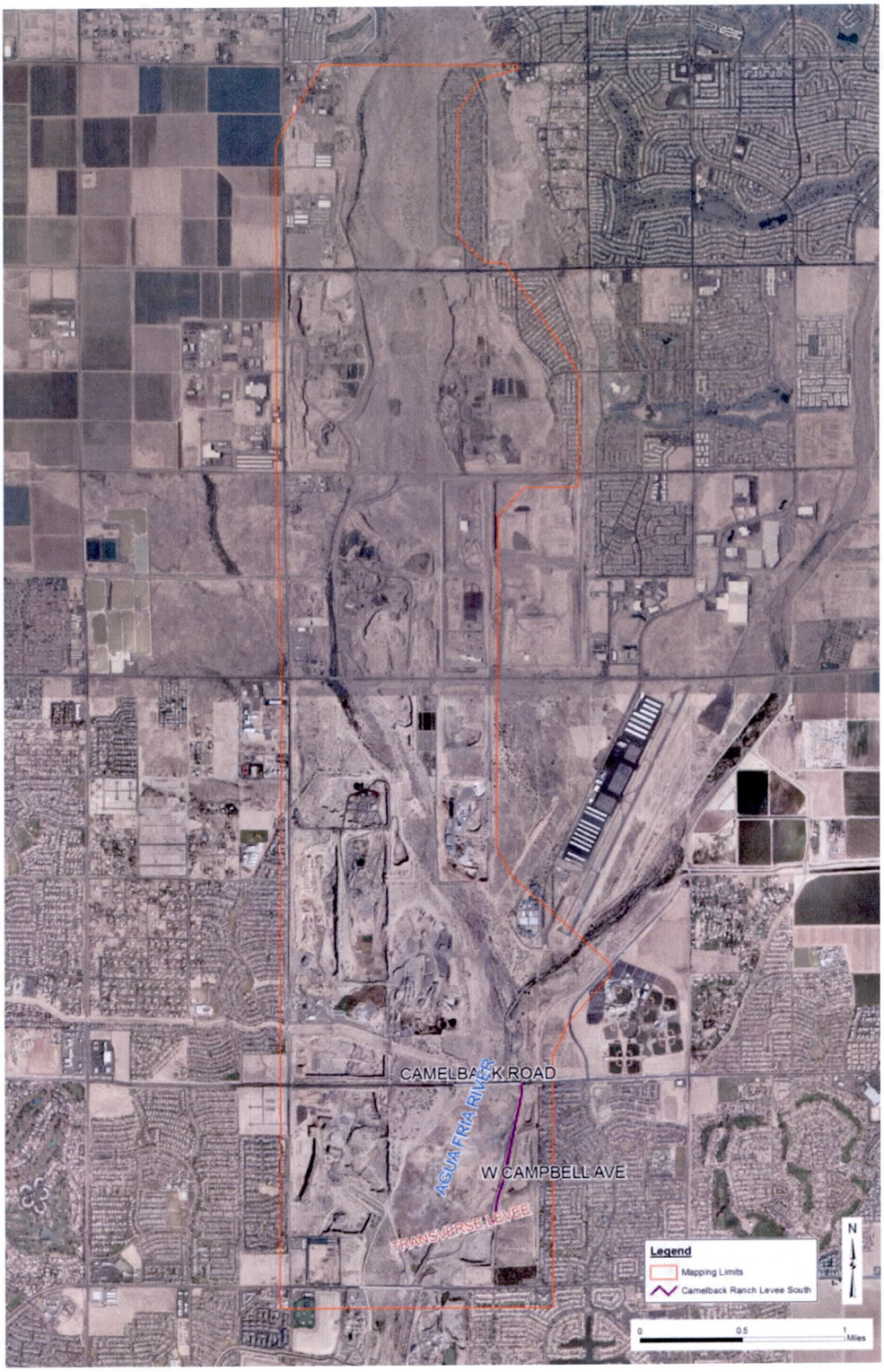


Figure 3-1: Mapping Limits

4. Hydrology

The flow rates utilized in this study were obtained from the effective FIS study. The 100-year peak discharge was applied based on the 100-year discharge of 54,400 cfs from the effective FIS HEC-2 model. No new hydrology was developed for this LOMR application.

5. Hydraulics

5.1 Method Description

A HEC-RAS model (AguaFriaRiver_CBRLS.prj) was developed for hydraulic analysis of the current condition of Agua Fria River from 1800 feet upstream (north) of Camelback Road Bridge to 1700 feet upstream (north) of Indian School Road. The analysis was completed using the U.S. Army Corps of Engineers HEC-RAS River Analysis System, Version 4.1.0 (January 2010). The subcritical steady-state flow regime option was selected.

5.1.1 Current Conditions Model Development

Agua Fria River was hydraulically modeled using the steady-flow routine in HEC-RAS. For the purpose of this evaluation, only a current existing condition HEC-RAS (current condition) model was created. To aid in HEC-RAS modeling, HEC-GeoRAS v4.1.1 procedures, tools and utilities were used to process geospatial data from ArcGIS into HEC-RAS format.

The HEC-RAS current condition work map is shown in **Figure E-1** provided in **Appendix E.5**.

5.1.2 Steady Flow Data

The 100-year peak discharge of 54,400 cfs at Camelback Road Bridge was obtained from the effective FIS HEC-2 model. This discharge was applied at the upstream end of the HEC-RAS model at cross-section 10.046. This cross-section is located downstream of the confluence of the Agua Fria and New River.

5.1.3 Downstream Boundary Conditions

The HEC-RAS downstream boundary condition for the 100-year discharge was provided by Stanley Consultants from the HEC-RAS model for the segment of the river located downstream of the study reach. The water surface elevation of 1012.88 was applied at cross-section 8.850 using the "Known WS" option. For the floodway profile the starting elevation was also set using a Known WS equivalent to 1012.90 ft based on the existing FIS elevation difference in Floodplain/Floodway elevation at the cross-section.

5.2 Parameter Estimation

5.2.1 Roughness Coefficients

The current condition HEC-RAS model used Manning's roughness coefficients (n-values) that reflected land use and channel characteristics. The channel bottom with the study reach consists of gravelly sand with very little vegetation. A significant portion of the model reach is within a sand and gravel mining pit. In addition, the overbank areas have also been subjected to mining activities with natural high ground separating the main channel and the pits in the overbanks. All the vegetation has been cleared within these pits with potential ponding occurring during low-flow events. The existing channel condition was observed and documented during a field visit conducted on December 11, 2009 and April 5, 2011. The digital photography obtained during this field visit is included in **Appendix E.1**. The Manning's-n value of 0.035 for the main channel was selected based upon the values used in the effective HEC-2 model and assessment of current conditions. For the current condition overbanks Manning's roughness coefficient, 0.04 was used for the reach downstream of Camelback Road Bridge and 0.05 was used for the reach upstream. These values are consistent with the values used in the

effective FIS HEC-2 model. Channel and overbank n-value photographs are included in the Field Reconnaissance Discussion in **Appendix E.**

5.3 Expansion and Contraction Coefficients

Expansion and contraction coefficients used were 0.1 and 0.3, along the channel and 0.3 and 0.5 upstream and downstream of Camelback Road Bridge. These values were obtained from Chapter 3 of the HEC-RAS Hydraulic Reference Manual and are generally accepted engineering hydraulic parameters.

5.4 Cross Section Descriptions

The HEC-RAS cross-sections were generated using the HEC-GeoRAS software within ArcGIS. HEC-GeoRAS software was used in conjunction with an ArcGIS triangulated irregular network (TIN) surface of the topography obtained from FCDMC (See **Section 3** for details) to generate cross-sectional geometry. A review of the mapping data suggests the topographic survey was performed when the sand and gravel mining pits contained ponded water. As a result, the topography captured by the survey included the water surface of the ponded water rather than the actual pit bottom. The use of the topography with the ponded water surface represented as pit bottom is not expected to impact the hydraulic computations performed as part of this study. Were the depressions not filled with water, flow in the depressions would be ineffective due to a lack of positive drainage. Further, flow in the rising limb of the hydrograph will likely fill the pits with water prior to arrival of the peak discharge. For the purposes of this study, the depressions have not been considered effective hydraulically or hydrologically.

The blocked obstructions option in HEC-RAS 4.1 was used to modify the cross-section geometry to adequately represent fully obstructed pits. The blocked obstruction option was applied at a representative slope of the overall cross-section without giving consideration to the changes in geometry due to the presence of gravel mining activities. The modifications were applied between cross-sections 9.172 at the downstream end to 9.518 at the upstream end resulting in a uniform slope of 0.0015 in this portion of the reach. These modifications limit the flow conveyance to the top portion of the cross-sectional area by disallowing conveyance within the pit. These modifications also allow smoother flow patterns at the downstream end of the pit where the pit-bottom topography results in a negative slope gradient in the downstream direction. Additionally, blocked obstructions and ineffective areas were used to remove overbank and in-stream pits and ponded from active conveyance of floodplain flows. Cross-section plots are included as PDF's on the study data disk located in **Appendix F**. This method is consistent with fixed-bed hydraulic modeling.

River mile stationing was modified with the addition of stream length at the confluence of the Agua Fria River with the Salt/Gila Rivers. Consequently at the upstream tie-in with the Effective FEMA HEC-2 model, the river stations are discontinuous. The upstream model cross-section is River Mile (RM) 10.046 and the Effective HEC-2 cross section station immediately upstream of this section is RM 9.605. For further discuss see The report is submitted under separate cover, *Agua Fria River Floodplain Re-Delineation, from Salt/Gila River to New River, Letter of Map Revision, FCD 2007C053, June 2011* under separate cover.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and Drop Analysis

As mentioned earlier, the channel bottom within the study includes the presence of a large sand and gravel mining pit. The pit boundary at the northern end is located approximately 500 ft from the Camelback Road Bridge. At this location, the channel bottom elevations change rapidly with the total change in elevation of approximately 7 to 10 ft across the width of the channel cross-section. These fluctuations in elevation, in unabated, can be expected to cause a significant impact in the flow hydraulics with higher velocities leading to Froude number close to critical. Blocked obstructions were used with HEC-RAS to restrict flow within the pit and force flow conveyance in the top portion of the channel. Due to filling of the pits during the rising limb of the hydrograph, hydraulic jumps are unlikely to develop in these areas and any jumps that do develop would be transitional in nature, existing only until the pits fill with water.

5.5.2 Culverts and Bridges

The study reach consists of only one bridge located at the Camelback Road crossing. The as-built drawing for this bridge was obtained from Maricopa County Department of Transportation and was incorporated in the HEC-RAS model. The following bridge modeling approaches were selected and HEC-RAS was set to select the highest energy answer: 1) Energy 2) Momentum and 3) Yarnell.

5.5.3 Levees and Dikes

The study reach of Agua Fria River contains a structure designated by FEMA as a Provisionally Accredited Levee (PAL). The levee, as seen in **Figure 1-3 and 1-5**, is shown on the effective FEMA map as providing protection for the 100-year flood. This study considers the levee as being accredited by FEMA and thus models the river in a "with" levee condition with the addition of a levee record along the Camelback Ranch Levee South limits.

Levee records were also used along the transverse dike at the southern end of the Camelback Ranch Levee. This structure is not certified but is constructed of soil cement. Floodplain limit are mapped behind the levee.

5.5.4 Flow Splits

No flow splits were modeled.

5.5.5 Ineffective Flow Areas

An area of the cross-section that impounds water, but does not actively convey the flow (velocity approximately equal to 0 ft/s), is defined as ineffective per this study. Ineffective areas were used on the eastern end of the cross-sections located between river-stations 9.059 and 9.225. This was implemented to represent a low-conveyance zone due to sharp turn of the right bank due to historical gravel mining activity. The limits were determined assuming a 4:1 expansion from the elevated right bank near cross-section 9.267.

5.5.6 Supercritical Flow

The overall flow within the study is in the subcritical regime. Localized supercritical flow may occur due to the presence of rapid topographic changes resulting from the presence of large in-stream mining pits. See model results in **Appendix E.4** for specific locations.

5.5.7 Floodway Modeling

The 100-year, current condition floodway was modeled using the 100-year flows from the

current effective hydrologic study (noted in **Section 4**). Encroachment Method 4 (Equal Conveyance) was used to define the floodway where the water surface elevations would not rise more than 1 ft above the floodplain water surface elevations and further refined using Method 1. The results indicate that the impacts of floodway encroachments to the water surface elevations were minimal.

5.6 Problems Encountered During the Study

5.6.1 Approach for Hydraulic Modeling of Agua Fria River with Levees

The study reach of Agua Fria River contains a structure designated by FEMA as a Provisionally Accredited Levee (PAL). This study considers the Levee as being accredited by FEMA and thus model Agua Fria River in a "with levee" condition through the addition of levee records along the length of the Camelback Ranch Levee South (9.059 to 9.686) and the Transverse dike along the east bank (8.850 to 9.059).

The Camelback Ranch Levee South is current under review for Accreditation by FEMA.

5.6.2 Model Warnings and Error Messages

5.6.3 HEC-RAS Summary of Warnings

The following modeling warnings were generated in the 100 year floodplain model:

- The energy loss was greater than 1.0 ft (0.3 m) between the current and previous cross section. This may indicate the need for additional cross sections.
- The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
- The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
- The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
- During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

No errors were encountered in the HEC-RAS model. Modeling warnings were reviewed for each cross section and evaluated for impacts to the integrity of the hydraulic model. Check-RAS model results are also included on the data disk in **Appendix F**.

In addition to the HEC-RAS warnings noted above, the model results were checked using FEMA's CHECKRAS program. Model notes were reviewed and evaluated for impacts to the integrity of the hydraulic model. Annotated CHECKRAS output files are included on the data disk in **Appendix F**.

