Flood Control District of Maricopa County, Arizona
APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WATERSHED "OO"
(FCD 2000C019)

Hassayampa River Tributaries & Lower Jackrabbit Wash Tributaries

TECHNICAL DATA NOTEBOOK

VOLUME 1 of 6 (Sections 1-7)

Submitted by:

JE Fuller / Hydrology and Geomorphology, Inc.
6101 S. Rural Road, Suite 110
Tempe, Arizona 85283
(480) 752-2124

In Association With:

Wood, Patel & Associates, Inc. &
Argus Consulting

on behalf of:

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

April, 2003

NATIONAL FLOOD INSURANCE PROGRAM

FEMA MAP COORDINATION CONTRACTOR

SEP 23 2004

JACKRABBIT PHASE 1 4 UNPRINTED PANELS

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REG | P & PM
ENG | FILE
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RECLAIM

Mr. Mike Duncan, P.E., CFM
Project Manager
Flood Delineation Group
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

IN REPLY REFER TO:
Case No.: 04-09-0756P
Community: Maricopa County, AZ
Community No.: 040037

316-INTc

PHASE 1-B

Dear Mr. Duncan:

This is in regard to a March 1, 2004, initiative by the Department of Homeland Security's Federal Emergency Management Agency (FEMA) to revise the Flood Insurance Rate Map for Maricopa County, Arizona and Incorporated Areas. In our letter to you dated June 24, 2004, we indicated we were reviewing the data submitted in support of this case and, within 60 days of the date of that letter, we would notify you if we needed additional data or if we encountered delays. Because we have encountered such delays, we will need additional time to complete our review. Therefore, we will inform you of our findings within 30 days of the date of this letter.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning this case, please call the Revisions Coordinator for your State, Mr. Craig Kennedy, who may be reached at (703) 960-8800, ext. 3091.

Sincerely,

Sheila M. Norlin
National LOMC Manager
Michael Baker Jr., Inc.

cc: Mr. Michael S. Ellegood, P.E.
Chief Engineer
General Manager
Flood Control District of Maricopa County

Mr. Ted Collins
Principal
Floodplain Administration
Flood Control District of Maricopa County

Mr. Brian Cosson
NFIP Coordinator
Arizona Department of Water Resources

Mr. Brian R. Iserman, P.E.
Hydrologist
JE Fuller Hydrology and Geomorphology, Inc.

Federal Emergency Management Agency

Washington, D.C. 20472

OCT 08 2004

FCD reed 10-18-04

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 04-09-0756P

The Honorable Andrew W. Kunasek
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson Street, 10th Floor
Phoenix, AZ 85003

Community: Maricopa County, AZ
Community No.: 040037
Panels Affected: 04013C0220 E, 0600 D, 0625 D, and 0650 D
Effective Date of This Revision: OCT 08 2004

ONLY PHASE 1 A

102-I-C

Dear Mr. Kunasek:

On March 1, 2004, the Department of Homeland Security's Federal Emergency Management Agency (FEMA) initiated a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas, in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. FEMA revised the FIRM to show the effects of new hydrologic and hydraulic analyses, new topographic data, and a new floodplain delineation study for the T5-R5-S25-B tributary to Daggs Wash; the following tributaries to Star Wash: T4-R5-S33, T5-R5-S18, T5-R5-S29-A and -B, T5-R5-S33, T5-R5-S8, T5-R5-S21-A and -B, T5-R5-S34-A through -C, T5-R5-S16, T5-R5-S17, T6-R5-S21, T5-R5-S10-A, T5-R5-S23-A and -B, T5-R5-S35, T5-R5-S14, and T6-R5-S35; the following tributaries to Tank Wash: T5-R5-S31, T6-R6-S25, T4-R6-S1, T4-R5-S7-A and -B, T5-R6-S18, T5-R6-S12-A and -B, T5-R6-S13, and T6-R6-S22; the following tributaries to Powerline Wash: T5-R7-S14, T6-R7-S34, T5-R6-S30, and T5-R6-S33-A and -B; and Jimmie Wash.

All data required to complete our review of this request were submitted with letters from Mr. Michael Duncan, P.E., CFM, Project Manager, Flood Delineation Group, Flood Control District of Maricopa County (FCDMC). Because this Letter of Map Revision (LOMR) is based on flood hazard information meant to improve upon that shown on the flood map or within the flood study, and does not partially or wholly incorporate manmade modifications within the Special Flood Hazard Area (SFHA), fees were not assessed for the review. The SFHA is the area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood).

We have completed our review of the submitted data and the flood data shown on the effective FIRM. We have revised the FIRM to establish floodplain boundary delineations and modify zone designations of the base flood along the studied reaches listed above. The affected areas, previously designated Zone D, areas in which flood hazards are undetermined but possible, were redesignated Zone X (shaded), areas that would be inundated by the base flood with average depths less than 1.0 foot. As a result of the new study, SFHAs designated Zone A, with no Base Flood Elevations determined, were added to the FIRM. At the request of the FCDMC, administrative floodways were delineated along the newly studied reaches listed above, for local management of flood hazards in designated areas.

The modifications are shown on the enclosed annotated copies of FIRM Panels 04013C0220 E, 04013C0600 D, 04013C0625 D, and 04013C0650 D. FIRM Panels 04013C0600 D, 04013C0625 D, and

NATIONAL FLOOD INSURANCE PROGRAM

FEMA MAP COORDINATION CONTRACTOR

PHASE 1-A, JUST THE 4 PREVIOUSLY-UNPRINTED PANELS

March 22, 2004

Mr. Mike Duncan, P.E., CFM
Senior Civil Engineer
Flood Delineation Branch
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

IN REPLY REFER TO:
Case No.: 04-09-0756P
Communities: Maricopa County, AZ
Community No.: 040037

316-ACK.FEX

Dear Mr. Duncan:

On March 1, 2004, the Department of Homeland Security's Federal Emergency Management Agency (FEMA) initiated a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Approximate Floodplain Delineation of Watershed OO
Flooding Sources:	Star Wash Tributaries, Tank Wash Tributaries, and Powerline Wash Tributaries
FIRM Panel(s) Affected:	04013C0225 E, 0600 D, 0625 D, and 0650 D

As you may know, FEMA has implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. However, because your request is based on flood hazard information meant to improve upon that shown on the flood map or within the flood study, and does not partially or wholly incorporate manmade modifications within the Special Flood Hazard Area (SFHA), no fees will be assessed for our review. The SFHA is the area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood).

We have completed an inventory of the items that you submitted. The items identified below are the additional items that are required before we can begin a detailed review of your request.

Our preliminary review of the submitted digital mapping revealed that at some locations, the proposed stream lines for all the proposed flooding sources shown on FIRM Panels 04013C0225 E, 04013C0600 D, 04013C0625 D, and 04013C0650 D are either missing or not properly delineated. The stream lines must be delineated within the SFHA boundaries, or within the boundaries of the administrative floodway(s) if applicable. Please submit digital mapping files with proper delineation of the proposed stream lines for all the proposed flooding sources shown on FIRM Panels 04013C0225 E, 04013C0600 D, 04013C0625 D, and 04013C0650 D.

When you write us about your request, you must include the case number referenced above in your letter.

FLOOD CONTROL DISTRICT
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Federal Emergency Management Agency

Washington, D.C. 20472

APR 07 2004

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 03-09-1020P

The Honorable Andrew W. Kunasek
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson Street, 10th Floor
Phoenix, AZ 85003

Community: Maricopa County, AZ
Community No.: 040037
Panels Affected: 04013C0240 E, 0265 F, 0660 F, 0675 F, 1035 G, 1055 G, 1060 G, 1070 G, 1080 H, 1090 H, 1510 H, 1525 G, and 1540 G

Effective Date of This Revision: MAY 07 2004

102-I-C

Dear Mr. Kunasek:

This responds to a request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) revise the effective Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas, in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated May 5, 2003, Mr. Mike Duncan, P.E., CFM, Senior Civil Engineer, Flood Delineation Branch, Flood Control District of Maricopa County (FCDMC), requested that FEMA revise the FIRM to show the effects of new hydrologic and hydraulic analyses, new topographic data, and a new floodplain delineation study for the following tributaries to the Hassayampa River: T2-R5-S2, T3-R5-S1, T4-R4-S30, T5-R4-S3, T5-R4-S7-A and -B, T5-R4-S20-A and -B, T5-R4-S21, T6-R4-S27, and T6-R4-S33; for the following tributaries to Daggs Wash: T5-R4-S19, T5-R5-S13-A and -B, T5-R5-S14, T5-R5-S25-A through -C, and T6-R5-S36; for the T3-R5-S33 tributary to Jackrabbit Wash; for the T4-R5-S33 tributary to Star Wash; for the T5-R5-S34-C tributary to Star Wash – Tributary A; for the T5-R5-S35 tributary to Star Wash – Tributary B; for the following tributaries to Star Wash – Tributary C: T5-R5-S34-A and -B; for the T5-R5-S33 tributary to Star Wash – Tributary D; for the following tributaries to Tank Wash: T4-R6-S1 and T4-R5-S7-A and -B; for the T4-R6-S2 tributary to South Branch of Tank Wash; for the following tributaries to Powerline Wash: T5-R6-S30 and T5-R6-S33-A and -B; and for Box Wash.

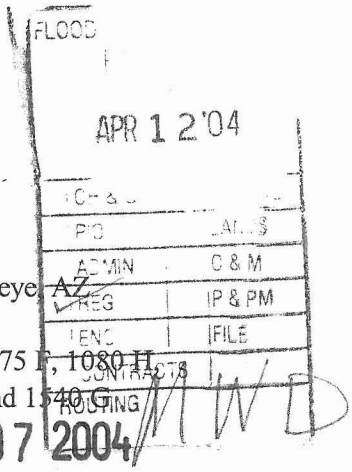
All data required to complete our review of this request were submitted with letters from Mr. Duncan. Because this Letter of Map Revision (LOMR) is based on flood hazard information meant to improve upon that shown on the flood map or within the flood study, and does not partially or wholly incorporate manmade modifications within the Special Flood Hazard Area (SFHA), fees were not assessed for the review. The SFHA is the area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood).