5.7 Final Results

5.7.1 Hydraulic Analysis Results

A review of the hydraulic results indicates reasonable water surface profiles for the Agua Fria River. The water surface elevations tie into the effective model at the upstream cross section (RM 10.046) with an elevation difference of 0.2 ft.

HEC-RAS computed water surface elevations along the Agua Fria River for the100-year flows are presented in **Table 5-1**. In addition, the Agua Fria modeling results Summary Tables for the 100-year floodplain and floodway profiles are located in **Appendix E.4,** and in the HEC-RAS output report included on the data disk in **Appendix F.** HEC-RAS cross-sections locations are shown on **Figure E-1** and the details of the results are provided on data disk in **Appendix F**.

Table 5-1: HEC-RAS Results for Agua Fria River 100-year Floodplain

HEC-RAS STA (ft)	100-year Water Surface Elevation (ft)
10.046	1028.19
9.961	1027.05
9.869	1025.77
9.792	1024.66
9.725	1023.88
9.710	Camelback Road Bridge
9.704	1023.29
9.686	1023.07
9.663	1022.73
9.643	1022.10
9.624	1021.00
9.602	1020.01
9.569	1017.83
9.546	1014.64
9.518	1014.21
9.487	1014.14
9.467	1014.08
9.445	1014.00
9.422	1013.94
9.400	1013.90
9.379	1013.86
9.353	1013.80

Table 5-1: HEC-RAS Results for Agua Fria River 100-year Floodplain (continued)

HEC-RAS STA (ft)	100-year Water Surface Elevation (ft)
9.324	1013.73
9.292	1013.65
9.267	1013.60
9.225	1013.55
9.193	1013.52
9.172	1013.51
9.131	1013.48
9.109	1013.46
9.082	1013.44
9.059	1013.42
9.038	1013.40
9.004	1013.36
8.982	1013.31
8.959	1013.27
8.932	1013.22
8.904	1013.13
8.878	1013.04
8.850	1012.88

6. Erosion and Sediment Transport

Erosion of Camelback Ranch Levee embankment was assessed in Certification Report for Camelback Ranch Levee South (ID#11), Camelback Road to 3600 feet south along the east bank of the Agua Fria River, Maricopa County, Arizona, June 2011 under separate cover.

7. Draft FIS Report Data

7.1 Summary Tables

Table 7-1: Summary of Discharges

Flooding Source and Location	1-Percent Annual Chance
At the Confluence with New River	54,400 cfs

Table 7-2: Manning's "n" Values

Flooding Source	Channel	Overbanks
At the Confluence with New River	0.035	0.04 & 0.05

7.2 Floodway Data Tables

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(Feet NGVD)			
Agua Fria River (Cont'd)								
AA	4.760	1,107	8,872	5.9	967.6	967.6	967.6	0.0
AB	4.936	1,107	8,580	6.1	968.4	968.4	968.4	0.0
AC	5.031	1,115	6,687	7.8	968.7	968.7	968.7	0.0
AD	5.256	1,282	7,891	6.6	971.1	971.1	971.1	0.0
AE	5.385	1,389	5,712	9.1	972.5	972.5	972.5	0.0
AF	5.508	1,330	5,734	9.1	976.0	976.0	976.0	0.0
AG	5.567	1,387	7,518	7.2	977.5	977.5	977.5	0.0
AH	5.723	1,256	7,613	7.1	979.6	979.6	979.6	0.0
AI	5.887	1,127	7,882	6.9	981.6	981.6	981.6	0.0
AJ	5.997	1,119	8,113	6.7	982.4	982.4	982.4	0.0
AK	6.177	1,113	7,701	7.1	984.0	984.0	984.0	0.0
AL	6.349	1,112	7,853	6.9	985.4	985.4	985.4	0.0
AM	6.539	1,116	6,806	8.0	986.9	986.9	986.9	0.0
AN	6.718	1,067	6,188	8.8	989.0	989.0	989.0	0.0
AO	6.938	1,112	7,434	7.3	991.6	991.6	991.6	0.0
AP	7.093	1,106	7,359	7.4	993.7	993.7	993.7	0.0
AQ	7.290	1,115	7,493	7.3	997.6	997.6	997.6	0.0
AR	7.472	1,063	7,770	7.0	999.8	999.8	999.8	0.0
AS	7.660	1,002	7,106	7.7	1,001.7	1,001.7	1,001.7	0.0
AT	7.848	966	7,454	7.3	1,003.6	1,003.6	1,003.6	0.0
AU	8.040	1,032	8,204	6.6	1,004.7	1,004.7	1,004.7	0.0
AV	8.223	1,315	9,309	5.8	1,006.0	1,006.0	1,006.0	0.0
AW	8.365	1,501	8,089	6.7	1,007.4	1,007.4	1,007.4	0.0
AX	8.850	1,562	12,797	4.3	1,010.8	1,010.8	1,010.8	0.0
AY	9.059	2,565	23,540	2.3	1,011.4	1,011.4	1,011.4	0.0
AZ	9.292	1,846	15,060	3.6	1,011.6	1,011.6	1,011.6	0.0

Limit of Study

[1]Miles Above Confluence With Gila River

TABLE 5

FEDERAY EMERGENECY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

Agua Fria River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(Feet NVGD)		
Agua Fria River (Cont'd)								
BA	9.518	1,327	7,228	7.5	1,012.2	1,012.2	1,012.2	0.0
BB	9.686	1,670	8,882	6.1	1,021.0	1,021.0	1,021.0	0.0
BC	9.869	1,851	8,622	6.3	1,023.7	1,023.7	1,023.7	0.0
BD	10.046	1,503	7,851	6.9	1,026.1	1,026.1	1,026.1	0.0
BE	9.953	2,203	11,152	4.9	1,028.7	1,028.7	1,028.7	0.0
BF	10.142	1,394	5,092	5.9	1,030.1	1,030.1	1,030.5	0.4
BG	10.327	1,231	5,331	5.6	1,032.8	1,032.8	1,033.2	0.4
BH	10.521	740	3,634	8.3	1,034.5	1,034.5	1,034.8	0.3
BI	10.699	749	4,886	6.1	1,038.5	1,038.5	1,039.1	0.6
BJ	10.889	985	6,513	4.6	1,040.5	1,040.5	1,041.1	0.6
BK	11.103	730	4,884	6.1	1,043.2	1,043.2	1,043.4	0.2
BL	11.481	812	5,451	5.5	1,046.8	1,046.8	1,047.0	0.2
BM	11.581	620	2,998	10.0	1,048.3	1,048.3	1,048.3	0.0
BN	11.823	892	5,128	6.7	1,054.4	1,054.4	1,054.4	0.0
BO	12.016	1,738	6,858	5.0	1,058.5	1,058.5	1,058.9	0.4
BP	12.164	2,408	6,640	5.2	1,061.0	1,061.0	1,061.3	0.3
BQ	12.307	2,709	17,026	2.0	1,064.1	1,064.1	1,064.5	0.4
BR	12.513	2,586	19,624	1.8	1,065.8	1,065.8	1,066.0	0.2
BS	12.730	2,300	11,443	3.0	1,066.6	1,066.6	1,066.7	0.1
BT	12.896	1,291	6,690	5.2	1,067.0	1,067.0	1,067.1	0.1
BU	13.082	703	4,875	7.1	1,067.8	1,067.8	1,068.2	0.4
BV	13.273	441	3,299	10.5	1,070.4	1,070.4	1,070.5	0.1
BW	13.465	551	5,555	6.2	1,073.6	1,073.6	1,073.7	0.1
BX	13.716	1,385	8,159	4.2	1,075.5	1,075.5	1,075.6	0.1
BY	13.929	1,334	5,387	6.4	1,079.2	1,079.2	1,079.4	0.2
BZ	14.123	1,040	5,776	6.0	1,082.2	1,082.2	1,082.5	0.3

Limit of Study

[1]Miles Above Confluence With Gila River

TABLE 5

FEDERAY EMERGENECY MANAGEMENT AGENCY

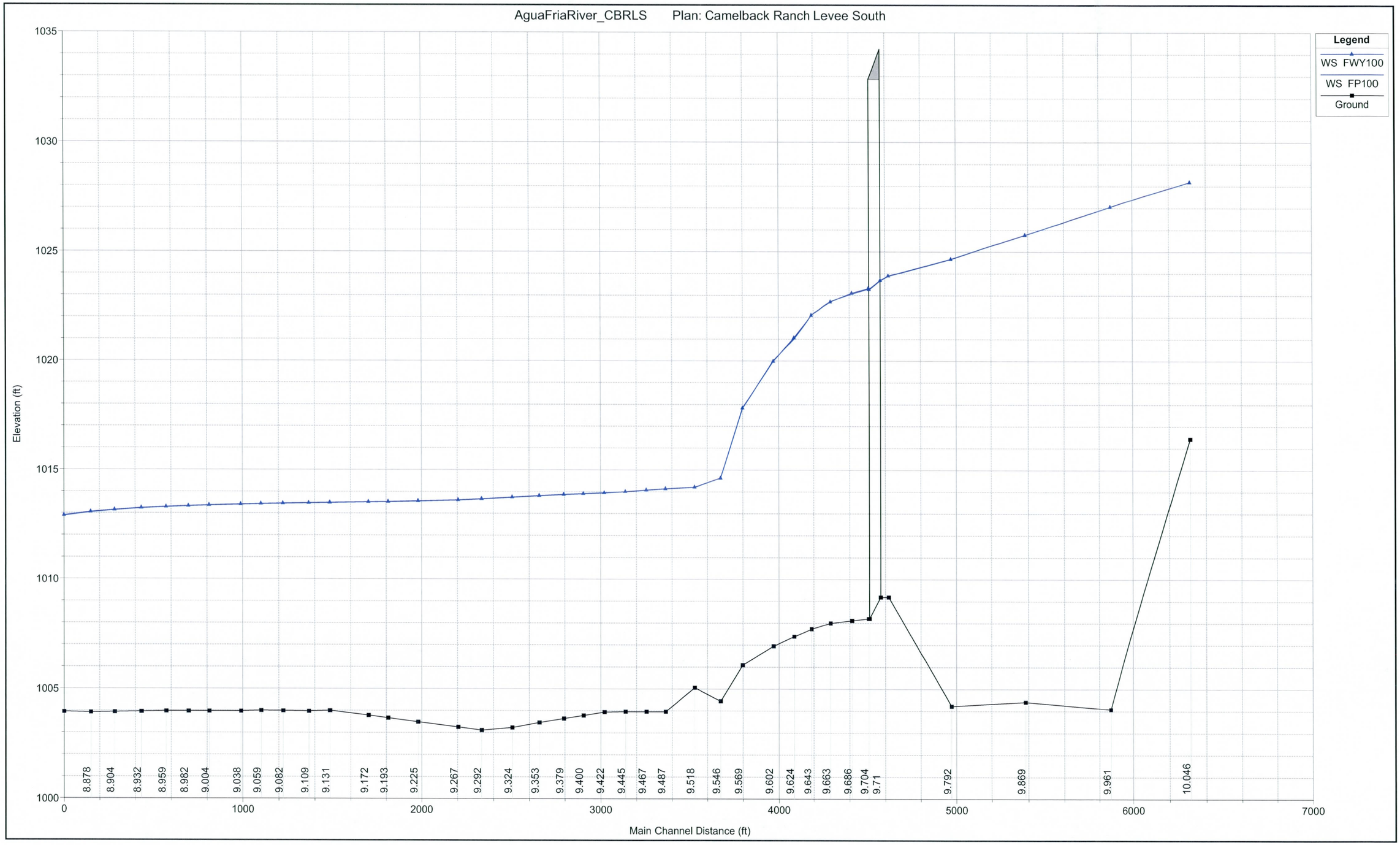
MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

AGUA FRIA RIVER

7.3 Flood Profiles

Flood Profiles were created using a plot function in HEC-RAS.


AguaFriaRiver_CBRLS Plan: Camelback Ranch Levee South
Legend
WS FWY100
WS FP100
Ground
Elevation (ft)
1035
1030
1025
1020
1015
1010
1005
1000
0
1000
2000
3000
4000
5000
6000
7000
Main Channel Distance (ft)
8.878
8.904
8.932
8.959
8.982
9.004
9.038
9.059
9.082
9.109
9.131
9.172
9.193
9.225
9.267
9.292
9.324
9.353
9.379
9.400
9.422
9.445
9.467
9.487
9.518
9.546
9.569
9.602
9.624
9.643
9.663
9.686
9.704
9.71
9.792
9.869
9.961
10.046

7.4 Annotated FIRM

FEMA Flood Insurance Rate Map (FIRM) panel numbers 04013C1620H, 04013C2080J, 04013C2085G and 04013C1615K, Effective September 30, 2005.

NOTES TO USERS

[illegible]

Coastal Base Flood Elevations (BFEs): This map does not show BFEs derived for the Coastal Barrier Resources System (CBRS) and Other Coastal Barriers. [illegible]

Floodway: [illegible]

Spatial Reference System (SRS): [illegible]

The projection used in the preparation of this map was Arizona State Plane Zone 3176 (Lambert Conformal Conic). The horizontal datum was NAD83 (GRS80 spheroid). Differences in datum, ellipsoid, projection or SRS/Zone mean that the data shown on this map may not align with data from other sources or data collected using other SRS/Zones. [illegible]

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must not be compared to those from other flood maps referenced to the North American 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
N/CG17x2
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3242

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 World Wide Web site 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 obtained from the USDA Farm Service Agency (FSA). [illegible]

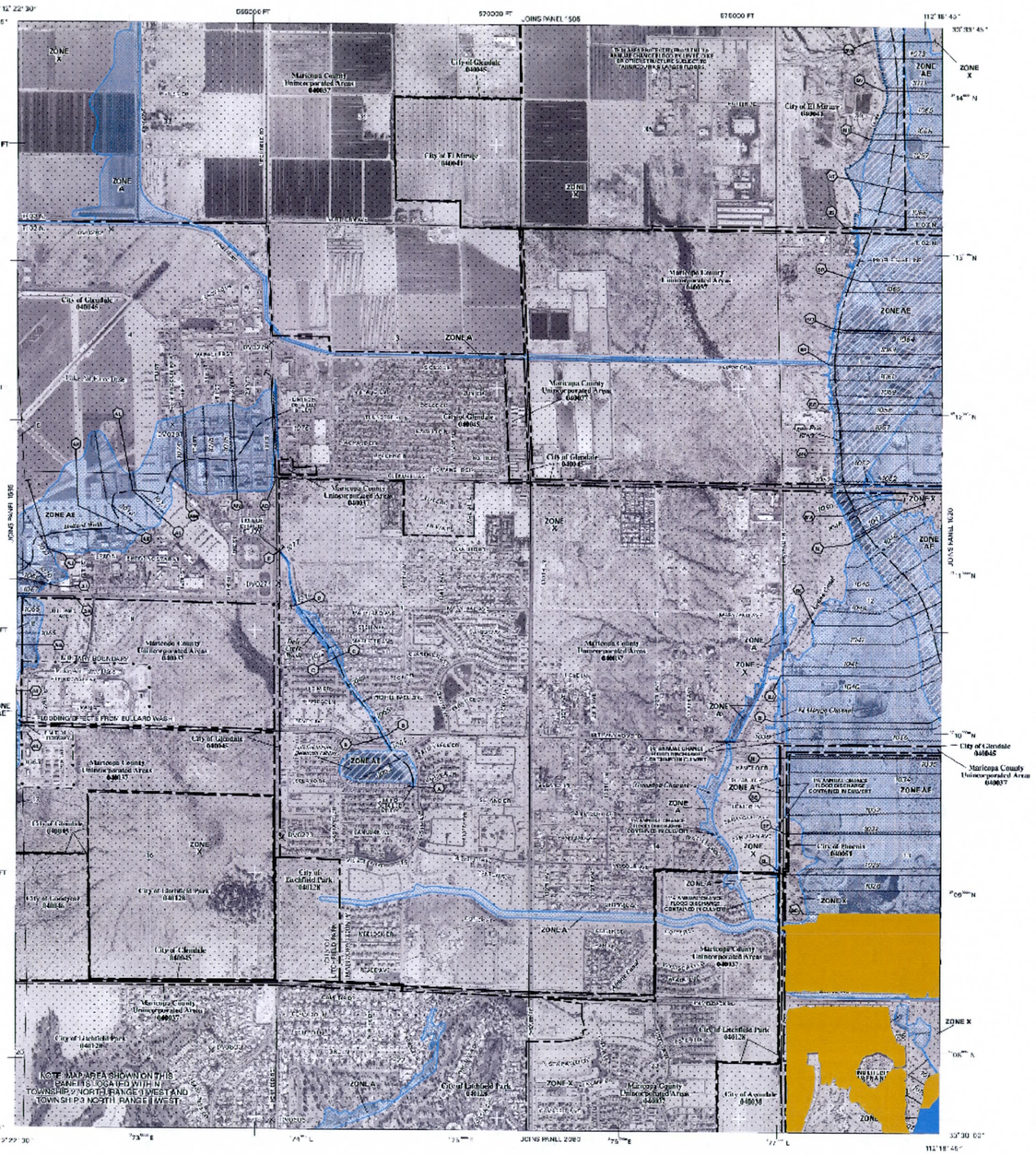
Information on flood hazards and flood-hazard stream channel configurations was based on the previous FIRMs for this jurisdiction. The floodplain and floodway boundaries on this map reflect [illegible] hydraulic analyses. [illegible]

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations and disconnections may have occurred after this map was published, [illegible]

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels; [illegible]

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, [illegible] The NFIP Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

For more questions about this map, or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

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

[illegible]

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually shallow ponding); average depths determined. For areas of alluvial fan flooding, velocities also 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 Area of flood risk due to levee system that is being restored to provide protection from the 1% annual chance or greater flood. Because flood hazards are being mitigated by the levee system, no Base Flood Elevations are shown.

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 river or other watercourse and the adjacent land areas that must be reserved in order to convey the 1% annual chance flood without cumulatively increasing water surface elevation more than 1 foot.

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 of undetermined but possible flood hazards.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHER COASTAL BARRIERS AREAS

Direction of water movement in the vicinity of a flood hazard area

- 15' wide channel with flow depth less than one foot
- 100' wide channel with flow depth less than one foot
- Floodway boundary
- Zone AE boundary
- Zone A boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Boundary dividing Special Flood Hazard Areas of different floodway widths or flood velocities.
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations in areas of shallow flooding (Zone AO), flood depths or flood velocities.

(A) (A) Cross section with 1% annual chance flood elevation

(7) (7) Transect line

112° 07' 00", 33° 25' 41" Geographic coordinates referenced to the North American Datum of 1983 (NAD83). Order of coordinates is longitude and latitude.

7000 FT Ticks for Universal Transverse Mercator grid values, zone 12, shown at intervals of 1000 meters.

6750000 FT Ticks for State Plane coordinate system, Arizona Zone 3176 (Lambert Conformal Conic), NAD83. Units are in meters.

X 3123 Bench mark (see explanation in National Geodetic Survey publication).

• M15 Elev. 1000

MAP REPOSITORY
Refer to Repository Listing on Title Page

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1990

EFFECTIVE DATES OF TO THIS PANEL

September 30, 1990, September 4, 1991, December 2, 1993, June 16, 1995

September 30, 2005 - [illegible] Flood Elevations, to change Special Flood Hazard Areas, to reflect jurisdictional boundary changes, to incorporate previously issued Letters of Map Revision, to reflect updated topographic and cultural information.

[illegible]

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1615K

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1615 OF 4350

[illegible]

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K
[illegible]	[illegible]	[illegible]	K

Floodway

Zone AE Floodplain

[illegible]

MAP NUMBER
04013C1615K

MAP REVISED
SEPTEMBER 30, 2005

Proposed Map Revision

Federal Emergency Management Agency

NOTES TO USERS

[illegible]

Coastal Base Flood Elevations shown on this map apply only landward of 0.0" National Geodetic Vertical Datum of 1929 (NGVD 29). Users should refer to Flood Insurance Study report for information on Coastal Base Flood Elevations (BFEs) shown within Zone AE on this FIRM.

[illegible]

The projection used in the preparation of this map was Arizona State Plane Zone 3476 (Lambert Conformal Conic). The horizontal datum was NAD83 (NSRS2007). Differences in datum, ellipsoid, projection and 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 converted to other datums in order to compare them with elevations referenced to the North American Vertical Datum. For information regarding conversion between National Geodetic Vertical Datum of 1929 and North American Vertical Datum of 1988, visit the Vertical Difference Gridded Surfaces Web Site at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

[illegible]

Base map information shown on this FIRM was derived from multiple sources. Base map information provided in digital format by Maricopa County. Orthophotos [illegible]

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations and disconnections may have occurred after this map was published, map users should contact appropriate community offices to verify current corporate limit locations.

Please refer to the community Map Index for a complete listing of the county showing the panels of important community representatives, [illegible]

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, digital versions of this map. The FEMA Map Service Center may be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

[illegible]

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, V, A99, AE, AH, AO, AR, V1-V30, VE, and the Coastal Barrier Resource System (CBRS) areas.

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 river or other watercourse and the adjacent land areas that must be reserved in order to convey the 1% annual chance flood without cumulatively increasing water surface elevation more than a fixed amount.

ZONE X — OTHER FLOOD AREAS

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.

ZONE X — OTHER AREAS

Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COAST AL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHER CBRS AREAS

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Boundary dividing Special Flood Hazard Areas of different floodways, or flood risk zones within the floodway.

Boundary dividing Special Flood Hazard Areas of different Coastal Base Flood Elevations.

Limit of Coastal Barrier Resource System (CBRS) area

Cross section line

Transect line

67 — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

32°07'00", 33°25'45" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

4275000 FT — Transverse Mercator grid values, zone number, false easting and false northing

5000 FT — Transverse Mercator grid ticks, spaced 1000-meter apart in the Universal Transverse Mercator grid system

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP — PANEL 1620H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1620 OF 4350

COMMUNITY NUMBER | NUMBER | PANEL | SUFFIX

Floodway

Zone AE Floodplain

NATIONAL FLOOD INSURANCE PROGRAM

MAP NUMBER
04013C1620H

MAP REVISED
SEPTEMBER 30, 2005

Proposed Map Revision

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal **Base Flood Elevations** shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 0202 (central zone)*. The **horizontal datum** was NAD 83, HARN, *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
(301) 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 1:8000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

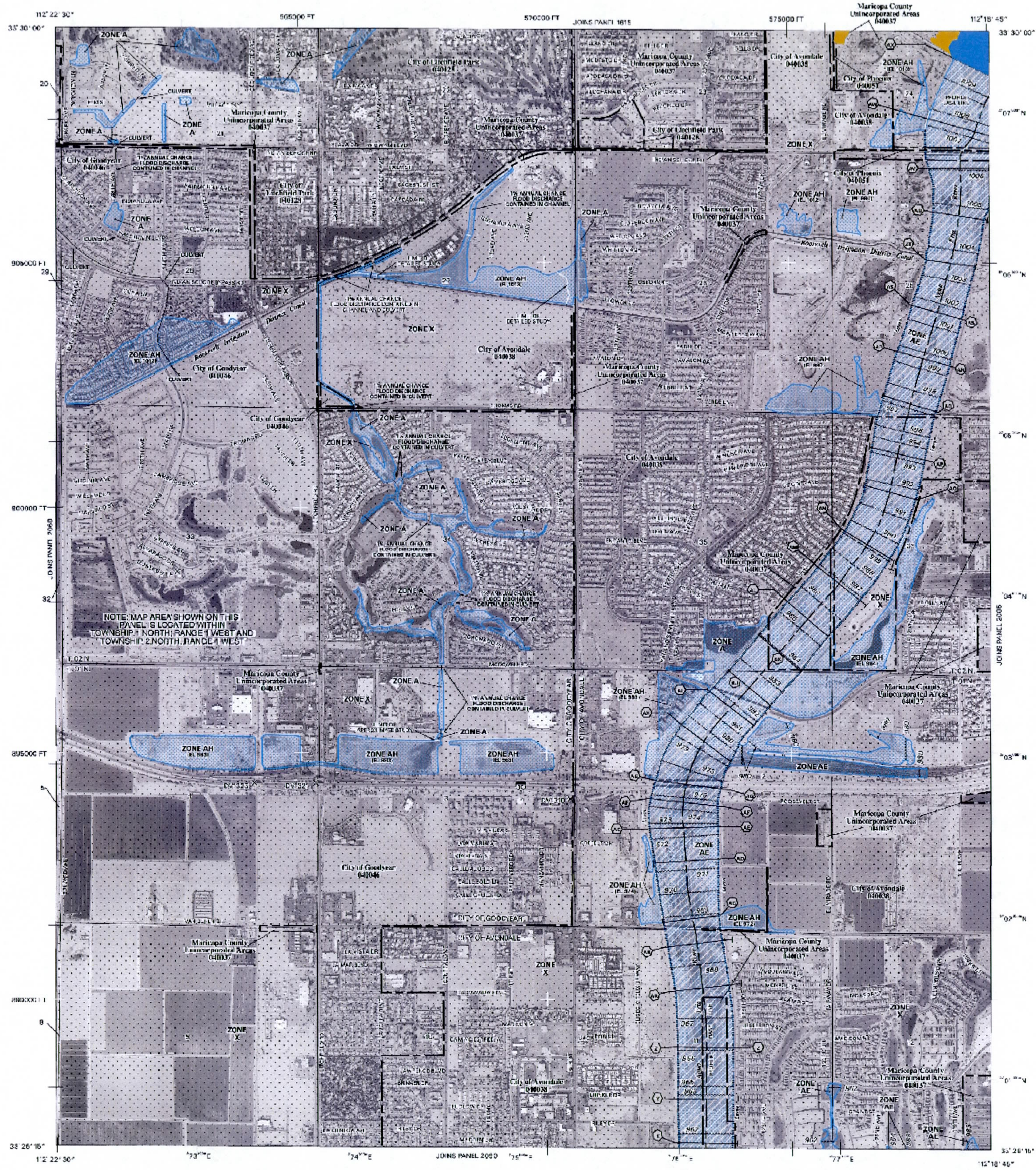
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and **floodways** that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/



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° 26' 14" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 76°°°E 1000-meter Universal Transverse Mercator grid ticks, zone 12
- 875000 FT 5000-foot grid ticks: Arizona State Plane coordinate system, central zone (FIPSZONE 0202), Transverse Mercator
- xDV2313 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 29, 1989, September 4, 1991, September 30, 1995, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations and Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2080J

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2080 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AVONDALE, CITY OF	040038	2080	J
GOODYEAR, CITY OF	040046	2080	J
LITCHFIELD PARK, CITY OF	040128	2080	J
MARICOPA COUNTY	040037	2080	J
PHOENIX, CITY OF	040051	2080	J