We have completed our review of the submitted data and the flood data shown on the effective FIRM. We have revised the FIRM to establish floodplain boundary delineations and modify zone designations of the base flood along the studied reaches listed above. The affected areas were previously designated Zone X (shaded), areas that would be inundated by the base flood with average depths less than 1.0 foot. As a result of the new study, SFHAs designated Zone A, with no Base Flood Elevations (BFEs) determined, were added to the FIRM. At the request of the FCDMC, administrative floodways were delineated along the above-referenced newly studied reaches for local management of flood hazards in designated areas. Wherever the SFHA boundary delineations of the newly studied reaches overlapped the effective SFHAs designated Zone AE, with BFEs determined, the AE zones remained but administrative

Federal Emergency Management Agency

Washington, D.C. 20472

APR 07 2004



CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 03-09-1020P

The Honorable Dusty Hull
Mayor, Town of Buckeye
100 North Apache Road
Buckeye, AZ 85326

Community: Town of Buckeye, AZ
Community No.: 040039
Panels Affected: 04013C0675 F, 1080 H, 1090 H, and 1540 G

Effective Date of This Revision: MAY 07 2004

102-I-C

Dear Mayor Hull:

This responds to a request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) revise the effective Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas (the effective FIRM for your community), in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated May 5, 2003, Mr. Mike Duncan, P.E., CFM, Senior Civil Engineer, Flood Delineation Branch, Flood Control District of Maricopa County (FCDMC), requested that FEMA revise the FIRM to show the effects of new hydrologic and hydraulic analyses, new topographic data, and a new floodplain delineation study for the following tributaries to the Hassayampa River: T2-R5-S2, T3-R5-S1, T4-R4-S30, T5-R4-S3, T5-R4-S7-A and -B, T5-R4-S20-A and -B, T5-R4-S21, T6-R4-S27, and T6-R4-S33; for the following tributaries to Daggs Wash: T5-R4-S19, T5-R5-S13-A and -B, T5-R5-S14, T5-R5-S25-A through -C, and T6-R5-S36; for the T3-R5-S33 tributary to Jackrabbit Wash; for the T4-R5-S33 tributary to Star Wash; for the T5-R5-S34-C tributary to Star Wash – Tributary A; for the T5-R5-S35 tributary to Star Wash – Tributary B; for the following tributaries to Star Wash – Tributary C: T5-R5-S34-A and -B; for the T5-R5-S33 tributary to Star Wash – Tributary D; for the following tributaries to Tank Wash: T4-R6-S1 and T4-R5-S7-A and -B; for the T4-R6-S2 tributary to South Branch of Tank Wash; for the following tributaries to Powerline Wash: T5-R6-S30 and T5-R6-S33-A and -B; and for Box Wash.

All data required to complete our review of this request were submitted with letters from Mr. Duncan. Because this Letter of Map Revision (LOMR) is based on flood hazard information meant to improve upon that shown on the flood map or within the flood study, and does not partially or wholly incorporate manmade modifications within the Special Flood Hazard Area (SFHA), fees were not assessed for the review. The SFHA is the area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood).

We have completed our review of the submitted data and the flood data shown on the effective FIRM. We have revised the FIRM to establish floodplain boundary delineations and modify zone designations of the

Flood Control District of Maricopa County, Arizona
APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WATERSHED "OO"
(FCD 2000C019)

Hassayampa River Tributaries &
Lower Jackrabbit Wash Tributaries

TECHNICAL DATA NOTEBOOK

VOLUME 1 of 6 (Sections 1-7)

Submitted by:

JE Fuller / Hydrology and Geomorphology, Inc.
6101 S. Rural Road, Suite 110
Tempe, Arizona 85283
(480) 752-2124

In Association With:

Wood, Patel & Associates, Inc. &
Argus Consulting

on behalf of:

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

April, 2003

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F TDN DATA CD CONTAINING HYDROLOGIC & HYDRAULICS FILES
F.1 TDN Data CD located on inside back cover

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EXHIBITS

Exhibit A: Hydrology Study Work Map
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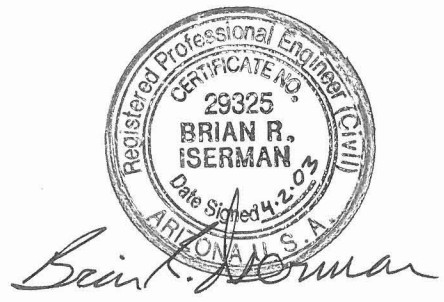
EXHIBITS

Exhibit C: Annotated Flood Insurance Rate Maps
Exhibit D: Non-Riverine Flood Hazard Zones (Task 6.4 Work Map)

Preface

This approximate Zone A floodplain delineation study was conducted for the Flood Control District of Maricopa County (FCDMC) by JE Fuller / Hydrology and Geomorphology, Inc. (JEF) in association with Wood, Patel & Associates, Inc. (WPA), and Argus Consulting (Argus). JEF was responsible for the overall management and integration of the work products from the other team members as well as for the performance of the hydrology for the entire study area and the approximate Zone A floodplain delineation of Hassayampa River Tributaries and Lower Jackrabbit Wash Tributaries located on the Hassayampa Plain. WPA concurrently performed the approximate Zone A floodplain delineation for Coyote Wash and Upper Jackrabbit Wash and its tributaries; this study is presented in TDN format under separate cover. Argus assisted JEF with portions of the approximate Zone A floodplain delineation of Hassayampa River Tributaries and Lower Jackrabbit Wash Tributaries. All team members contributed to the development of the reconnaissance report.



SECTION 1: INTRODUCTION

1.1 Purpose of study

The purpose of this floodplain delineation study is to identify the approximate extents (Zone A) of the 100-year floodplains associated with certain Hassayampa River Tributaries & Lower Jackrabbit Wash Tributaries located within Watershed "OO", which is also referred to as the Jackrabbit Wash Watershed. The reaches included in this study have not been previously studied and are expected to be subject to increasing growth pressure as the population of Maricopa County continues to expand.

The information presented in this study will be used to update existing Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs). The information will also be used by local and regional planners and floodplain administrators to further promote sound land use practices and floodplain development.

This study is one of 3 concurrent submittals which cover Watershed "OO". Table 1.1 presents the 3 submittals prepared for Watershed "OO":

Table 1.1: Watershed "OO" Approximate Zone A Floodplain Delineation Studies

Sub-Watershed	Miles of Delineation
Hassayampa River Tributaries & Lower Jackrabbit Wash Tributaries	**210.2**
Coyote Wash and its Tributaries	45.3
Upper Jackrabbit Wash & its Tributaries	100.4
Total Area	**355.9**

1.2 Authority for study

JE Fuller / Hydrology and Geomorphology, Inc. (JEF) performed this study under contract with the Flood Control District of Maricopa County (FCDMC). JEF's Project Manager for this project is Brian Iserman, P.E. The contract number is FCD 2000C019. The FCDMC is located at 2801 West Durango Street, Phoenix, AZ 85009 (602) 506-1501. The Project Manager for the FCDMC is Michael Duncan, P.E.

1.3 Location of study reach

Watershed "OO" is located in western Maricopa County, Arizona (see Figure 1.3.1 and Figure 1.3.2). The watershed encompasses approximately 450 square miles. This study includes 64 distinct study reaches which are tributary to Daggs Wash, Powerline Wash, Tank Wash, Star Wash, Jackrabbit Wash and The Hassayampa River. Table 1.3-1 presents a listing of the study reaches and mileages.

Table 1.3-1: Study Reaches

Reach	Mileage	Reach	Mileage
T2 R5 S2	1.0	T5 R5 S25 A	5.7
T3 R5 S1	0.4	T5 R5 S25 B	8.7
T3 R5 S33	4.6	T5 R5 S25C	6.3
T4 R4 S30	1.6	T5 R5 S29 A	1.9
T4 R5 S7 A	3.6	T5 R5 S29 B	2.1
T4 R5 S7 B	13.6	T5 R5 S31	2.2
T4 R5 S14	1.5	T5 R5 S33	10.9
T4 R5 S33	4.6	T5 R5 S34 A	5.4
T4 R6 S1	4.8	T5 R5 S34 B	5.5
T4 R6 S2	1.5	T5 R5 S34 C	7.2
T5 R4 S3	0.9	T5 R5 S35	10.1
T5 R4 S7 A	1.2	T5 R6 S12 A	1.2
T5 R4 S7 B	0.7	T5 R6 S12 B	1.2
T5 R4 S19	2.9	T5 R6 S13	1.5
T5 R4 S20 A	10.5	T5 R6 S18	2.9
T5 R4 S20 B	1.1	T5 R6 S25 A	10.3
T5 R4 S21	8.6	T5 R6 S25 B	1.1
T5 R5 S8	3.2	T5 R6 S30	1.2
T5 R5 S10 A	2.5	T5 R6 S33 A	2.3
T5 R5 S13 A	0.6	T5 R6 S33 B	5.1
T5 R5 S13 B	1.9	T5 R7 S14	6.2
T5 R5 S14	1.0	T6 R4 S27	1.8
T5 R5 S16	1.6	T6 R4 S33	1.5
T5 R5 S17	1.0	T6 R5 S21	4.0
T5 R5 S18	5.7	T6 R5 S35	3.0
T5 R5 S21 A	0.9	T6 R5 S36 B	0.5
T5 R5 S21 B	2.9	T6 R6 S22	1.5
T5 R5 S23 A	3.3	T6 R6 S25	1.3
T5 R5 S23 B	6.5	T6 R7 S34	3.4
		Total	**210.2**

The climate in the area is semi-arid desert with an average annual precipitation of approximately 12 inches. Precipitation is typically divided into two seasons of comparative rainfall depths: summer and winter. The summer storms are associated with warm, moist tropical air masses that enter the state from the Gulf of Mexico producing moderate to intense afternoon and evening thundershowers. Winter precipitation originates from the Pacific Ocean and produces light to moderate precipitation over relatively large areas.