Floodway

Zone AE Floodplain

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
04013C2080J

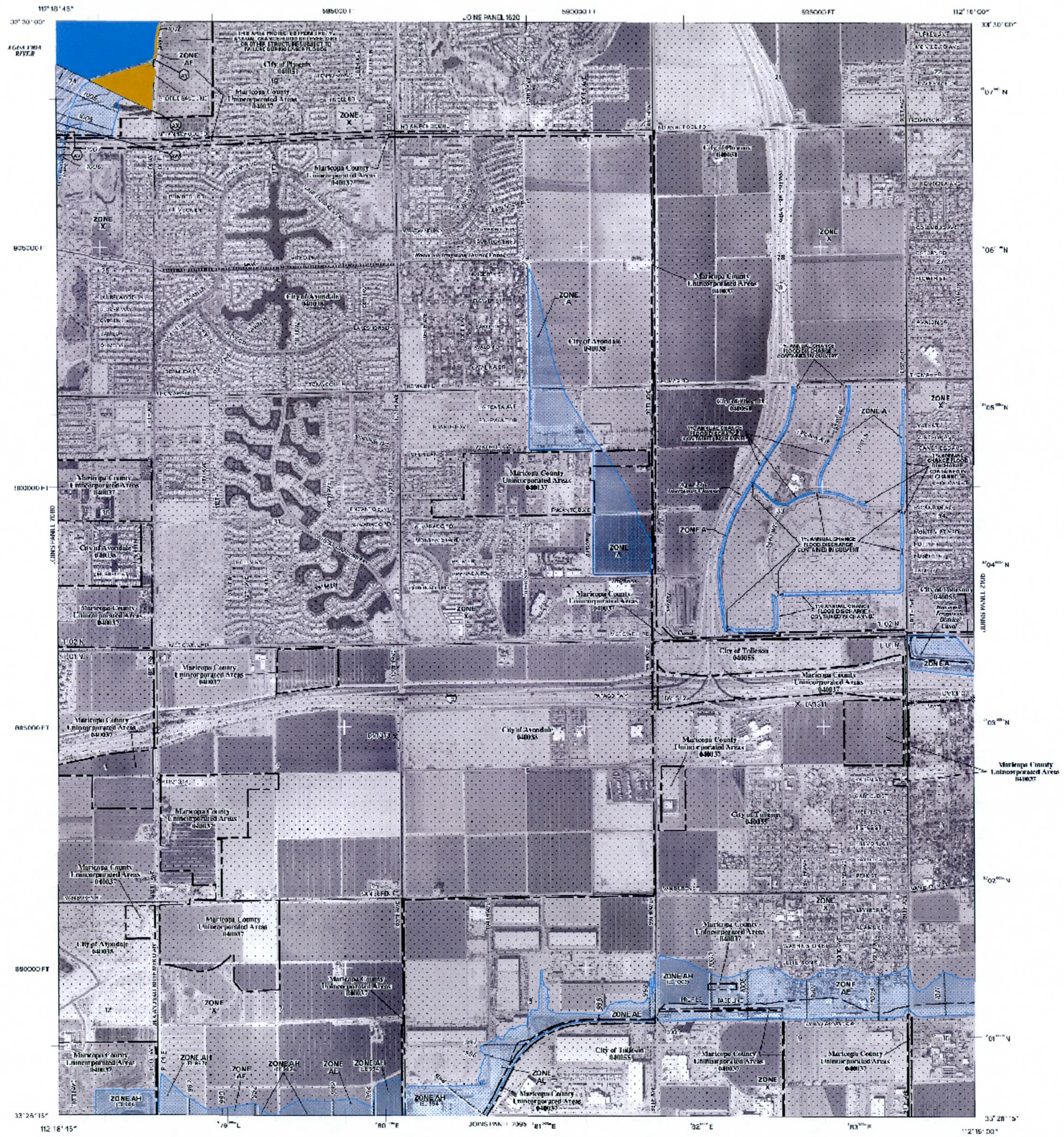
MAP REVISED
SEPTEMBER 30, 2005

Proposed Map Revision

Federal Emergency Management Agency

NOTES TO USERS

[illegible]



LEGEND

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

[illegible]

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

OTHER AREAS

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

PANEL 2085G

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 2085 OF 4350

Floodway

Zone AE Floodplain

MAP NUMBER

04013C2085G

MAP REVISED

SEPTEMBER 30, 2005

Proposed Map Revision

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

Appendix A. References

A.1 References

A.1 References

1. Data Collection and Reference Documents

1.1 Summary of Collected Data

Available Camelback Ranch Levee South data has been collected and assessed to determine its applicability for evaluation of compliance per 44 CFR 65.10 criteria. Discussion regarding collected documentation and data relevant to levee certification is provided below. In addition, a summary of relevant documents and data is listed in **Table 1-1**.

1.1.1 FEMA Data Request

A data request was submitted to the FEMA Library on 12/18/09. FEMA delivered, via ftp site, a compressed file containing several documents and FEMA forms associated with the FEMA approved LOMR request (Case Number 98-09-229P).

98-09-226P (98-09-226P.pdf)

This electronic file contains correspondence and support documentation for the LOMR 98-09-226P. The file contains the following items:

- LOMR Acceptance Letter (City of Phoenix)
- General project correspondence
- FEMA Internal review comment

Technical Support Data Notebook (TSDN.pdf)

This electronic file contains correspondence and support documentation for the CLOMR 98-09-226R (converted to LOMR 98-09-226P). The file contains the following items:

- General correspondence
- Exhibit A - USACE 404 Permit
- Exhibit B – Public Notice to of Study to Johnson-Stewart Materials, LLC
- Exhibit C – Bank Protection Agreement, Johnson-Stewart Materials, LLC
- FEMA MT-2 Form 1
- FCDMC O&M Procedures for Camelback Ranch Levee South
- Exhibit 2 – Affidavit of Publication
- Exhibit 3 – FEMA Form 2, Form 4, Form 5, Form 8
- Exhibit 4 – Flood Profiles
- Exhibit 5 – Annotated FIRM
- Exhibit 6 – HEC-2 model input file
- Exhibit 7 – HEC-2 model output file
- Exhibit 8 – Floodplain Work Maps

Levee Backup (Levee Backup.pdf)

This electronic file contains support documentation for the LOMR 98-09-226P. The file contains the following items:

- In-place density tests results
- Construction Special Provisions for Camelback Ranch Levee – South
- Simons, Li and Associates, Inc. – Letter report, Phase 1 Design Submittal
- Earthwork calculations
- 100% response to comments (FCDMC/DMJM)
- Calculations and Analysis, Geotechnical Investigation, Camelback Ranch Levee

- Final Calculations, Camelback Ranch Levee - South

Interior Drainage Report (Interior Drainage Report.pdf)

"Draft" Interior Drainage Report, Camelback Ranch Levee Design Project, April 1996 evaluating the interior drainage behind the Levee.

Geotechnical Investigation Report (Geotechnical Investigation Report.pdf)

Geotechnical Investigation Report, Camelback Ranch Levee, By ATL, Inc September 18, 1996.

Miscellaneous

- AutoCAD Files of Profiles 11P, 12P and 13P.
- CBR.zip file containing AutoCAD files of four floodplain work maps (zip file corrupt)

1.1.2 Other Data

Additional data collection efforts were conducted with a search of the FCDMC Library and City of Phoenix.

Table 1-1: Summary List of Relevant Collected Data

Document Title	Prepared By	Date
FCDMC, Operations and Maintenance Division, Standard Operating Procedures (SOP's) Deficiency Levels, Maintenance Standards, and Standard Drawings.	FCDMC	Revised 2005
Annual Inspection Report - Camelback Ranch Levee	FCDMC	March 4, 2009
Flood Control District of Maricopa County, Maintenance Inspection Report, Camelback Ranch Levee	FCDMC	February 29, 2008
Flood Control District of Maricopa County, Plans for the Construction of Camelback Ranch Levee - South (FCD 97-18)	FCDMC	February 5, 1997
Final Interior Drainage Report, Camelback Ranch Levee Design Project, (FCD 95-15)	DMJM Arizona, Inc.	April 1, 1998
Construction Special Provisions for Camelback Ranch Levee - South, Indian School Road to Camelback Road (FCD 97-18)	DMJM Arizona, Inc.	May 1, 1997
Final Calculations, Camelback Ranch Levee South, Indian School Road to Camelback Road (FCD 95-15)	DMJM Arizona, Inc.	February 24, 1997
Agua Fria River Floodplain Delineation Re-study, prepared for the Flood Control District of Maricopa County (FCD 95-05), Agua Fria River, Gila river to the New Waddell Dam	Coe & Van Loo Consultants, Inc.	September 24, 1997

Table 1-1: Summary List of Relevant Collected Data (Continued)

Document Title	Prepared By	Date
Camelback Ranch Levee - South Conditional Letter of Map Revision (CLOMR/LOMR Submittal, FCD A 400.916)	FCDMC	1997
Flood Control District of Maricopa County, Permit to use Flood Control District Right-of-way,	FCDMC	October 29, 2007
Camelback Road, Agua Fria River to 99th Avenue, Project No. ST83110057, Storm Drain. Design Drawings	Tetra Tech, Inc	November 11, 2006
Camelback Road, Agua Fria River to 99th Avenue, Project No. ST83110057, Storm Drain. Hydrologic and Hydraulic Design Report.	Tetra Tech, Inc	August 23, 2005

Appendix B. General Documentation and Correspondence

B.1 General Correspondence and Meeting Notes

None Provided

Appendix C. Survey and Mapping

C.1 Field Survey

No field survey was used as part of this study.

C.2 Mapping

2-ft Topography data was provided by the Flood Control District of Maricopa County.

Refer to **Section 3**

Appendix D. Hydrologic Analysis and Support Documentation

See **Section 4** for discussion on hydrologic documentation.

Appendix E. Hydraulic Analysis Support Documentation

E.1 Roughness Coefficient Estimation

E.2 Cross Section Plots

E.3 Hydraulic Structure Sheets

Portion of Camelback Road Bridge Plans

E.4 Hydraulic Calculations

Table E-1: Standard Table 1 (100-year Floodplain\Floodway model)

E.5 Figures

Figure E-1: Floodplain Work Map

E.1 Roughness Coefficient Estimation

Project: **Camelback Ranch Levee South**
Stream: **Agua Fria River**
Location: **Maricopa County, Arizona**

Photo B1 : Typical photo of Agua Fria River Main Channel

Channel Conditions		Manning's n Adjustment		n Value
Channel Material	Concrete	n_b	0.012-0.018	
	Firm Soil		0.025-0.032	
	Coarse Sand		0.026-0.035	
	Gravel		0.028-0.035	0.03
	Cobble		0.030-0.050	
	Boulder		0.040-0.070	
Degree of Irregularity	Smooth	n_1	0.000	
	Minor		0.001-0.005	
	Moderate		0.006-0.010	
	Severe		0.011-0.020	
Effects of Obstruction	Negligible	n_2	0.000-0.004	0.002
	Minor		0.005-0.015	
	Appreciable		0.020-0.030	
	Severe		0.040-0.060	
Vegetation	Small	n_3	0.002-0.010	0.003
	Medium		0.010-0.025	
	Large		0.025-0.050	
	Very Large		0.050-0.100	
Variations in Channel Cross Section	Gradual	n_4	0.000	
	Occ. Alt.		0.001-0.005	
	Frequently Alt.		0.010-0.015	
Intermediate Sum				0.035
Degree of Meandering	Minor	m	1	1
	Appreciable		1.15	
	Severe		1.3	
$n=(n_b+n_1+n_2+n_3+n_4)m$				**0.035**

Main Channel

E.2 Cross Section Plots

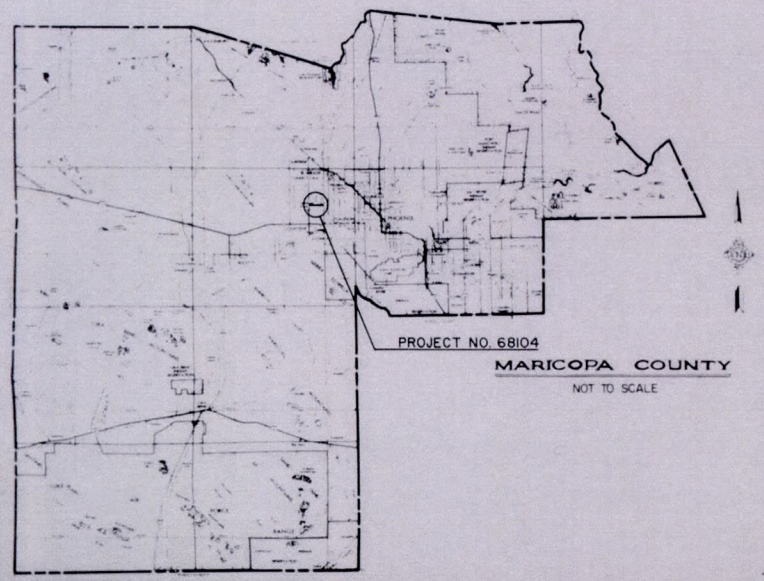
Cross section plots in pdf format included on data disk in **Appendix F**.

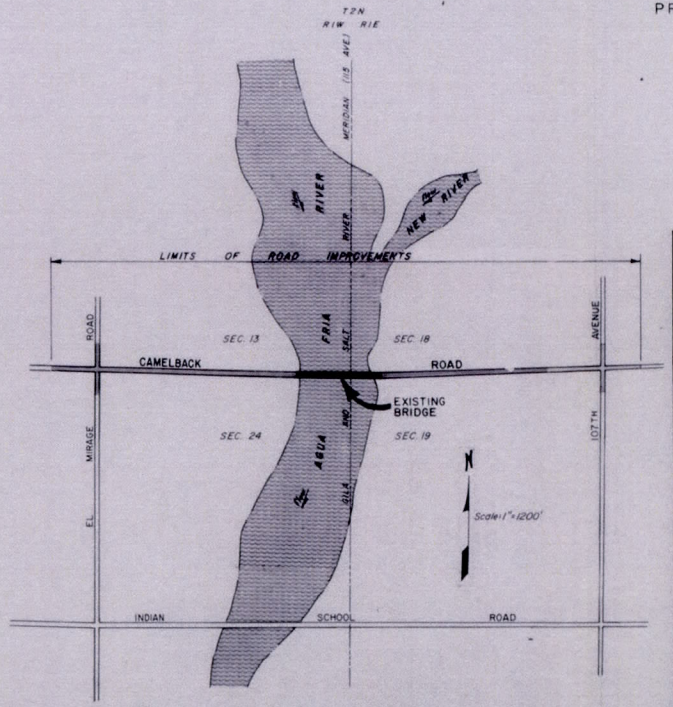
E.3 Hydraulic Structure Sheets

MARICOPA COUNTY HIGHWAY DEPARTMENT

PLANS FOR THE CONSTRUCTION OF
CAMELBACK ROAD BRIDGE OVER AGUA FRIA RIVER
PROJECT NO. 68104
APPROACH ROADWAY - EL MIRAGE ROAD TO 107TH AVENUE

AS BUILT DRAWINGS
6/17/85
PRC TWCRS





PROJECT NO. 68104

PREPARED BY:
PRC TOUPS
A DIVISION OF:
PRC ENGINEERING INC.
4131 NORTH 24TH STREET
PHOENIX, ARIZONA 85016
(602) 954-9191

8-6-84

DATE: 8-7-84 DEPUTY CHIEF ENGINEER

COUNTY BOARD OF SUPERVISORS

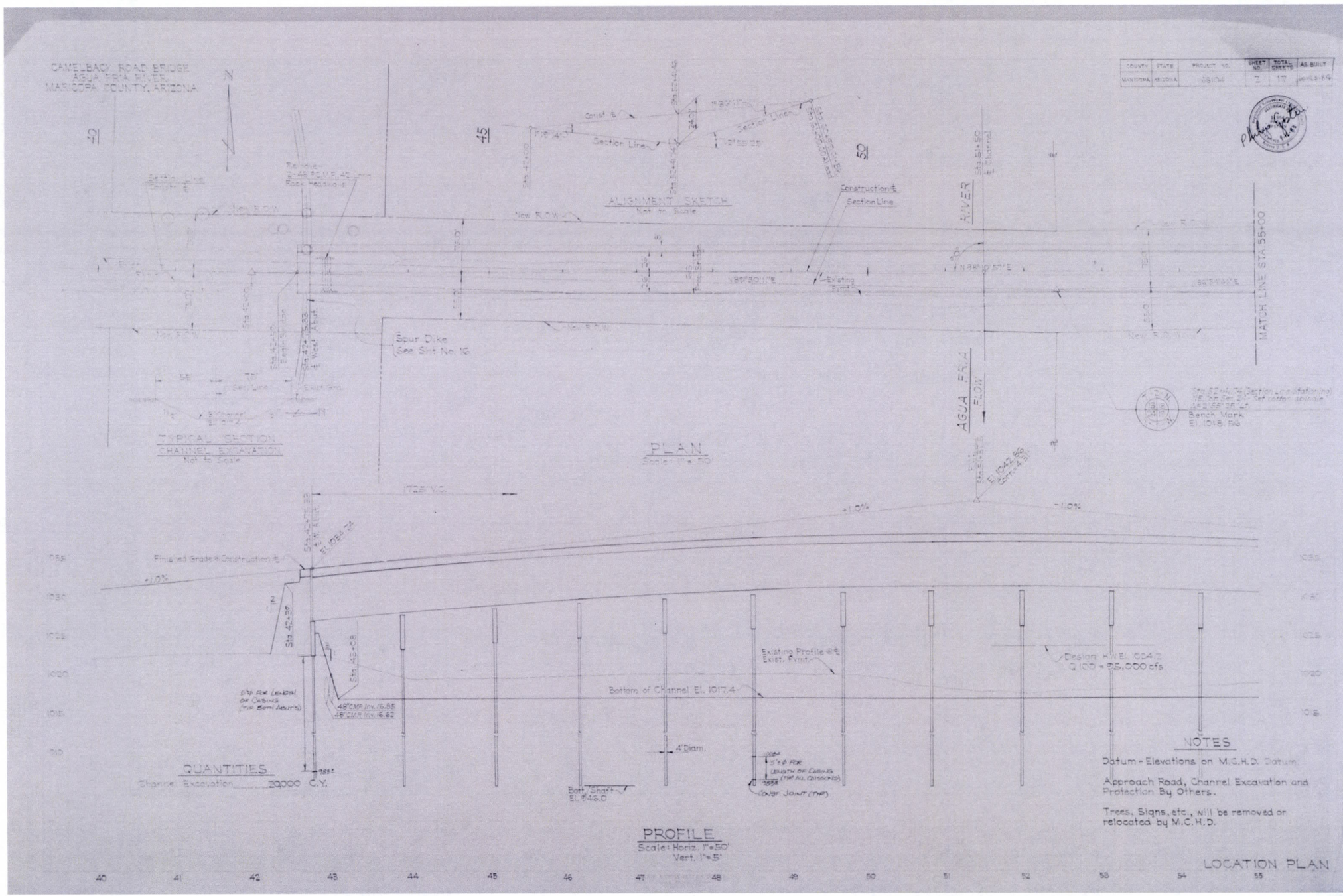
TOM FREESTONE

APPROVED: _____ CHAIRMAN.

DATE: _____

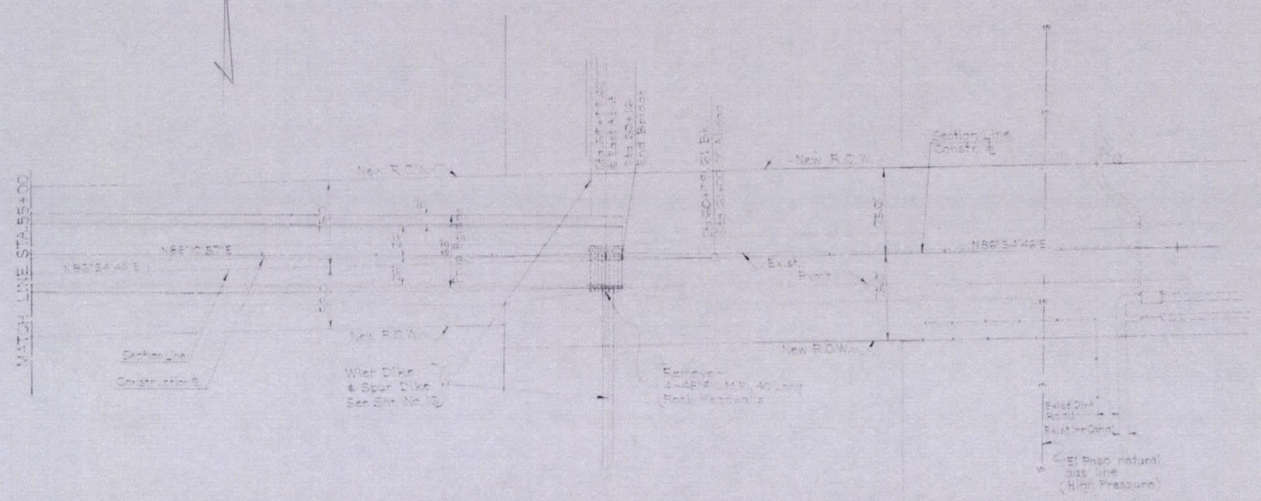
CAMELBACK ROAD BRIDGE
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA

COUNTY	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS-BUILT
MARICOPA	ARIZONA	08104	2	17	MAY 13-89

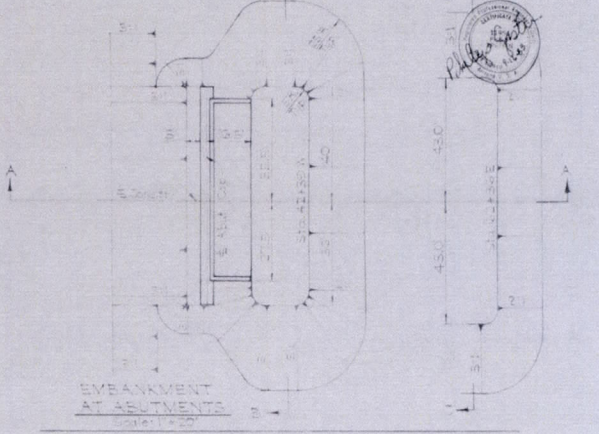


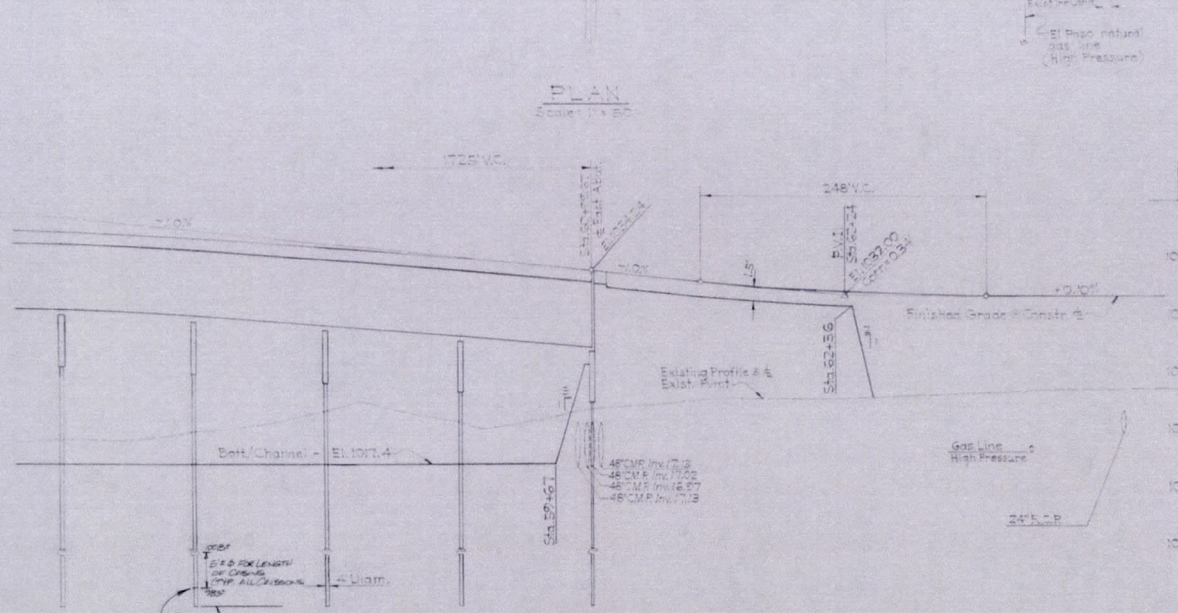
CAMELBACK ROAD BRIDGE
AQUA FRIA RIVER
MARICOPA COUNTY, ARIZONA

COUNTY	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	ARIZONA DOT
MARICOPA	ARIZONA	88104	3	17	6-13-84

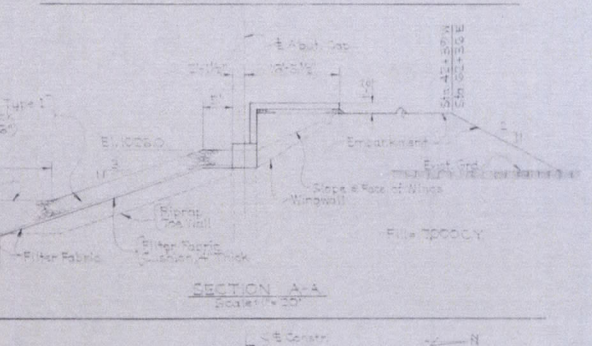


PLAN
Scale: 1" = 50'

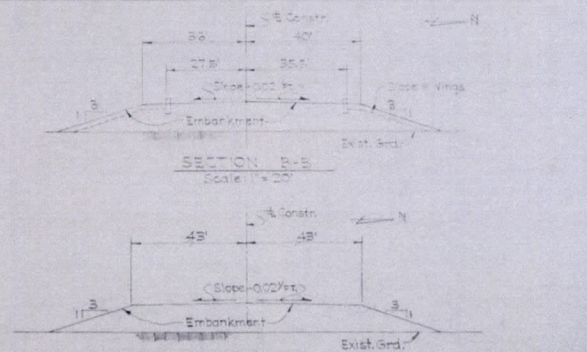




PROFILE
Scale: Horiz. 1" = 50'
Vert. 1" = 5'



SECTION A-A
Scale: 1" = 20'



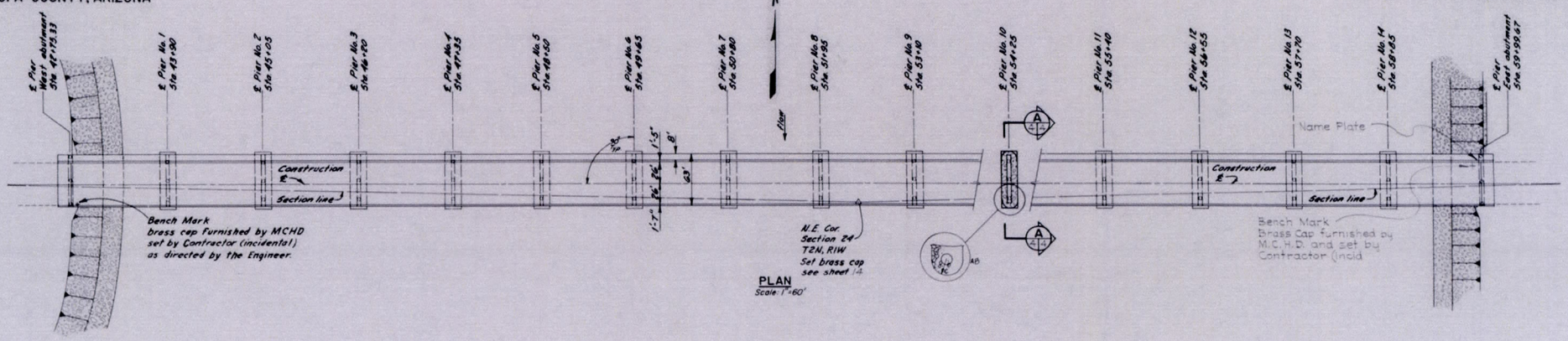
SECTION B-B
Scale: 1" = 20'