1.4 Methodology

1.4.1 Hydrology

100-year peak discharge values were provided by the Flood Control District of Maricopa County (FCDMC) in the Technical Data Notebook for the study entitled *Jackrabbit Wash Floodplain Delineation Study, FCD 90-05*[2] performed by Burgess & Niple, Inc. Subsequent modifications to the original HEC-1 model were performed by the FCDMC. These modifications are described in the Technical Data Notebook for the study entitled *Powerline Wash and Tank Wash Flood Delineation Study, FCD 92-09*[8].

100-year peak discharge values at additional concentration points were determined using discharge-drainage area relationships based on the earlier HEC-1 modeling performed by Burgess & Niple and the subsequent modifications made by FCDMC. Additional concentration point locations were discussed and mutually agreed upon between the FCDMC and JE Fuller/Hydrology & Geomorphology, Inc. (JEF). Flow splits and diversions were analyzed with HEC-RAS.

1.4.2 Hydraulics

The U.S. Army Corp of Engineers computer program, HEC-RAS 3.1, was used to perform step-backwater profile calculations to determine approximate 100-year floodplain limits and approximate administrative floodway limits. Floodplain and floodway limits were drafted using AutoCAD Land Development Desktop Release 2, Service Pack 1. Cross section locations are shown on the work study maps, which are located in Exhibit B, in Volumes 4 and 5 of this TDN.

1.5 Study Results

This study resulted in the new delineation of approximately 210 miles of approximate Zone A floodplain and administrative floodway in the Hassayampa/Lower Jackrabbit Tributaries portion of the Watershed "OO" (Jackrabbit Wash) study area. The Zone A and administrative floodway delineations for the newly delineated floodplains are shown in the reduced-scale maps in Section 5 and in large-scale maps contained in Exhibit B, which is located in Volumes 4 and 5 of this TDN.

Figure 1.3.1

Location Map

Approximate Zone A Floodplain Delineation Study
of Watershed "OO", FCD 2000C019

LEGEND

SECTION BOUNDARY

STUDY REACH AND REACH ID — T5 R5 S36

ROAD — Carefree Hwy.

SHEET OUTLINE AND NUMBER — 5

SCALE

5500' 0' 5500' 11000'

1 INCH = 11000 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DAGGS WASH AND HASSAYAMPA RIVER TRIBUTARIES
OF WATERSHED "OO"

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY, FCD 2000C019

DECEMBER, 2002

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 335-8500
ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, L.L.C.

Figure 1.3.2: Project Area Vicinity

SECTION 2: ADWR/FEMA Forms and Local Government/ADWR Abstracts

2.1 Study Documentation Abstract for FEMA Submittals

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

Section 2.1: Study Documentation Abstract for FEMA Submittals		
2.1.1	Date Study Accepted	
2.1.2	Study Prime Contractor	JE Fuller / Hydrology and Geomorphology, Inc.
	Contact(s)	Brian R. Iserman, P.E., Jonathan E. Fuller, P.E.
	Address	6101 S. Rural Rd., Suite 110 Tempe, AZ 85283
	Phone	(480) 752-2124
	Internal Reference Number	
2.1.2	Study Sub-Contractor	Wood, Patel & Associates, Inc.
	Contact(s)	Jack K. Moody, P.E., Shimin Zou, Ph.D., P.E.
	Address	2051 West Northern, Suite 100 Phoenix, AZ 85021
	Phone	(602) 335-8500
	Internal Reference Number	
2.1.2	Sub Study Sub-Contractor	Argus Consulting
	Contact(s)	Jorge R. Garré, P.E.
	Address	16738 North 109th Street Scottsdale, AZ 85259
	Phone	480-596-1131
	Internal Reference Number	
2.1.3	FEMA Technical Review Contractor	Michael Baker, Jr.
	Contact(s)	Pernille Buch-Pederson
	Address	3600 Eisenhower Ave. Suite 600 Alexandria, VA 22304
	Phone	703-317-6224
	Internal Reference Number	
2.1.4	FEMA Regional Reviewer	Michael Baker, Jr. Engineering
	Phone	(703) 960-8800
2.1.5	State Technical Reviewer	Arizona Department of Water Resources
	Phone	(602) 417-2400
2.1.6	Local Technical Reviewer	Flood Control District of Maricopa County (FCDMC)
	Phone	(602) 506-1501
2.1.7	Reach Description	Hassayampa River Tributaries & Lower Jackrabbit Wash Tributaries
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	Aguila, AZ - 1951/1960, 1990 Belmont Mountain, AZ - 1951/1960, 1989 Black Butte, AZ - 1951/1960, 1990 Daggs Tank, AZ - 1984, 1988

		Flatiron Mountain, AZ - 1951/1960, 1990 Forepaugh Peak, AZ - 1951/1960, 1990 Hummingbird Sring, AZ - 1960, 1990 Outlaw Hill, AZ - 1951/1960, 1990 Star Well, AZ - 1951/1960, 1989 Tiger Well, AZ - 1951/1960, 1990 Vulture Mine, AZ - 1951/1960, 1990 Vulture Peak, AZ - 1951/1960, 1990 Wagner Wash Well, AZ - 1984, 1988 Wickenburg, AZ - 1962, 1978 Wickenburg SW, AZ - 1962, 1965 Wildcat Well, AZ - 1951 & 1960/1990
2.1.9	Unique Conditions and Problems	
2.1.10	Coordination of Peak Discharges (Agency, Date, Comments)	HEC-1 from 1990 Flood Control District of Maricopa County study (FCD 90-05), and from drainage area/discharge relationships developed for this study based on the earlier HEC-1.

2.2 FEMA Forms

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTER AND COMMUNITY OFFICIAL FORM**	O.M.B No. 3067-0148 Expires April 30, 2001

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. REQUESTED RESPONSE FROM FEMA

This request is for a:

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

☐ LOMR A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, floodway or flood elevations. LOMRs typically decrease flood hazards. (See 44 CFR Ch. 1 Parts 60 & 65.)

☒ Other Describe: Initial Approximate Zone A Floodplain Delineation for Hassayampa River Tributaries, and Lower Jackrabbit Wash Tributaries.

2. OVERVIEW

1. The basis for this revision request is (are): (check all that apply)

☐ Physical Change ☒ Improved Methodology/Data ☐ Floodway Revision

☒ Other Describe: This is the initial study for the referenced water courses.

Note: A photograph is not required, but is very helpful during review.

2. Flooding Source: Hassayampa River Tributaries and Lower Jackrabbit Wash Tributaries.

3. Project Name/Identifier: Approximate Zone A Floodplain Delineation of Watershed " OO" (Jackrabbit Wash), FCD 2000C019

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

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

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
040037	Unincorporated Maricopa County	AZ	04013C	0240 E	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	0660 F	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	0675 F	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1035 G	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1055 G	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1060 G	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1070 G	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1080 H	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1090 H	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1510 H	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1525 G	7/19/01
040037	Unincorporated Maricopa County	AZ	04013C	1540 G	7/19/01

4. ENCROACHMENT INFORMATION

1. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP?
☐ Yes ☒ No

If Yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

2. Does the development in the floodway cause the 1% annual chance (base) elevation to increase at any location by more than 0.000 feet? ☐ Yes ☐ No ☒ N/A

3. Does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the base flood elevation to increase at any location by more than one foot (or other increase limit if community or state has adopted more stringent criteria - even if a floodway has not been delineated by FEMA)? ☐ Yes ☒ No

If the answer to either items is Yes, please attach documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

5. MAINTENANCE RESPONSIBILITY

The community is willing to assume responsibility for ☐ performing ☐ overseeing compliance with the maintenance and operation plans of the

(Name)

flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Operation and maintenance plans are attached. ☐ **Yes** ☐ **No** ☒ **N/A**

6. REVIEW FEE

The review fee for the appropriate request category has been included. ☐ Yes Fee amount: $

OR

This request is based on a federally sponsored flood-control project where 50 percent or more of the project's cost is federally sponsored, or the request is based on detailed hydrologic and hydraulic studies conducted by Federal, State, or local agencies to replace approximate studies conducted by FEMA and shown on the effective FIRM; thus the project is fee exempt.
☒ Yes

Please see Instructions for Fee Amounts

7. SIGNATURE

Note: **I understand that my signature indicates that all information submitted in support of this request is correct**

Michael Duncan
Signature of Revision Requester

Michael Duncan, P.E., Project Manager, C.F.M.
Printed Name and Title of Revision Requester

Flood Control District of Maricopa County
Company Name

Telephone No.: (602)506-4732 Date: 5-1-03

Note: **Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.**

Signature of Community Official

Michael S. Ellegood, P.E., Chief Engineer and General Manager
Printed Name and Title of Community Official

Flood Control District of Maricopa County
Community Name

Telephone No.: (602)506-1501 Date: 5-7-03

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is in accordance with 44 CFR Ch. 1, Sect 65.2

Brian R. Iserman 5/1/03
Signature

Brian Iserman, P.E., Hydrologist
Printed Name and Title of Revision Requester

Registr No. 29325 Expires (Date) 9/30/2004 State AZ

Type of License/Expertise: Civil

Check which forms have been included with this request

Form Name and (Number)	Required if .....
☒ **Hydrologic** (3)	new or revised discharges
☒ **Hydraulic** (4)	new or revised water-surface elevations
☒ **Mapping** (5)	floodplain/floodway changes
☐ **Channelization** (6)	channel is modified
☐ **Bridge/Culvert** (7)	addition/revision of bridge/culvert
☐ **Levee/Floodwall** (8)	addition/revision of levee/floodwall
☐ **Coastal** (9)	new or revised coastal elevations
☐ **Coastal Structures** (10)	addition/revision of coastal structure
☐ **Dam** (11)	addition/revision of dam
☐ **Alluvial Fan** (12)	structures proposed on alluvial fan

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

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

PAPERWORK BURDEN DISCLOSURE NOTICE

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

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

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

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

B. OVERVIEW

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

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
040039	Town of Buckeye	AZ	04013C	240E 660F 675F 1035G 1055G 1060G 1070G 1080H 1090H	7/19/01
			1510H, 1525G,	1540G	

2. Flooding Source: Hassayampa River Tributaries and Lower Jackrabbitr Tributaries

3. Project Name/Identifier: Approximate Zone A Floodplain Delineation of Watershed "OO" (Jackrabbit Wash Watershed), FCD 2000C019