SECTION C-C
Scale: 1" = 20'

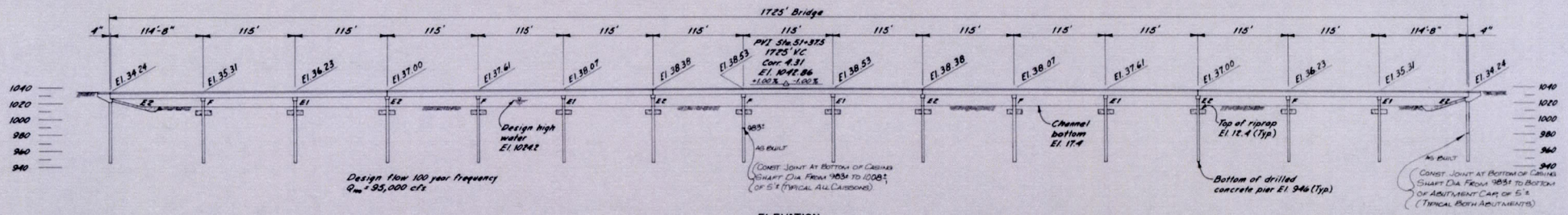
LOCATION PLAN

CAMELBACK ROAD BRIDGE
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA

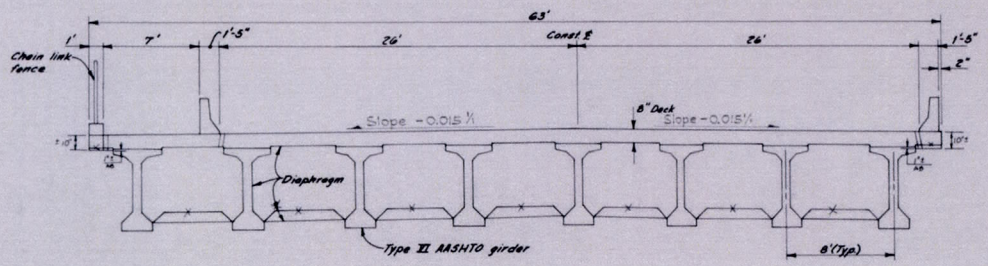
COUNTY	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS	AS BUILT
MARICOPA	ARIZONA	68104	4	17	



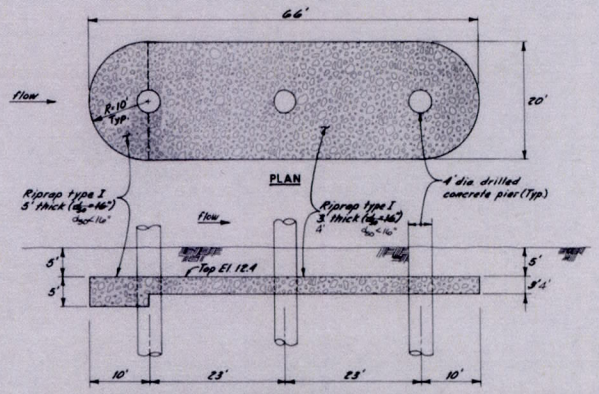
PLAN
Scale: 1"=60'



ELEVATION
Scale: 1"=60'



TYPICAL BRIDGE SECTION
No Scale



ELEVATION

TYPICAL PIER RIPRAP
SECTION A-A
Scale 1"=10'

NO.	DATE	REVISION DESCRIPTION	APPR

MARICOPA COUNTY
HIGHWAY DEPARTMENT

PRC Toups
A Planning Research Company
4131 North 24th Street, Phoenix, Arizona 85016
Telephone (602) 954-9191

CAMELBACK ROAD BRIDGE
—AGUA FRIA RIVER—

GENERAL BRIDGE PLAN

DATE	DRN. BY	DES. BY	CHK. BY
12-82	LJC, DBH	J.M.S.	J.M.S.

JOB NO. 1842-600 FILE RS-502 SHEET 4 OF 17

PROJECT NO. 68104

CAMELBACK ROAD BRIDGE
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA

COUNTY	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
MARICOPA	ARIZONA	68104	5	17	

STRUCTURAL NOTES

CONSTRUCTION: SHALL CONFORM TO THE 1979 EDITION OF "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION" ISSUED BY THE MARICOPA ASSOCIATION OF GOVERNMENTS AND THE SPECIAL PROVISIONS OF THIS PROJECT.

DESIGN: CONFORMS TO THE AMERICAN ASSOCIAITON OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1977 EDITION WITH 1978, 1979, 1980 AND 1981 INTERIM SPECIFICATIONS. GIRDER DESIGN 3 SPAN CONTINUOUS FOR LIVELOAD, SIMPLE SPAN FOR DEADLOAD. ALLOWANCE FOR FUTURE WEARING SURFACE IS INCLUDED.

LOADING CLASS: HS20-44

ALLOWABLE STRESSES:

CONCRETE CLASS "A" - f_c'	3,000 PSI
CONCRETE CLASS "AA" - f_c'	4,000 PSI
CONCRETE GIRDER - f_c'	5,000 PSI
REINFORCING STEEL, GRADE 40 - f_s	20,000 PSI
REINFORCING STEEL, GRADE 60 - f_s	24,000 PSI
STRUCTURAL STEEL - f_s	20,000 PSI

PRESTRESSING STEEL SHALL BE TYPE 270 K, 7 WIRE, UNCOATED, STRESS RELIEVED STRAND (A=0.1531 SQ. IN.) = 41,300 LBS SHALL CONFORM TO ASTM A-416 GRADE 270.

STRUCTURAL STEEL SHALL CONFORM TO ASTM A-36.

ALL WELDING SHALL CONFORM TO AMERICAN WELDING SOCIETY SPEC'S FOR WELDED HIGHWAY AND RAILWAY BRIDGES.

PAINT AND PAINTING SHALL CONFORM TO STANDARD SPEC'S. CONTACT SURFACES SHALL NOT BE PAINTED.
SHOP PAINT - 1 COAT #1
FIELD COATS - 1ST COAT OF #1 (SAME AS SHOP) TINTED LIGHT BROWN.
2ND COAT OF #10 PAINT

CHAMFER ALL EXPOSED EDGES AND CORNERS 3/4" UNLESS NOTED OTHERWISE ON PLANS.

ALL DIMENSIONS FOR REINFORCING STEEL SHALL BE FROM THE SURFACE OF THE CONCRETE TO THE CENTER OF THE BARS UNLESS SHOWN OTHERWISE ON THE PLANS, EXCEPT FOR CLEARANCES WHICH SHALL BE FROM SURFACE OF CONCRETE TO FACE OF STEEL. ALL CLEARANCES ARE 2" UNLESS NOTED OTHERWISE.

ALL BEND DIMENSIONS FOR REINFORCING STEEL ARE TO BE OUT-TO-OUT DIMENSIONS UNLESS NOTED OTHERWISE ON THE PLANS.

DIMENSIONS SHALL NOT BE SCALED FROM DRAWINGS.

NO SEPARATE PAYMENT OR MEASUREMENT WILL BE MADE FOR STRUCTURAL EXCAVATION, BACKFILL, AND MISCELLANEOUS STEEL ITEMS INCLUDING EXPANSION JOINTS AND DECK DRAINS. THE COST OF THESE ITEMS IS TO BE INCLUDED IN THE PRICE OF OTHER BID ITEMS.

CONTRACTOR MAY USE POST-TENSION METHOD FOR GIRDERS PROVIDED THE DESIGN AND DETAILS ARE APPROVED BY THE ENGINEER.

BRIDGE QUANTITIES

ITEM	UNIT	QUANTITY
CHAIN LINK FENCE	L.F.	1,757
DRILLING OF SHAFT FOUNDATIONS (48 - 4 FOOT DIAM.)	L.F.	3,455
CONCRETE CLASS AA	C.Y.	5,765
REINFORCING STEEL, GRADE 40	LBS	1,002,847
REINFORCING STEEL, GRADE 60	LBS.	584,836
PRESTRESSED PRECAST CONCRETE GIRDERS (AASHTO TYPE VI)	EACH	120
CONCRETE CLASS A	C.Y.	443

CONCRETE AND REINFORCING STEEL

ITEM	CONCRETE CLASS AA	REINFORCING STEEL* GRADE 40	GRADE 60
COLUMNS	1,772.0 C.Y.	-----	584,836 LBS.
PIER CAPS	578.2 C.Y.	177,713 LBS	-----
ABUTMENTS & WING WALLS	147.0 C.Y.	24,639 LBS.	-----
DIAPHRAGMS	405.4 C.Y.	53,102 LBS.	-----
BRIDGE DECK	2,862.0 C.Y.	688,116 LBS.	-----
APPROACH SLABS	64.8 C.Y. *	9,749 LBS.	-----
BARRIER & FENCE SUPPORT	378.3 C.Y. *	49,528 LBS.	-----
TOTALS	6207.7 C.Y.	1,002,847 LBS.	584,836 LBS.

CLASS AA CONCRETE UTILIZED IN APPROACH SLABS

*CLASS 'A' CONCRETE TO BE USED.

* AS BUILT
ALL STEEL UTILIZED IN THE CONSTRUCTION WAS GRADE 60, NO GRADE 40 WAS USED

PEDESTAL CONCRETE ELEVATION

(BASE ELEVATION 1000.00)

PIER NUMBER	JOINT TYPE	GIRDER A	GIRDERS B & H	GIRDERS C & G	GIRDERS D & F	GIRDER E	TOP OF PIER CAP	BOTTOM OF PIER CAP
West Abutment	E2	26.68	26.80	26.92	27.04	27.16	-------	-------
No. 1	F	27.93	28.05	28.17	28.29	28.41	27.72	23.72
No. 2	E1	28.85	28.97	29.09	29.21	29.33	28.64	24.64
No. 3	E2	29.44	29.56	29.68	29.80	29.92	29.23	25.23
No. 4	F	30.23	30.35	30.47	30.59	30.71	30.02	26.02
No. 5	E1	30.69	30.81	30.93	31.05	31.17	30.48	26.48
No. 6	E2	30.82	30.94	31.06	31.18	31.30	30.61	26.61
No. 7	F	31.15	31.27	31.39	31.51	31.63	30.94	26.94
No. 8	E1	31.15	31.27	31.39	31.51	31.63	30.94	26.94
No. 9	E2	30.82	30.94	31.06	31.18	31.30	30.61	26.61
No. 10	F	30.69	30.81	30.93	31.05	31.17	30.48	26.48
No. 11	E1	30.23	30.35	30.47	30.59	30.71	30.02	26.02
No. 12	E2	29.44	29.56	29.68	29.80	29.92	29.23	25.23
No. 13	F	28.85	28.97	29.09	29.21	29.33	28.64	24.64
No. 14	E1	27.93	28.05	28.17	28.29	28.41	27.72	23.72
East Abutment	E2	26.68	26.80	26.92	27.04	27.16	-------	-------

NOTES:
1 SEE SHEET 6 FOR BEARING PAD DETAILS AND SHEET 12 FOR JOINT TYPE DETAILS.

LIST OF DRAWINGS

1. FACE SHEET
2-3. LOCATION PLAN
4. GENERAL BRIDGE PLAN
5. STRUCTURAL NOTES, QUANTITIES
6-7. BORINGS
8-15. DETAILS
16-17. SPUR & WIER DIKES

MARICOPA COUNTY
HIGHWAY DEPARTMENT

PRC Toups
A Planning Research Company
4131 North 24th Street, Phoenix, Arizona 85016
Telephone (602) 954-9191

CAMELBACK ROAD BRIDGE
—AGUA FRIA RIVER—

STRUCTURAL NOTES

DATE	DRN BY	DES BY	CHK BY
12-82	LLT	LLT	J.M.S.