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

5. Basis for Request and Type of Revision:

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

☐ Physical Change ☒ Improved Methodology/Data

☐ Regulatory Floodway Revision ☒ Other (Attach Description)

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

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

Types of Flooding:	☒ Riverine	☐ Coastal	☐ Shallow Flooding (e.g., Zones AO and AH)
	☐ Alluvial fan	☐ Lakes	☐ Other (Attach Description)
Structures:	☐ Channelization	☐ Levee/Floodwall	☐ Bridge/Culvert
	☐ Dam	☐ Fill	☐ Other, Attach Description

C. REVIEW FEE

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

☒ No, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/mit/tsd/frm_fees.htm **for Fee Amounts and Exemptions.**

D. SIGNATURE

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

Name: Michael Duncan, PE, CFM	Company: Flood Control District of Maricopa County	
Mailing Address: Flood Control District of Maricopa County 2801 W Durango St Phoenix AZ 85009	Daytime Telephone No.: 602-506-4732	Fax No.: 602-506-4601
	E-Mail Address: mwd@mail.maricopa.gov	
Signature of Requester (required): Michael Duncan		Date: 06-13-03

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

Community Official's Name and Title: WOODROW C. SCOUTTEN, TOWN ENGINEER		Telephone No.: 623-547-4661 x222
Community Name: Town of Buckeye	Community Official's Signature (required): M Scoutten	Date: 8-8-03

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

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

Certifier's Name: Brian Iserman, PE, Hydrologist	License No.: 29325 Civil Engineer	Expiration Date: 9/30/2004
Company Name: JE Fuller/Hydro.&Geomorpho.	Telephone No.: 480-752-2124	Fax No.: 480-839-2193
Signature: Brian R. Iserman		Date: 8/11/03

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

Seal (Optional)

6. The area of revision encompasses the following types of flooding and structures. Check all that apply.

Types of Flooding		Structures	
☒	Riverine	☐	Channelization
☐	Coastal	☐	Levee/Floodwall
☐	Alluvial fan	☐	Bridge/Culvert
☐	Shallow Flooding (e.g. Zones AO and AH)	☐	Dam
☐	Lakes	☐	Fill
☐	Other (describe)	☐	Other (describe)

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS FORM**	O.M.B No. 3067-0148 Expires April 30, 2001

Public reporting burden for this form is estimated to average **3.67** hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: Unincorporated Maricopa County, Arizona and Town of Buckeye, Arizona

Flooding Source: Hassayampa River Tributaries and Lower Jackrabbit Wash Tributaries

Project Name/Identifier: Approximate Zone A Floodplain Delineation Study of Watershed "OO" (Jackrabbit Wash)

1. REASON FOR NEW HYDROLOGIC ANALYSIS

☒ No existing analysis ☒ Improved data ☐ Changed physical condition of watershed

☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☒ Other

For the reason stated above, please attach a detailed explanation. If a computer program/model was used in revising the hydrologic analysis, **please provide a diskette with the input files** for the same flood recurrence intervals contained in the FIS for that stream; and at least for the 1% annual chance (base) flood where no detailed study exists.

Explanation provided: ☒ Yes ☐ No **Diskettes provided:** ☒ Yes ☐ No

2. METHODOLOGY FOR NEW ANALYSIS

Indicate Method	Required Data	Data Included
☐ Statistical Analysis of Gage Records	Form 3 – Attachment A	☐ Yes ☐ No
☐ Regional Regression Equations	Form 3 – Attachment C	☐ Yes ☐ No
☐ Precipitation/Runoff Model	Form 3 – Attachment D	☐ Yes ☐ No
☒ Other	Back-up computations and supporting data	☒ Yes ☐ No

3. APPROVAL OF ANALYSIS

The hydrologic analysis has already been approved by a local, state, or Federal Agency. ☐ Yes ☐ No ☒ Not Required

If Yes, attach evidence of approval. ☐ **Approval attached.** If No, attach explanation. ☐ **Explanation attached.**

4. COMPARISON OF BASE FLOOD DISCHARGES

Location:	Drainage Area (SqMi)	FIS(cfs)	Revised (cfs)
CP 74	6.252	5900	3000
CP 75	6.252	2100	4700
CP 79	5.615	4000	3000
CP 87	6.983	2000	3500

Note: When revised discharges are not significantly different than the FIS discharges, FEMA may require a confidence limits analysis (see attachment B) at a later date to complete the review.

If only a portion of a detailed study area was revised please attach an explanation describing the transition from the proposed discharges to the effective discharges. ☐ **Explanation Included** ☒ **Explanation Not Required**

5. HISTORICAL FLOODING INFORMATION

If historical data are available for the flooding source please provide: Location, peak discharges/water-surface elevations and dates, and source of information. ☐ **Data Attached** ☒ **Data Not Available**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

ATTACHMENT D: PRECIPITATION/RUNOFF MODEL

		FIS:		Revised:	
1.	Method or model used:	HEC-1		Basin Area/Discharge based on FIS HEC-1 and Split Flow Analyses	
	Version:	4.0		NA	
	Date:	September 1990		NA	
2.	Source of rainfall depth:	NOAA Atlas II		NA	
3.	Source of rainfall distribution:	SCS Type II, and FCDMC Design Manual		NA	
4.	Rainfall duration:	6 and 24 hr		NA	
5.	Areal adjustment to precipitation (%):	USACOA1954 Queen Creek aerial reduction curve for 6-hour storms, NOAA TM HYDRO-40 for 24-Hr Storms		NA	
6.	Maximum overland flow length is	N/A		NA	
7.	Hydrograph development method:	Clark Unit Hydrograph & S-Graphs		NA	
8.	Loss rate method:	Green & Ampt		NA	
	Source of soils information:	Soil Survey of Central Maricopa County, SCS, 1977, and Soile Survey of Aquila-Carefree Area, SCS 1986		NA	
	Source of land use information:	FCDMC, Hillslope, Desert & Rangeland, Mountain		NA	
9.	Channel routing method:	Normal Depth		NA	
10.	Reservoir routing:	Modified Puls		NA	
11.	Baseflow considerations: **If Yes, explain below how baseflow was determined:**	☐ Yes	☒ No	☐ Yes	☒ No
12.	Snowmelt considerations:	☐ Yes	☒ No	☐ Yes	☒ No
13.	Model calibration: **If Yes, explain below how calibration was performed**	☐ Yes	☒ No	☐ Yes	☒ No
14.	Future land use condition: **If Yes, explain why below**	☐ Yes	☒ No	☐ Yes	☒ No

15. **Attach precipitation/runoff model, hydrologic model schematic, curve number calculations, time of concentration calculations, and supporting maps, delineating the watershed boundary and drainage area divides.**

Information and Maps provided? ☐ Yes ☒ No

NOTE: FEMA policy is to base flooding on existing conditions.

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS FORM**	O.M.B No. 3067-0148 Expires April 30, 2001

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: Unincorporated Maricopa County, Arizona and Town of Buckeye, Arizona

Flooding Source: Hassayampa River Tributaries and Lower Jackrabbit Wash Tributaries

Project Name/Identifier: Approximate Zone A Floodplain Delineation Study of Watershed "OO" (Jackrabbit Wash)

1. REACH TO BE REVISED

Describe the limits of the revision OR submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☒ Yes

Downstream Limit: See FIRMs

Upstream Limit: See FIRMs

2. MODELS SUBMITTED

Requirements: for areas which have detailed flooding:	**for areas which do not have detailed flooding:**
Full input and output listings along with files on diskette for each of the models listed below (items 1-4) and a summary of the source of input parameters used in the models must be provided. The summary must include a description of any changes made from model to model (e.g., Duplicate Effective model to Corrected Effective model). At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.	Only the 100-year (Base) flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

If hydraulic models are not developed, hydraulic analyses (including all calculations) for existing or pre-project conditions and revised or post-project conditions must be submitted.

1. Duplicate Effective Model ☐ Natural File Name ___ ☐ Floodway File Name
Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models (10-, 50-, 100-, and 500-year multi-profile runs and the floodway run) must be obtained and then reproduced on the requester's equipment to produce the Duplicate Effective model. This is required to assure that the effective models input data has been transferred correctly to the requester's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model ☐ Natural File Name ___ ☐ Floodway File Name
The Corrected Effective model is the model that corrects any errors that occur in the Duplicate Effective model, adds any additional cross sections to the Duplicate Effective model, or incorporates more detailed topographic information than that used in the currently effective model. The Correctly Effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model ☐ Natural File Name ____ ☐ Floodway File Name ____
The Duplicate Effective model or Corrective Effective model is modified to produce the Existing or Pre-Project Conditions model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective model or Duplicate Effective model.

4. Revised or Post-Project Conditions Model ☐ Natural File Name ___ ☐ Floodway File Name
The Existing or Pre-Project Conditions model (or Duplicate Effective model or Corrected Effective model, as appropriate) is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for the proposed project this model must reflect proposed conditions.

5. Other – Please attach a sheet describing all other models submitted along with the file names. ☐ Natural ☐ Floodway

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. STARTING WATER-SURFACE ELEVATIONS

Explain how they were determined. Explanation Attached? ☒ Yes ☐ No

NOTE: If the effective study is an approximate study, the slope/area method is recommended.
For detailed analysis studies, using a known water-surface elevation is recommended. See Section 3 explanation attached.

4. RESULTS (from the model used to revise the 100-year water surface elevations)

If the results indicate any of the following, attach an explanation - to this form, or to the hydraulic model printout- as to the reasonableness of the situation.

☐ Supercritial depth ☐ Critical Depth ☐ Drawdowns ☐ Negative Floodway Surcharges

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

☒ Water surface elevations higher than the end points of cross sections.

☐ Floodway discharge is different than the Natural 100-year (base) flood discharge.

☐ Project causes 100-year floodplain or floodway elevations to increase (state if increases are located off the requester's property)

Explanation attached with Form ☒ Explanation provided on attached printout ☐
If Hydraulic model used is HEC-2, has it been checked with FEMA' S CHECK-2 computer program ☐ Yes ☐ No
(see instructions for information on how to obtain CHECK-2)

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. **Profile Transition**

a. 100-Year Water-Surface Elevations - indicate the difference in water surface elevations where the project 100-year elevations tie into the existing 100-year water surface elevations at each end of the project.

Downstream End: ____ within _____ (feet) Upstream End ___ within ___ (feet)

b. Floodway Elevations – indicate the difference in water surface elevations where the project floodway elevations tie into the existing floodway water surface elevations at each end of the project.

Downstream End: _____ within _____ (feet) Upstream End ___ within ___ (feet)

c. Floodway widths – indicate the difference in floodway widths where the project floodway widths tie into the existing floodway width at each end of the project.

Downstream End _____ within _____ (feet) Upstream End ___ within ___ (feet)
Cross-Section # *Cross-Section #*

2. **Profile Checklist (check box if information has been provided on profile)**

The following information (unless in parentheses) must be included at the same scale as the existing profiles for this project:

☐ Stream Name ☐ Community Name ☐ Corporate Limits labeled ☐ Study limits labeled

☐ Confluences labeled ☐ Channel Stationing ☐ Streambed profiled ☐ Cross Sections labeled

☐ Horizontal/Vertical Scales indicated ☐ 100-year elevs profiled*

☐ Road Crossings ☐ Labeled ☐ Low Chord Elevations ☐ Top of Road Elevations

* All recurrence intervals in the effective study must also be profiled.

Floodway Data Table

Attach a Floodway Data Table for each cross section listed in the published Floodway Data table in the FIS report.

Floodway Data Table Attached ☐ Yes ☒ Not Required

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE / COASTAL MAPPING FORM**	O.M.B No. 3067-0148 Expires April 30, 2001

Public reporting burden for this form is estimated to average 1.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: Unincorporated Maricopa County, Arizona and Town of Buckeye, Arizona

Flooding Source: Hassayampa River Tributaries and Lower Jackrabbit Wash Tributaries

Project Name/Identifier: Approximate Zone A Floodplain Delineation Study of Watershed "OO" (Jackrabbit Wash)

This is a ☒ Manual ☐ Digital submission. *Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance as possible.*

1. MAPPING CHANGES

1. A topographic workmap must be submitted showing the following information (check N/A when not applicable):

a. Revised approximate 100-year floodplain boundaries (Zone A)	☒ Yes	☐ No	☐ N/A
b. Revised detailed 100- and 500-year floodplain boundaries.	☐ Yes	☐ No	☒ N/A
c. Revised floodway boundaries	☒ Yes	☐ No	☐ N/A
d. Location and alignment of all cross sections with stationing control indicated.	☒ Yes	☐ No	☐ N/A
e. Stream alignments, road alignments and dam alignments.	☒ Yes	☐ No	☐ N/A
f. Current community boundaries.	☒ Yes	☐ No	☐ N/A
g. Effective 100- year floodplain and floodway boundaries from FIRM/FBFM reduced or enlarged to the scale of the topographic workmap	☒ Yes	☐ No	☐ N/A
h. Tie-ins between the effective and revised 100-, 500-year and floodway boundaries	☒ Yes	☐ No	☐ N/A
i. The requester's property boundaries and community easements	☒ Yes	☐ No	☐ N/A
j. The signed certification of a registered professional engineer	☒ Yes	☐ No	☐ N/A
k. Location and description of reference marks	☒ Yes	☐ No	☐ N/A
l. Vertical datum (example: NGVD, NAVD)	☒ Yes	☐ No	☐ N/A
m. Coastal zone designations tie into adjacent areas not being revised	☐ Yes	☐ No	☒ N/A
n. Location and alignment of all coastal transects used to revise the coastal analyze	☐ Yes	☐ No	☒ N/A
o. V-zone has been delineated to extend landward to the heel of the primary frontal dune	☐ Yes	☐ No	☒ N/A

If any items are marked No or N/A please attach an explanation.

2. What is the source and date of the updated topographic information (example: orthophoto maps, July 1985; filed survey, May 1979, beach profile, June 1987 etc.)? Aerial mapping provided by FCDMC, Spring 2001

3. What is the scale and contour interval of the following workmaps?

Effective FIS Scale NA Contour Interval NA

Revision Request Scale 1"= 400' Contour Interval 10'

NOTE: Revised topographic information must be of equal or greater detail than effective.

4. Attach an annotated FIRM/FBFM at the scale of the effective FIRM/FBFM showing the revised 100- and 500-year floodplain and the floodway boundaries and how they tie into those shown on the effective FIRM/FBFM downstream and upstream of the revisions or adjacent to the area of revision for coastal studies. **FIRM/FBFM attached?** ☒ **Yes** ☐ **No**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. EARTH FILL PLACEMENT

1. The fill is: ☐ Existing ☐ Proposed ☒ N/A

2. Has fill been/will be placed in the regulatory floodway? ☐ Yes ☐ No
If Yes, please attach completed Riverine Hydraulic Analysis Form (Form 4).

3. Has fill been/will be placed in floodway fringe (*area between the floodway and 100-year floodplain boundaries*)? ☐ Yes ☐ No

If Yes, then complete A, B, C, and D below.

a. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? ☐ Yes ☐ No

If Yes, justify steeper slopes _____

b. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? (*Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)*

☐ Yes ☐ No

If No, describe erosion protection provided _____

c. Has all fill placed in revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? ☐ Yes ☐ No

d. Can structures conceivably be constructed on the fill at any time in the future? ☐ Yes ☐ No

If Yes, attach certification of fill compaction (item 3c. above) by the community' s NFIP permit official, a registered professional engineer, or an accredited soils engineer in accordance with Subparagraph 65.5(a)(6) of the NFIP regulations.

Fill certification attached ☐ **Yes** ☐ **No**

4. Has fill been/will be placed in a V zone? ☐ Yes ☐ No

If Yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall?

☐ Yes ☐ No

If Yes, attach the Coastal Structures Form (Form 10).

SECTION 3: SURVEY AND MAPPING INFORMATION

3.1 Field Survey Information

Field survey work associated with the topographic mapping was performed by RBF Consulting of Phoenix, Arizona under contract with the FCDMC. Split flow analyses were performed for 17 significant flow splits using field survey data collected by JEF staff using a Sokia $C3_2$ Auto Level.

3.2 Mapping

The topographic mapping and aerial photography was provided by Landata Airborne Systems of Irvine California, under contract with the FCDMC.

SECTION 4: HYDROLOGY

4.1 Method Description

100-year peak discharge values were provided by the Flood Control District of Maricopa County (FCDMC) in the Technical Data Notebook for the study entitled *Jackrabbit Wash Floodplain Delineation Study, FCD 90-05*[2] performed by Burgess & Niple, Inc. Subsequent modifications to the original HEC-1 model were performed by the FCDMC. These modifications are described in the Technical Data Notebook for the study entitled *Powerline Wash and Tank Wash Flood Delineation Study, FCD 92-09*[8].

100-year peak discharge values at additional concentration points were determined using discharge-drainage area relationships based on the earlier HEC-1 modeling performed by Burgess & Niple and the subsequent modifications made by FCDMC. Additional concentration point locations were discussed and mutually agreed upon between the FCDMC and JE Fuller/Hydrology & Geomorphology, Inc. (JEF). Concentration points are included at the following general locations:

- At the limits of this study
- At significant tributaries
- At significant road crossings.

Discharge-drainage area regression relationships were developed for 5 general physiographic regions within Watershed "OO" for 100-year 6-hour and 24-hour events (see Figure 4.1: Study Area). Each physiographic region was defined based on a number of general physical and geographical considerations (i.e., elevation, soils and surficial geology, vegetation, slope, channel types, general sub-basin shapes, drainage network development, etc.). The 5 physiographic regions include:

- Vulture Mountains
- Northwest Mountains
- Belmont Mountains
- Belmont Foothills
- Piedmont

Generally, only sub-basin 100-year discharge values were used to develop the regression relationships rather than 100-year-discharge values at concentration points because additional concentration points for this study are the result of sub-basins which are much smaller (i.e., 1 to 5 square miles) than the sub-basins defined in the original Burgess & Niple HEC-1. The exception is for the piedmont area where additional sub-basins were needed for very large drainage areas (i.e., 15 to 20 square miles). A separate discharge-area relationship was developed for the Piedmont Physiographic Region using only concentration points rather than sub-basins.

Some discharge-drainage area regression relationships for selected physiographic regions were developed for specific discharge ranges (i.e., less than 1 square mile, between 1 and 4 square miles, etc.) in order to get a better relationship for the specific range of discharges. Additionally, because there were very few small-watershed delineations in the original Burgess & Niple HEC-1, discharge-area regression relationships were developed using various ranges of small watersheds from the entire Watershed "OO" (i.e., less than 1 square mile, between 1 and 4 square miles, etc.). Table 4.1-1 presents all the discharge-drainage area relationships developed for this project.

Table 4.1-1: List of Discharge-Drainage Area Relationships

Physiographic Region	Discharge – Drainage Area Relationship
Vulture Mountains	24-Hour Peak Discharge
	6-Hour Peak Discharge
Northwest Mountains	24-Hour Peak Discharge
	6-Hour Peak Discharge
Belmont Mountains	24-Hour Peak Discharge
	6-Hour Peak Discharge
	24-Hour Peak Discharge <6.5 Square Miles
	6-Hour Peak Discharge <6.5 Square Miles
Belmont Foothills	24-Hour Peak Discharge
	6-Hour Peak Discharge
Piedmont	24-Hour Peak Discharge >1 Square Mile
	6-Hour Peak Discharge >1 Square Mile
	24-Hour Peak Discharge, Concentration Points
Watershed OO (Jackrabbit Wash)	6-Hour Peak Discharge <1 Square Mile
	24-Hour Peak Discharge 1<x<4 Square Mile
	6-Hour Peak Discharge 1<x<4 Square Mile
	24-Hour Peak Discharge 4<x<10 Square Mile
	6-Hour Peak Discharge 4<x<10 Square Mile

These discharge-drainage area relationships are included in Appendix D.