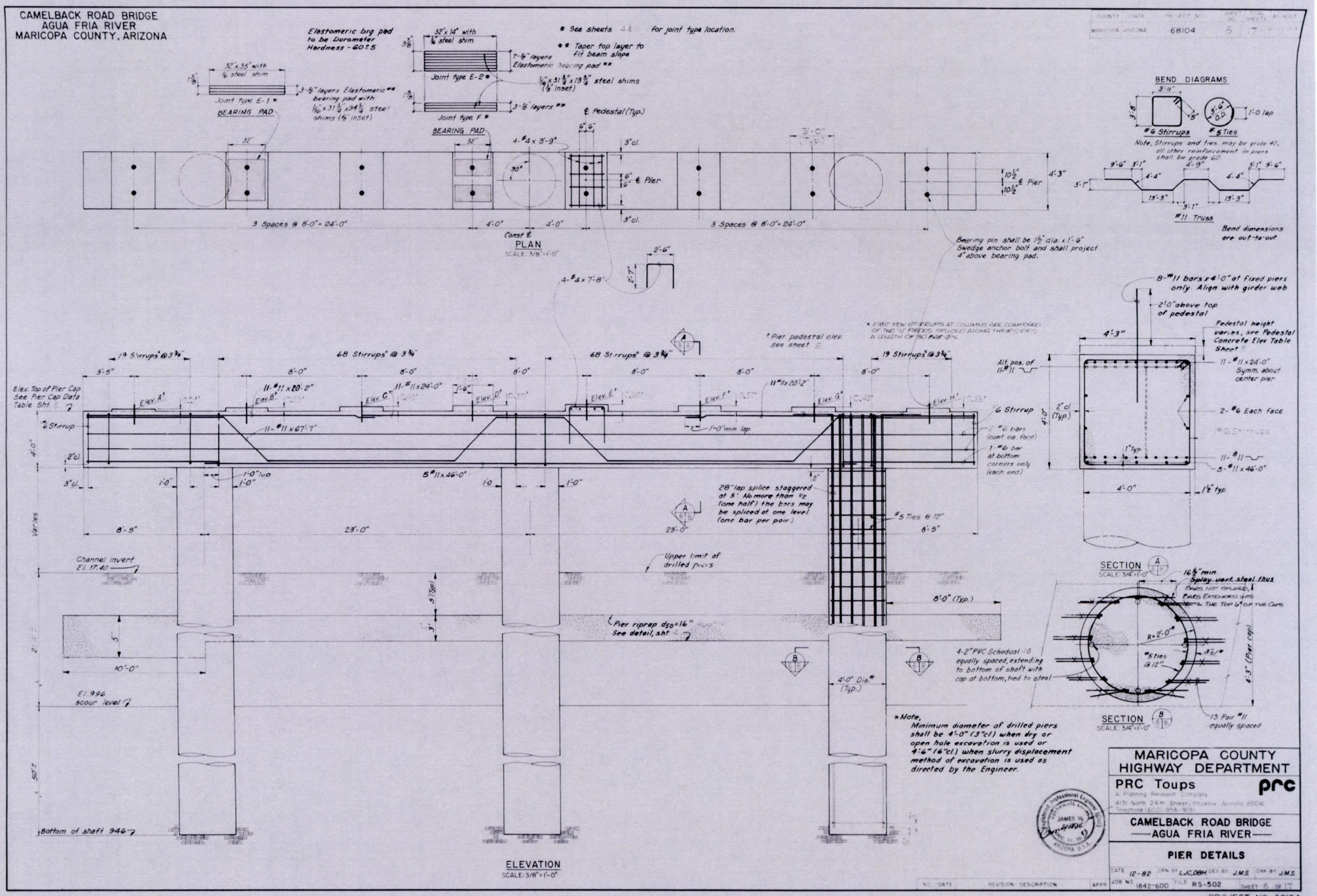
JOB NO.	FILE	SHEET
1842-600	RS-502	5 OF 17

NO.	DATE	REVISION DESCRIPTION	APPR

PROJECT NO. 68104

CAMELBACK ROAD BRIDGE
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA

COUNTY	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
MARICOPA	ARIZONA	68104	8	17



MARICOPA COUNTY
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CAMELBACK ROAD BRIDGE
AGUA FRIA RIVER

PIER DETAILS

DATE	DRN. BY	DES. BY	CHK. BY
12-82	LJC, DBH	J.M.S.	J.M.S.

JOB NO. 1842-600 FILE RS-502 SHEET 8 OF 17

NO.	DATE	REVISION DESCRIPTION	APPR.

PROJECT NO. 68104

E.4 Hydraulic Calculations

Table E-1: Standard Table 1

HEC-RAS Plan: LeveeCert River: Agua Fria Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	10.046	FP100	54400.00	1016.43	1028.19	1026.38	1028.94	0.002947	6.94	7847.98	4517.20	0.53
Reach	10.046	FWY100	54400.00	1016.43	1028.19	1026.38	1028.94	0.002943	6.94	7851.46	1503.05	0.53
Reach	9.961	FP100	54400.00	1014.64	1027.05	1024.98	1027.70	0.002499	6.46	8425.94	5214.58	0.49
Reach	9.961	FWY100	54400.00	1014.64	1027.06	1024.98	1027.70	0.002494	6.46	8431.17	1586.89	0.49
Reach	9.869	FP100	54400.00	1013.18	1025.77	1024.12	1026.40	0.002880	6.38	8615.02	5935.00	0.52
Reach	9.869	FWY100	54400.00	1013.18	1025.77	1024.11	1026.40	0.002874	6.38	8621.58	1851.22	0.52
Reach	9.792	FP100	54400.00	1011.61	1024.66	1022.05	1025.26	0.002608	6.21	8784.70	6062.22	0.50
Reach	9.792	FWY100	54400.00	1011.61	1024.67	1022.05	1025.27	0.002592	6.20	8801.35	1818.96	0.49
Reach	9.725	FP100	54400.00	1009.19	1023.88	1021.50	1024.43	0.002059	5.94	9161.39	5302.00	0.45
Reach	9.725	FWY100	54400.00	1009.19	1023.90	1021.50	1024.44	0.002040	5.92	9187.76	1687.89	0.45
Reach	9.71		Bridge									
Reach	9.704	FP100	54400.00	1008.21	1023.29	1021.17	1023.87	0.002240	6.13	8919.58	1686.95	0.47
Reach	9.704	FWY100	54400.00	1008.21	1023.32	1021.17	1023.90	0.002220	6.12	8906.14	1661.73	0.46
Reach	9.686	FP100	54400.00	1008.12	1023.07	1020.96	1023.66	0.002302	6.17	8830.52	1679.88	0.47
Reach	9.686	FWY100	54400.00	1008.12	1023.10	1020.97	1023.69	0.002251	6.13	8881.91	1670.38	0.47
Reach	9.663	FP100	54400.00	1008.00	1022.73	1020.86	1023.36	0.002669	6.35	8567.93	1727.52	0.50
Reach	9.663	FWY100	54400.00	1008.00	1022.71	1020.92	1023.37	0.002871	6.56	8307.99	1692.27	0.52
Reach	9.643	FP100	54400.00	1007.74	1022.10	1020.95	1022.97	0.004542	7.49	7272.44	1714.41	0.64
Reach	9.643	FWY100	54400.00	1007.74	1022.10	1020.98	1022.97	0.004571	7.52	7248.45	1707.47	0.64
Reach	9.624	FP100	54400.00	1007.39	1021.00	1020.55	1022.32	0.008185	9.23	5903.46	1584.68	0.84
Reach	9.624	FWY100	54400.00	1007.39	1021.06	1020.55	1022.34	0.007788	9.07	6007.97	1594.88	0.82
Reach	9.602	FP100	54400.00	1007.83	1020.01	1019.43	1021.39	0.007620	9.46	5809.75	1471.36	0.82
Reach	9.602	FWY100	54400.00	1007.83	1019.98	1019.40	1021.41	0.007887	9.59	5677.74	1400.20	0.84
Reach	9.569	FP100	54400.00	1007.57	1017.83	1017.83	1019.76	0.011479	11.16	4888.25	1313.15	1.00
Reach	9.569	FWY100	54400.00	1007.57	1017.85	1017.85	1019.76	0.011268	11.10	4913.80	1301.04	0.99
Reach	9.546	FP100	54400.00	1007.38	1014.64	1014.64	1016.72	0.011150	11.59	4696.03	1121.44	1.00
Reach	9.546	FWY100	54400.00	1007.38	1014.64	1014.64	1016.72	0.011150	11.59	4696.03	1121.44	1.00
Reach	9.518	FP100	54400.00	1007.15	1014.21	1012.45	1015.09	0.003263	7.55	7213.23	1326.87	0.57
Reach	9.518	FWY100	54400.00	1007.15	1014.22	1012.45	1015.10	0.003241	7.53	7227.72	1326.66	0.57
Reach	9.487	FP100	54400.00	1006.90	1014.14	1011.11	1014.64	0.001483	5.67	9607.22	1495.00	0.39
Reach	9.487	FWY100	54400.00	1006.90	1014.15	1011.11	1014.65	0.001474	5.66	9624.93	1494.99	0.39
Reach	9.467	FP100	54400.00	1006.73	1014.08	1010.63	1014.47	0.001108	5.02	10849.48	1623.54	0.34
Reach	9.467	FWY100	54400.00	1006.73	1014.09	1010.63	1014.48	0.001101	5.01	10869.70	1623.54	0.34
Reach	9.445	FP100	54400.00	1006.55	1014.00	1010.18	1014.33	0.000902	4.67	11663.77	1672.43	0.31
Reach	9.445	FWY100	54400.00	1006.55	1014.01	1010.18	1014.35	0.000897	4.66	11685.61	1672.42	0.31
Reach	9.422	FP100	54400.00	1006.37	1013.94	1009.68	1014.22	0.000712	4.28	12700.88	1731.27	0.28
Reach	9.422	FWY100	54400.00	1006.37	1013.95	1009.68	1014.24	0.000707	4.28	12724.23	1731.27	0.28
Reach	9.400	FP100	54400.00	1006.19	1013.90	1009.30	1014.13	0.000572	3.91	13918.53	1856.05	0.25
Reach	9.400	FWY100	54400.00	1006.19	1013.91	1009.30	1014.15	0.000568	3.91	13944.58	1856.03	0.25
Reach	9.379	FP100	54400.00	1006.02	1013.86	1009.01	1014.07	0.000495	3.70	14729.68	1922.55	0.23
Reach	9.379	FWY100	54400.00	1006.02	1013.87	1009.01	1014.08	0.000492	3.69	14757.50	1922.50	0.23
Reach	9.353	FP100	54400.00	1005.81	1013.80	1008.78	1014.00	0.000455	3.58	15212.56	1979.91	0.23
Reach	9.353	FWY100	54400.00	1005.81	1013.82	1008.78	1014.01	0.000452	3.57	15242.16	1979.84	0.22
Reach	9.324	FP100	54400.00	1005.57	1013.73	1008.59	1013.93	0.000444	3.58	15213.72	1955.41	0.22
Reach	9.324	FWY100	54400.00	1005.57	1013.75	1008.59	1013.95	0.000441	3.57	15238.13	1934.22	0.22
Reach	9.292	FP100	54400.00	1005.31	1013.65	1008.41	1013.86	0.000440	3.62	15031.01	1968.48	0.22
Reach	9.292	FWY100	54400.00	1005.31	1013.67	1008.41	1013.87	0.000437	3.61	15059.85	1845.87	0.22
Reach	9.267	FP100	54400.00	1005.11	1013.60	1008.26	1013.80	0.000439	3.56	15297.17	2078.35	0.22
Reach	9.267	FWY100	54400.00	1005.11	1013.62	1008.26	1013.81	0.000436	3.55	15327.82	1931.92	0.22
Reach	9.225	FP100	54400.00	1004.76	1013.55	1007.62	1013.70	0.000302	3.12	17512.19	2361.60	0.19
Reach	9.225	FWY100	54400.00	1004.76	1013.57	1007.63	1013.72	0.000301	3.12	17544.18	2007.91	0.19
Reach	9.193	FP100	54400.00	1004.50	1013.52	1007.35	1013.65	0.000258	2.93	18648.25	2491.18	0.17
Reach	9.193	FWY100	54400.00	1004.50	1013.53	1007.35	1013.67	0.000257	2.93	18657.23	2089.33	0.17

Table E-1: Standard Table 1

HEC-RAS Plan: LeveeCert River: Agua Fria Reach: Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	9.172	FP100	54400.00	1004.33	1013.51	1007.01	1013.62	0.000208	2.67	20490.61	2686.81	0.16
Reach	9.172	FWY100	54400.00	1004.33	1013.52	1007.01	1013.63	0.000208	2.68	20470.66	2238.20	0.16
Reach	9.131	FP100	54400.00	1004.00	1013.48	1006.67	1013.57	0.000175	2.49	21916.49	2780.10	0.14
Reach	9.131	FWY100	54400.00	1004.00	1013.49	1006.68	1013.59	0.000174	2.49	21885.44	2338.39	0.14
Reach	9.109	FP100	54400.00	1003.97	1013.46	1006.69	1013.55	0.000174	2.47	22132.58	2786.01	0.14
Reach	9.109	FWY100	54400.00	1003.97	1013.47	1006.70	1013.57	0.000173	2.47	22071.92	2397.06	0.14
Reach	9.082	FP100	54400.00	1004.03	1013.44	1006.60	1013.52	0.000157	2.35	23287.07	2785.09	0.14
Reach	9.082	FWY100	54400.00	1004.03	1013.45	1006.59	1013.54	0.000157	2.36	23184.58	2518.27	0.14
Reach	9.059	FP100	54400.00	1004.00	1013.42	1006.54	1013.51	0.000154	2.33	23528.09	2770.57	0.13
Reach	9.059	FWY100	54400.00	1004.00	1013.44	1006.54	1013.52	0.000154	2.33	23539.82	2564.59	0.13
Reach	9.038	FP100	54400.00	1003.97	1013.40	1006.58	1013.49	0.000162	2.39	22967.03	2580.84	0.14
Reach	9.038	FWY100	54400.00	1003.97	1013.41	1006.58	1013.50	0.000161	2.39	23009.09	2581.45	0.14
Reach	9.004	FP100	54400.00	1003.97	1013.36	1006.71	1013.45	0.000186	2.55	21667.88	2419.41	0.15
Reach	9.004	FWY100	54400.00	1003.97	1013.37	1006.71	1013.47	0.000185	2.55	21708.18	2419.41	0.15
Reach	8.982	FP100	54400.00	1003.97	1013.31	1006.85	1013.43	0.000219	2.75	20106.99	2270.63	0.16
Reach	8.982	FWY100	54400.00	1003.97	1013.33	1006.85	1013.45	0.000217	2.75	20145.51	2270.63	0.16
Reach	8.959	FP100	54400.00	1003.97	1013.27	1006.94	1013.40	0.000245	2.90	19032.17	2144.51	0.17
Reach	8.959	FWY100	54400.00	1003.97	1013.29	1006.94	1013.42	0.000243	2.90	19069.08	2144.51	0.17
Reach	8.932	FP100	54400.00	1003.95	1013.22	1007.01	1013.36	0.000269	3.02	18283.47	2071.29	0.18
Reach	8.932	FWY100	54400.00	1003.95	1013.24	1007.01	1013.38	0.000267	3.02	18319.99	2071.35	0.18
Reach	8.904	FP100	54400.00	1003.93	1013.13	1007.42	1013.31	0.000362	3.50	16448.33	2252.20	0.20
Reach	8.904	FWY100	54400.00	1003.93	1013.15	1007.42	1013.33	0.000359	3.49	16484.61	1988.05	0.20
Reach	8.878	FP100	54400.00	1003.91	1013.04	1007.58	1013.26	0.000438	3.84	15036.03	2263.09	0.23
Reach	8.878	FWY100	54400.00	1003.91	1013.06	1007.58	1013.27	0.000435	3.83	15071.33	1859.91	0.22
Reach	8.850	FP100	54400.00	1003.94	1012.88	1007.92	1013.17	0.000604	4.42	12797.10	1561.72	0.26
Reach	8.850	FWY100	54400.00	1003.94	1012.90	1007.92	1013.19	0.000599	4.41	12828.36	1561.72	0.26