Flow splits or bifurcations were analyzed to determine the flow distribution of each split or bifurcation. Split flow analyses were performed for 17 significant flow splits using field survey data, existing 2' contour interval mapping[8] and HEC-RAS. The field surveys were performed by JEF staff using a Sokia $C3_2$ Auto Level. The flow distribution at an additional split, split 15, was assumed due to the extremely complicated pattern of diverging flow paths at that site. Table 4.1-2 (next page) presents a summary of the results of the split flow analyses.

Field surveys typically consisted of one cross-section aligned perpendicularly across the expected 100-year floodplain, and additional points upstream and downstream along the thalweg to determine the average slope of the reaches associated with the flow bifurcation. The cross sections were placed as close to the actual point of flow division as possible.

N-values were estimated at each flow split using the guidelines developed for this project in the Task 6.7 Technical Memorandum dated February 9, 2001, (see Appendix B). The field survey

notes, attendant calculations and HEC-RAS output associated with the flow splits are included in Appendix D.

Table 4.1-2: Split Flow Summary Table

Split #	Left Discharge (cfs)	Right Discharge (cfs)	Total Discharge (cfs)	Notes
1	2500	400	2900	Surveyed
2	2300	1300	3600	Surveyed
3	900	1400	2300	Surveyed
4	500	300	800	Surveyed
5	2800	1000	3800	Surveyed
6	2600	2100	4700	Surveyed
7	1100	2200	2200	Surveyed, but due to a high degree of uncertainty of the flow distribution at this split, it is assumed that 2200 cfs goes to the right split, and 1100 cfs goes to the left split
8	600	700	1300	Surveyed
9	800	900	1700	Surveyed
10	700	3100	3800	Surveyed
11	1900	1100	3000	Surveyed
12	1700	1100	2800	Surveyed
13	700	600	1300	Data from existing topographic mapping (Toyota)
14	2300	1100	3400	Data from existing topographic mapping (Toyota)
15	3000	3000	5200	Due to the uncertainty of the flow distribution at this split, it is assumed that 3000 cfs (approx. 60% of 74B) goes down each side of the split.
16	400	600	1000	Surveyed
17	500	1000	1500	Surveyed
18	300	400	700	Surveyed
20	200	3900	4100	Data from existing topographic mapping (FCDMC)
21	700	3200	3900	Data from existing topographic mapping (FCDMC)
22	1400	2000	3400	Data from existing topographic mapping (FCDMC)
23	2300	1300	3600	Data from existing topographic mapping (FCDMC)
24	1200	1600	2800	Data from existing topographic mapping (FCDMC)
25	1700	600	2300	Data from existing topographic mapping (FCDMC) Additional 100 cfs added to each side to account for uncertainty

4.2 Parameter Estimation

4.2.1 Drainage Area Boundaries

The original basin delineation work by Burgess & Niple was based on US Geological Survey (USGS) 7½ minute Quad maps (see references 16 through 23). Additional basin delineation work was performed for this study using the same USGS quad maps as a base (see Figure 4.5: Hydrology Work Map in the back of this chapter). Since the original Burgess & Niple delineation was not available electronically, JEF digitized these information before adding concentration points and attendant basin delineations.

In the course of digitizing the original Burgess & Niple delineation, JEF used digital aerial photography[4] of the study area to check the delineations around flow splits. In some cases, the original delineation was modified based on the more recent aerial photography.

4.2.2 Watershed Work Maps

The base map for the watershed work map (Figure 4.5) is USGS digital raster graphics (DRG) projected to Stateplane North American Datum of 1983 and tiled by FCDMC. The subbasin naming convention is an expansion of the naming convention presented in the original Burgess & Nipple TDN entitled *Jackrabbit Wash Floodplain Delineation Study, FCD 90-05*[2].

The original Burgess & Niple HEC-1 naming convention is based on 18 major basins, with sub-basins being denoted with a letter (i.e., 1H, 1I, 4A, 4B etc.). Additional basins added for this study are denoted by adding a number after the letter (i.e., 1H_1, 1I_5, 4A_2, 4B_1, etc.).

Concentration point identification numbers are likewise an expansion of the previous Burgess & Nipel hydrology numbering scheme, which simply numbers the concentration points sequentially from 1 to 119. Additional concentration points are denoted by adding a letter after the numeral; for example: Watershed 10F corresponded to Concentration Point 53 in the original Burgess & Niple hydrology. Additional concentration points 53A, 53B, 53C, 53D and 53E were added upstream of concentration point 53, resulting in the delineation of sub-watersheds 10F_1, 10F_2, 10F_3, 10F_4 and 10F_5 (see figure 4.2.2, Example Delineation).

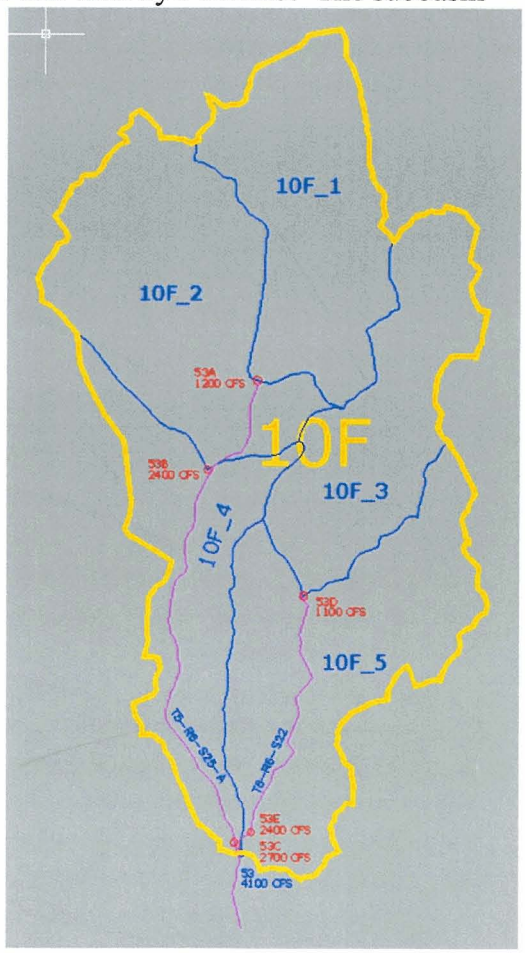


Figure 4.2.2, Example Delineation

4.2.3 Gauge Data

4.2.3.1 Precipitation Gauging:

Two precipitation gauges are operated by the Flood Control District of Maricopa County in the Jackrabbit Wash watershed. Gauge 5195, Dead Horse Wash, was installed November 1, 2000, Gauge 5215, Jackrabbit Wash was installed September 14, 1982. An additional gauge, 5260 Vulture Mine, which is located just north of the study area, was installed October, 1981.

4.2.3.2 Stream Gauging:

The US Geological Survey publishes annual peak discharges measured at Jackrabbit Wash Near Tonopah, AZ (USGS Gauge number 09516800). Annual peak flow data are available from 1964 to the present. The largest flow measured at this site to date occurred on October 22, 2000, resulting in an estimated discharge of 27,000 cfs with a gage height of 15.1 ft according to preliminary USGS analyses

The Flood Control District of Maricopa County operates a stream gauge on Jackrabbit Wash; Gauge 5218. This gauge was installed October 31, 2000 approximately 5 miles upstream of the USGS gauge. Based on high water marks and a cross-section survey performed on 10/31/00, the FCDMC estimated a discharge of 32,400 cfs.

4.2.4 Statistical Parameters

4.2.4.1 Precipitation Statistics:

No precipitation statistical parameters were used for this hydrologic analysis.

4.2.4.2 Discharge Statistics:

No discharge statistics were used in this analysis, however, the following general information is available: Streamflow statistics are published by the USGS for Jackrabbit Wash Near Tonopah, AZ (USGS Gauge number 09516800) in *Statistical Summaries of Streamflow Data and Characteristics of Drainage Basins for Selected Streamflow-Gaging Stations in Arizona Through Water Year 1996*[7]. This publication present the results of a log-Pearson Type II analysis for the gauging station noted in section 4.2.3.2.

The streamflow statistics for the gauge located on Jackrabbit Wash, which is presented in the above publication, were not used to develop the peak discharge estimates used in this study for Jackrabbit Wash nor its tributaries.

4.2.5 Precipitation and Runoff

4.2.5.1 Historical Precipitation Records

The Flood Control District of Maricopa County (FCDMC) operates 2 precipitation gauges in Watershed "OO"; Gauge number 5195, Dead Horse Wash and 5215, Jackrabbit Wash (see Figure 4.1). Gauge number 5195 was installed November, 2000, and is situated at an elevation of 2350 feet mean sea level. Gauge number 5215 was installed September, 1982 and is situated at an elevation of 1798 feet mean sea level. Monthly statistics based on 18 years of record through March, 2001 for Gauge 5215 are presented in Table 4.2.5.1-2 below.

Table 4.2.5.1-1: Monthly Precipitation Summary for FCDMC Gauge 5215, Jackrabbit Wash

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Precip. (in.)	1.0	1.17	0.87	0.28	0.07	0.09	0.72	1.20	0.65	0.26	0.42	0.90	7.63

The FCDMC also operates 2 precipitation gauges which are located just outside the project area; number 5260, Vulture Mine just north of the project area near Wickenburg and number 5130, Upper Tiger Wash, just west of the project area. The Vulture Mine gauge was installed in October, 1981 and is at an elevation of 2311 feet mean sea level. Monthly statistics based on 20 years of record at this gauge through March, 2001 are presented in Table 4.2.5.1-2 below. The Upper Tiger Wash Gauge was installed November, 1981. Monthly statistics based on 20 years of record at this gauge through March, 2001 are presented in Table 4.2.5.1-3 below.

Table 4.2.5.1-2: Monthly Precipitation Summary for Gauge 5260, Vulture Mine

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Precip. (in.)	1.04	1.21	0.99	0.27	0.14	0.14	1.04	1.63	0.90	0.36	0.52	0.76	8.97

Table 4.2.5.1-3: Monthly Precipitation Summary for Gauge 5130, Upper Tiger Wash

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Precip. (in.)	1.12	1.15	0.82	0.31	0.09	0.14	0.64	1.06	0.94	0.34	0.46	0.81	7.88

4.2.5.2 Historic Flooding

Due to the overall remoteness of this area, no detailed historical flooding accounts have been found. In general, the study area experiences two distinct precipitation seasons; summer monsoons (July-October) and winter frontal storms (December-March).

The monsoon season precipitation events tend to be convective and are relatively shorter in duration. The monsoon storms are typically more intense than winter storms, and are usually highly variable, both spatially and temporally. Winter storms tend to be frontal and are relatively

longer in duration, less intense than summer storms, and tend to have less spatial and temporal variability throughout the area impacted by the storm.

In the region surrounding the study area, it is generally observed that the smaller watersheds (less than 5 square miles) tend to yield the largest peak flows as a result of the more intense, short duration storm events. Likewise, the larger basins (greater than 10 square miles) tend to yield the largest peak flows as a result of the storms having greater spatial and temporal distribution than the summer storms.

4.2.5.3 Rainfall Depth and Distribution

No rainfall depth nor distribution parameters were used in this analysis.

4.2.5.4 Areal Precipitation Reduction

No areal precipitation reduction was applied in this analysis.

4.2.5.5 Comparison to Historical Recorded Extremes

Based on the period of record for this gauge (USGS Gauge number 09516800) 1964-79, 1983, and 1991-96, the published[7] 100-year peak flow at this site is 33,900 cubic feet per second (cfs). A note accompanying this statistic indicates that the reliability of this value "*is uncertain, and potential errors are large*". The peak flow published in the Technical Data Notebook from the original Burgess & Niple HEC-1 for this same location is 21,100 cfs.

4.2.6 Physical Parameters

Other than basin areas, as described in section 4.2.1 and 4.2.2, no other physical parameters were gathered for this analysis.

4.3 Problems Encountered During Study

4.3.1 Special Problems and Solutions

The original Burgess and Niple HEC-1 did not take into account diversions resulting from flow splits or bifurcations. As a result, certain downstream HEC-1 concentration points may be under or over estimated. Table 4.3.1 presents a qualitative estimate of the expected impact to the HEC-1 concentration points which are susceptible to significant changes in the 100-year discharge as a result of flow splits. Only those changes which impact existing detailed floodplain delineations are shown in Table 4.3.1.

At a minimum, the downstream areas impacted by significant net increases in the estimated 100-year discharges (i.e., Jackrabbit Wash, Star Wash West Tributary and Daggs Wash) should be restudied.

Table 4.3.1: Impacted Downstream HEC-1 Concentration Points

Split Location	Impacted Downstream HEC-1 Concentration Points	Predicted Impact on the Q_{100}
1	8,10,11,12,21,22,32,33,34,37,38,94,97,98, Jackrabbit Wash	Increase
7	61, Tank Wash	Decrease
7	63, Star Wash West Tributary	Increase
5, 12	79, Star Wash East Tributary	Decrease
12	87, Daggs Wash	Increase
2, 12	88, Daggs Wash	Increase

4.3.2 Modeling Warning and Error Messages

No additional hydrologic modeling was performed during the course of this study.

4.4 Calibration

No calibrations were performed for this study.

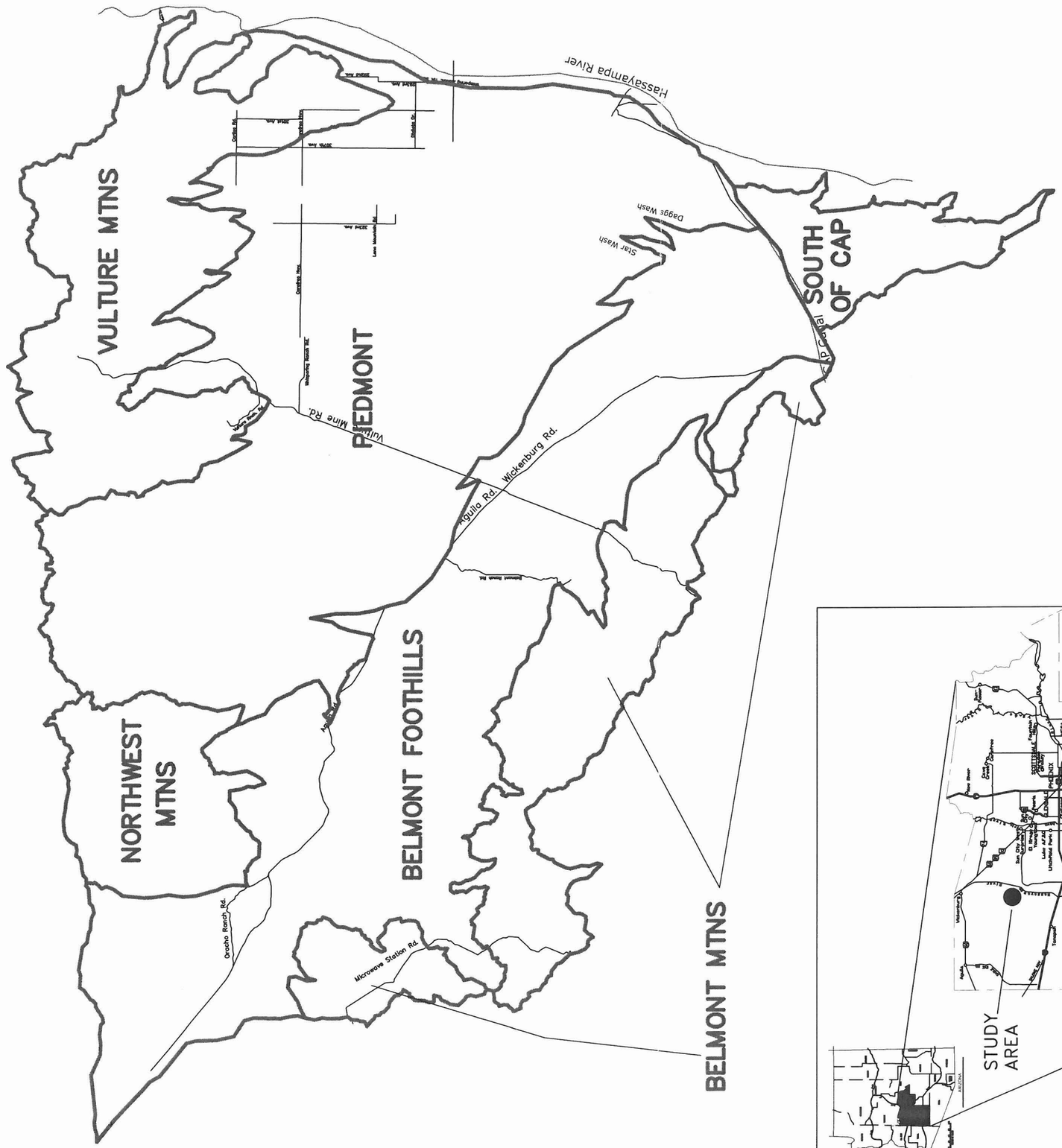
4.5 Final Results

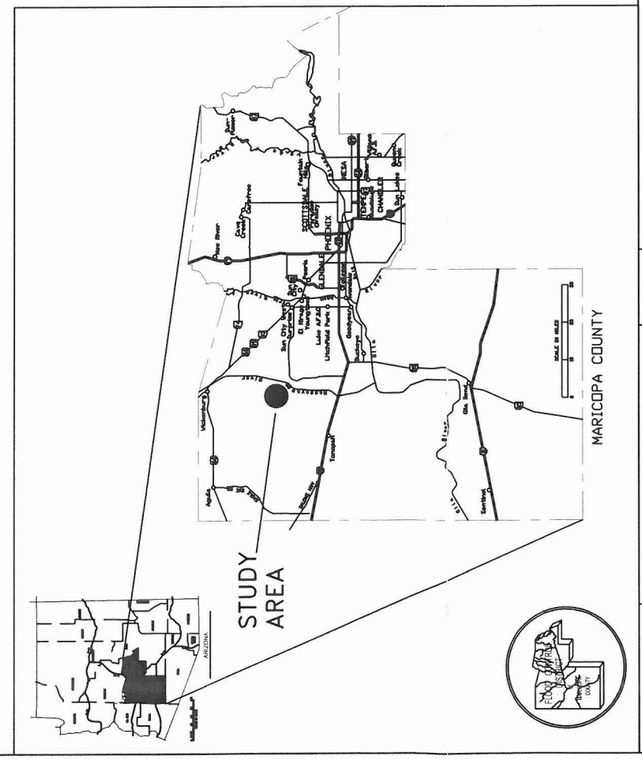
Computed 100-year discharges are presented in Table 4.5 starting on the following page. Results are also shown on the Hydrology Work Map (Figure 4.5) in Volume 4 of this TDN.

4.5.1 Verification of Results

The Burgess & Niple results and the additional resulting calculated 100-year discharge estimates from this report were plotted on *Figures 10-3, 10-4 and 10-5, 100-Year Peak Discharge by LP3 Analysis (LP3 Q100) and Maximum Recorded Discharge (Q_m Record) vs. Drainage Area* from the ADOT Drainage Design Manual[1]. Values from both studies fall within the cloud of common values from the various sources presented on Figure 10-3, 10-4 and 10-5. The results of this verification are shown in Appendix D.

Table 4.5: Computed 100-Year Discharges





LEGEND

PYSIOGRAPHIC REGION

ROAD — Carefree Hwy.