E.5 Figures

Appendix F. Data Disk

FEMA Documents

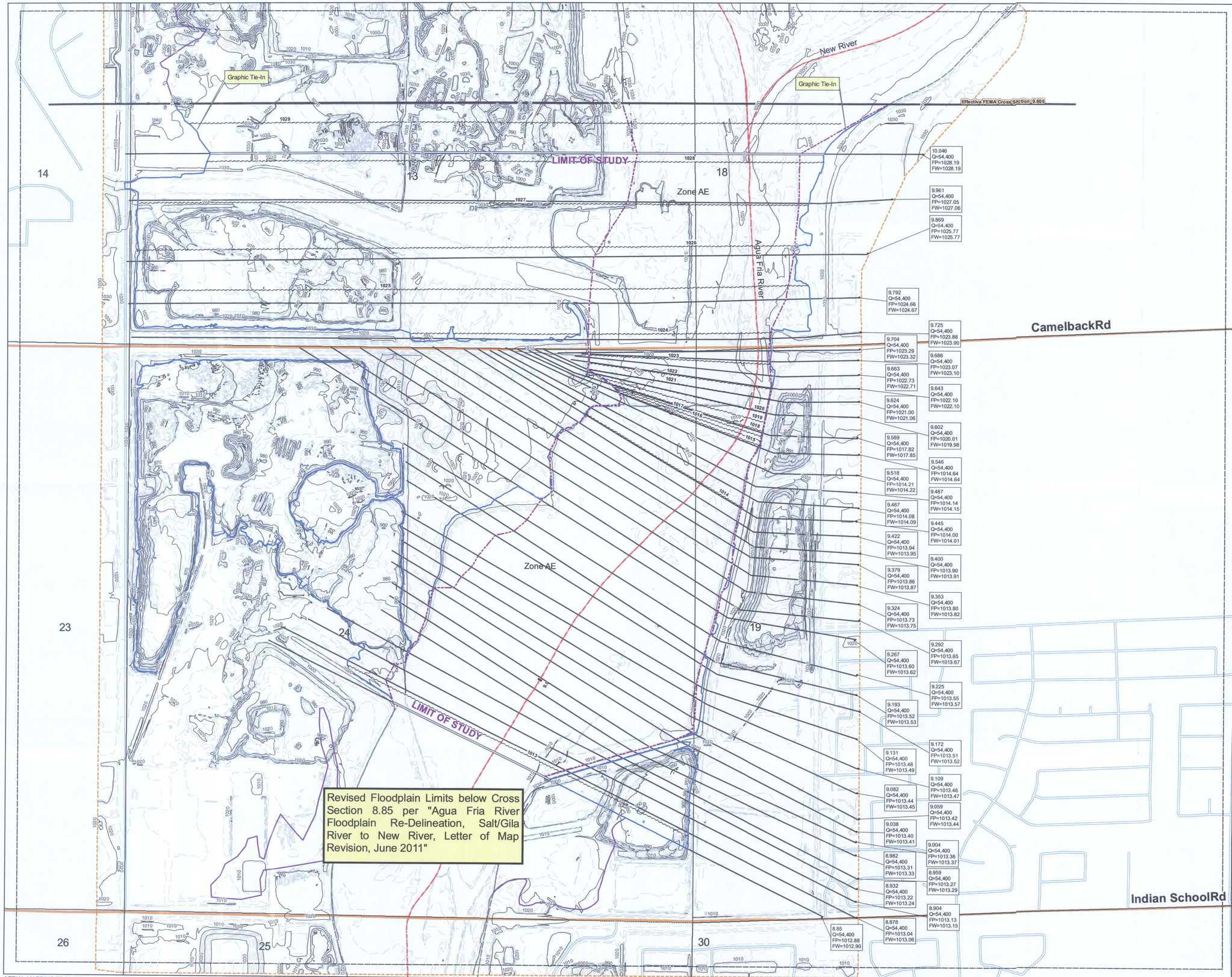
- 98-09-226P.pdf

Hydraulic Models Related Files

- Effective FIS HEC-2 models
- HEC-RAS Model (AguaFriaRiver_CBRLS.prj)
- HEC-RAS Model Report (AguaFriaRiver_CBRLS.rep)
- HEC-RAS Cross sections plots (100-yr Floodplain/Floodway)
- Annotated Check-RAS Reports
- Work Maps (Figures E-1)

Plans

- Camelback Bridge As-built Plans



AERIAL MAPPING FROM RM 8.40 TO RM 10.05 SUPPLIED BY COOPER AERIAL SURVEYS, MAPPING FOR AGUA FRIA WATERCOURSE MASTER PLAN, MARCH 24, 2009 FCD 2007C038

AERIAL PHOTOGRAPHY FLIGHT DATE: 2009

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR FLOODWAY
- 500-YR FLOODPLAIN
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY BOUNDARY
- BASE FLOOD ELEATION — 1020
- HYDRAULIC BASE LINE WITH RIVER MILE — 9.0
- SECTION BOUNDARY
- CROSS SECTION — 9.602 Q = 54,400 FP = 1019.98 FW = 1020.01
- ZONE DESIGNATION — ZONE AE
- CORPORATE LIMITS — CORPORATE LIMITS
- ELEVATION REFERENCE MARK
- TOPOGRAPHIC BOUNDARY

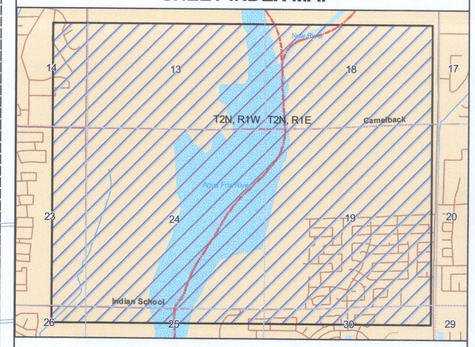
NOTES

1. THE PORTIONS OF AGUA FRIA RIVER BEING STUDIED ARE LOCATED WITHIN SECTIONS 13 AND 24 OF TOWNSHIP 0201, RANGE 0104 AS WELL AS SECTIONS 18 AND 19 OF TOWNSHIP 0201, RANGE 0102 OF THE SALT RIVER BASELINE AND MERIDIAN.
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

ELEVATION REFERENCE MARKS

STATION DESIGNATION	NAD 83 EASTING (FEET)	NAD 83 NORTHING (FEET)	NAVD 88 ELEVATION (FEET)	DESCRIPTION

SHEET INDEX MAP



FLOODPLAIN DELINEATION STUDY FOR A PORTION OF AGUA FRIA RIVER

FLOODPLAIN WORK MAP

MARICOPA COUNTY, ARIZONA

JUNE, 2011

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

Flood Control District of Maricopa County

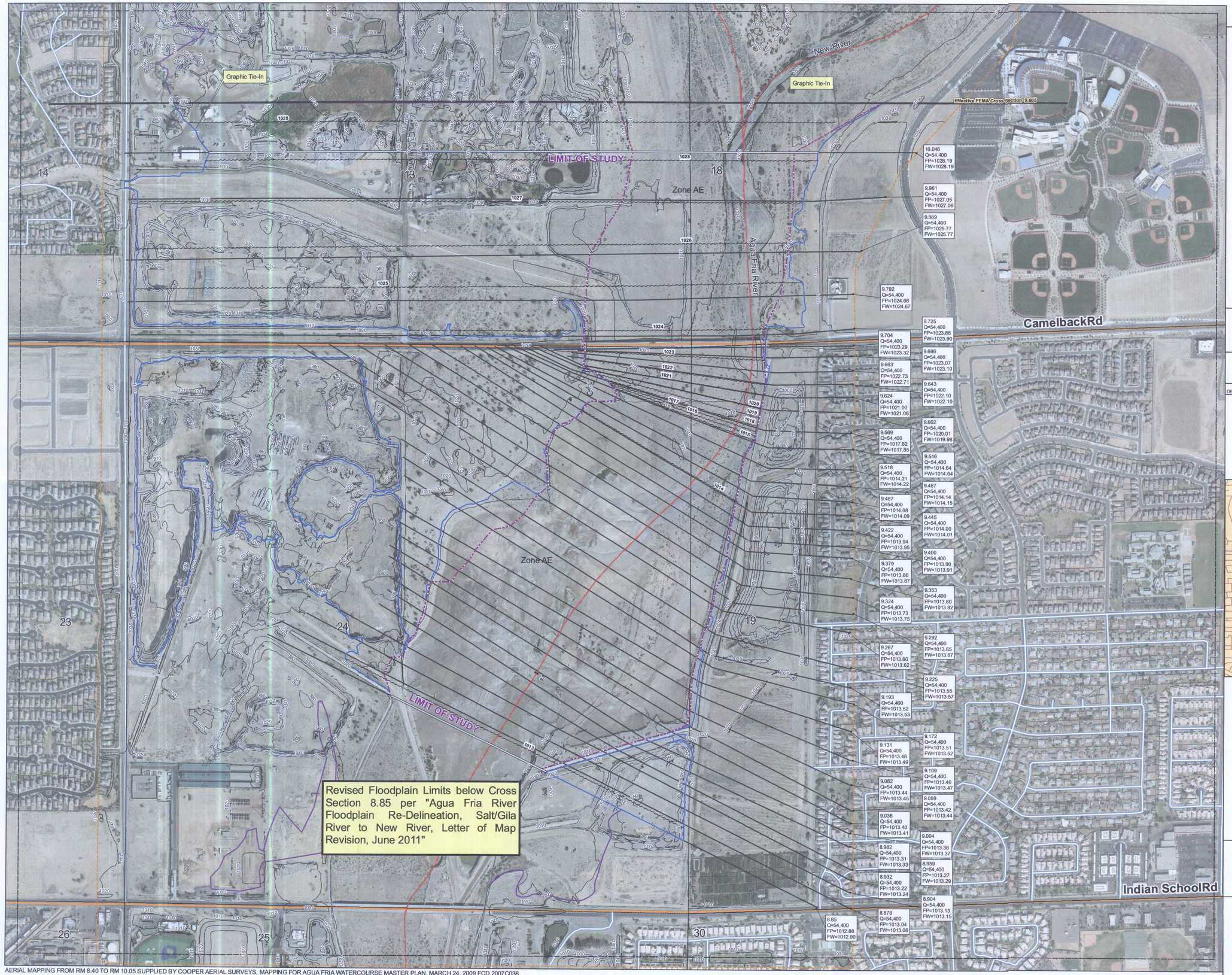
Registered Professional Engineer (Civil) CERTIFICATE NO. 34141 JON T. AHERN Date Signed 6/30/2011 ARIZONA, U.S.A.

Expires 7/30/2011

400 200 0 400 800 Feet

CONTOUR INTERVAL = 2 FEET

FIGURE E-3



AERIAL MAPPING FROM RM 8.40 TO RM 10.05 SUPPLIED BY COOPER AERIAL SURVEYS, MAPPING FOR AGUA FRIA WATERCOURSE MASTER PLAN, MARCH 24, 2009 FCD 2007C038

AERIAL PHOTOGRAPHY FLIGHT DATE: 2009

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR FLOODWAY
- 500-YR FLOODPLAIN
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY BOUNDARY
- BASE FLOOD ELEATION — 1020
- HYDRAULIC BASE LINE WITH RIVER MILE — 9.0
- SECTION BOUNDARY
- CROSS SECTION — 9.602 Q = 54,400 FP = 1019.98 FW = 1020.01
- ZONE DESIGNATION — ZONE AE
- CORPORATE LIMITS — CORPORATE LIMITS
- ELEVATION REFERENCE MARK
- TOPOGRAPHIC BOUNDARY

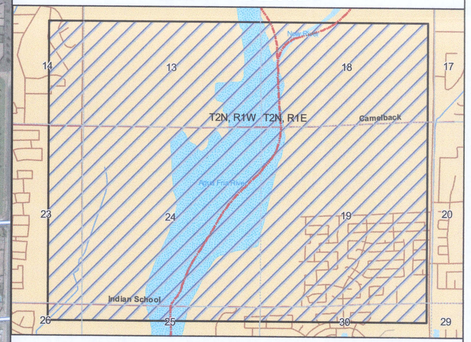
NOTES

1. THE PORTIONS OF AGUA FRIA RIVER BEING STUDIED ARE LOCATED WITHIN SECTIONS 13 AND 24 OF TOWNSHIP 0201, RANGE 0104 AS WELL AS SECTIONS 18 AND 19 OF TOWNSHIP 0201, RANGE 0102 OF THE SALT RIVER BASELINE AND MERIDIAN.
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

ELEVATION REFERENCE MARKS

STATION DESIGNATION	NAD 83 EASTING (FEET)	NAD 83 NORTHING (FEET)	NAVD 88 ELEVATION (FEET)	DESCRIPTION

SHEET INDEX MAP



FLOODPLAIN DELINEATION STUDY FOR A PORTION OF AGUA FRIA RIVER

FLOODPLAIN WORK MAP

MARICOPA COUNTY, ARIZONA

JUNE, 2011

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC

Flood Control District of Maricopa County

Registered Professional Engineer (Civil) CERTIFICATE NO. 34141 JON T. AHERN Date Signed 10/6/11 ARIZONA, U.S.A. Expires 7/31/2011

400 200 0 400 800
Feet

CONTOUR INTERVAL = 2 FEET

FIGURE E-3