SCALE

7500' 0' 7500' 15000'

1 INCH = 7500 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WATERSHED "OO"

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY, FCD 2000C019

Daggs Wash and Hassayampa River Tributaries

SEPTEMBER, 2001

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

Figure 4.1: Study Area

Approximate Zone A Floodplain Delineation Study of Jackrabbit Wash (FCD 2000C019)
Table 4.5: Computed 100-Year Discharges

Concentration Point	Area (sq. mi.)	Calculated Q (cfs)	Rounded Q (cfs)	Unit Discharge (cfs/sq mi)	Discharge Source or Graph
Vulture Mountains					
53	5.700		4,100	719	FCD 90-05
53A (10F_1)	1.063	1,245	1,200	1,129	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
53B (10F_1+10F_2)	2.361	2,397	2,400	1,016	Vulture Mountains HEC-1 Results, 24 hr
53C (10F_1+2+4)	3.256	2,716	2,700	829	Vulture Mountains HEC-1 Results, 24 hr
53D (10F_3)	0.912	1,084	1,100	1,206	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
53E (10F_3+5)	2.249	2,357	2,400	1,067	Vulture Mountains HEC-1 Results, 24 hr
59A (10F-1+2+3+4+5+10G_1)	6.675	3,934	4,100	614	For Consistency, Discharge Assumed to Equal 53)
60	6.900		3,500	507	FCD 90-05
60A (10I_1)	0.771	965	1,000	1,297	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
60B (10I_1+2)	1.172	1,281	1,300	1,109	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
60C (10I_1+2+3)	1.696	2,160	2,200	1,298	Vulture Mountains HEC-1 Results, 24 hr
60D (10I_4)	0.793	984	1,000	1,261	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
60E (10I_4+5)	1.709	2,165	2,200	1,287	Vulture Mountains HEC-1 Results, 24 hr
60F (10I_1+2+3+4+5+6)	3.591	2,835	2,800	780	Vulture Mountains HEC-1 Results, 24 hr (Note: Split 7 ignored, see Split Flow Calculation Sheet)
62 (10K1+23% of 60C)	1.243	1,999	2,000	1,609	Vulture Mountains HEC-1 Results, 24 hr (Note: 10K1 is in the piedmont area, but derives most of its contributing drainage area from the Vulture Mountains)
65	1.900		2,400	1,263	FCD 90-05 (6hr) (Note: part of this watershed is in the piedmont area, but derives most of its contributing drainage area from the Vulture Mountains)
66	1.500	1,490	1,500	1,000	FCD 90-05 (6hr)
67A (10M1+M3_1)	3.759	2,895	2,900	771	Vulture Mountains HEC-1 Results, 24 hr
73	3.100		3,200	1,032	FCD 90-05
73A (10O_1)	1.429	1,366	1,400	980	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
74	9.200		5,900	641	FCD 90-05 (Note: an assumed discharge of 3,000 cfs will be used instead due to assumed upstream split distribution of 60%/60%)
74A (10O_1+2+10P_1)	4.338		3,700	853	Area Weighted Discharge Based on Discharges at CP73 and CP74 (5900 before adjustments) in order to remain consistent with upstream and downstream HEC-1 results.
74B (10O_1+2+10P_1+2)	7.543		5,200	689	Area Weighted Discharge Based on Discharges at CP73 and CP74 (5900 before adjustments) in order to remain consistent with upstream and downstream HEC-1 results.
75 (includes 60% of 74B area)	6.252		4,700	752	752 cfs per sq mi (based on weighted avg of unit discharges from 74B & 75) in order to maintain better consistency with contributing area.
75A (10Q_1)	1.676	1,448	1,400	835	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
76A (10Q_1+2+10R_2)	3.585	2,833	2,800	781	Vulture Mountains HEC-1 Results, 24 hr
76B			3,000		From assumed Distribution at Split 15
76C			4,900		Direct addition of re-joining split (Split 6)
78	5.300		3,800	717	FCD 90-05
78A (10W_1)	1.504	1,391	1,400	931	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
78B (10W_2)	1.187	1,286	1,300	1,095	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
78C (10W_2+3)	2.428	2,421	2,400	989	Vulture Mountains HEC-1 Results, 24 hr
86	4.900		3,600	735	FCD 90-05
86A (12A_1)	4.093	3,014	3,000	733	Vulture Mountains HEC-1 Results, 24 hr
87A (12B_1)	0.639	848	800	1,252	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
88A (12A_1+2+12C_1)	5.038	3,351	3,600	715	For Consistency, Discharge Assumed to Equal 86)
88B			2,700		Direct addition of re-joining splits (Splits 2 and 3)
88C (12A_1+2+12C_1+2)	5.898	3,657	1,500	254	Vulture Mountains HEC-1 Results, 24 hr - 66% due to split left at 88C + 250 cfs for uncertainty of split at 88C)
120 (20A)	1.038	1,237	1,200	1,156	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
121 (20A+20B)	1.727	2,171	2,200	1,274	Vulture Mountains HEC-1 Results, 24 hr
122 (21A)	0.846	1,029	1,000	1,183	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
123 (21A+21B)	1.766	2,185	2,200	1,246	Vulture Mountains HEC-1 Results, 24 hr
124 (22_1+2)	1.847	1,504	1,500	812	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
124A (22_1)	1.421	1,364	1,400	985	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
125 (22A)	2.136	2,317	2,300	1,077	Vulture Mountains HEC-1 Results, 24 hr
126 (22A+B)	3.482	2,796	2,800	804	Vulture Mountains HEC-1 Results, 24 hr
127 (22A+B+C)	5.702	3,587	3,600	631	Vulture Mountains HEC-1 Results, 24 hr
128 (22A+B+C+D)	7.764	4,322	4,300	554	Vulture Mountains HEC-1 Results, 24 hr
129 (23A)	1.313	1,328	1,300	990	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
130 (24A+66% of 88C Area)	6.809	3,981	4,000	587	Vulture Mountains HEC-1 Results, 24 hr
131 (23A+B+24A+B+66% of 88C Area)	9.795	5,045	5,000	510	Vulture Mountains HEC-1 Results, 24 hr
Northwest Mountains					
8A (1H_1)	0.983	1,141	1,100	1,119	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
8B (1H_1+2)	5.040	2,948	2,900	575	Jackrabbit Wash HEC-1 Results 4<x<10sq mi, 24hr
8C (1H_1+2+3 Less 15% of 1H_1+2)	7.407	4,230	4,200	567	Jackrabbit Wash HEC-1 Results 4<x<10sq mi, 24hr
11A (1K_1)	1.493	1,387	1,400	938	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
11B (1K_1+2)	3.271	1,990	2,000	611	Jackrabbit Wash HEC-1 Results 4<x<10sq mi, 24hr
11C (1K_4)	0.624	834	800	1,283	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr

Table 4.5: Computed 100-Year Discharges

Concentration Point	Area (sq. mi.)	Calculated Q (cfs)	Rounded Q (cfs)	Unit Discharge (cfs/sq mi)	Discharge Source or Graph
11D (1K_3+4)	1.162	1,278	1,300	1,119	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
11E (1K_1+2+3+4)	4.432	2,619	2,600	587	Jackrabbit Wash HEC-1 Results 4<x<10sq mi, 24hr
19	6.000	3,468	3,500	583	Jackrabbit Wash HEC-1 Results 4<x<10sq mi, 24hr
19A (3A_1)	0.860	1,041	1,000	1,163	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
19B (3A_1+2)	1.088	1,253	1,300	1,194	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
19C (3A_1+2+3)	2.420	1,694	1,700	703	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
19D (3A_1+2+3+4)	3.370	2,043	2,000	594	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 24hr
19E (3A_5)	0.164	332	300	1,833	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
19F (3A_5+6)	1.474	1,381	1,400	950	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
Upper Jackrabbit Wash Main Stem					
1	6.700		7,400	1,104	FCD 90-05
2	12.400		9,000	726	FCD 90-05
4	16.500		8,900	539	FCD 90-05
7	23.200		8,900	384	FCD 90-05
8	30.800		11,400	370	FCD 90-05
10	37.600		13,500	359	FCD 90-05
11	45.200		13,200	292	FCD 90-05
12	79.100		18,800	238	FCD 90-05
21	102.100		21,100	207	FCD 90-05
22	105.000		20,800	198	FCD 90-05
29	18.100		5,700	315	FCD 90-05
30	24.000		5,700	238	FCD 90-05
31	26.600		5,200	195	FCD 90-05
32	134.500		21,400	159	FCD 90-05
33	138.100		21,100	153	FCD 90-05
35	3.700		3,000	811	FCD 90-05
36	8.400		3,000	357	FCD 90-05
37	148.700		19,800	133	FCD 90-05
38	319.200		33,200	104	FCD 90-05
Belmont Mountains					
6A (1F_1)	1.135	1,201	1,200	1,058	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
9A (1I_1)	1.135	1,201	1,200	1,057	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
9B (1I_2)	0.873	1,051	1,100	1,261	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
9D (1I_3)	0.362	574	600	1,656	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
9C (1I_1+2+5)	3.418	2,165	2,200	644	Belmont Mountains HEC-1 Results, 24hr
9E (1I_3+4)	1.068	1,184	1,200	1,124	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
9F (1I_1+2+3+4+5+6)	4.597	2,803	2,800	609	Belmont Mountains HEC-1 Results, 24hr
13	7.800		5,700	731	FCD 90-05
13A (2A_1)	0.985	1,143	1,100	1,116	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
13B (2A_2)	1.239	1,229	1,200	968	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
13C (2A_1+2+3)	2.837	1,851	1,900	670	Belmont Mountains HEC-1 Results, 24hr
13D (2A_4)	2.898	1,884	1,900	656	Belmont Mountains HEC-1 Results, 24hr
13E (2A_1+2+3+4+5)	6.075	3,604	3,600	593	Belmont Mountains HEC-1 Results, 24hr
13F (2A_6)	1.059	1,181	1,200	1,133	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
14A (2B_1)	0.547	762	800	1,463	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
14B (2B_2)	0.955	1,118	1,100	1,152	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
14C (2B_1+2+3)	1.825	1,383	1,400	767	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
15A (2C_1)	1.381	1,266	1,300	941	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
17A (2D_1)	0.968	1,129	1,100	1,136	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
23D (4A_1)	0.532	748	700	1,315	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
23E (4A_1+3)	0.840	1,024	1,000	1,190	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
23F (4A_2)	0.258	454	500	1,936	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
23G (4A_2+4)	0.712	914	900	1,264	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
23H (4A_1+2+3+4)	1.552	1,311	1,300	837	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
39	4.600		2,700	587	FCD 90-05
39A (9A_1)	0.587	800	800	1,362	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
40	13.100		6,500	496	FCD 90-05
40A (9B_1)	0.564	778	800	1,419	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
40B (9B_1+2)	2.006	1,431	1,400	698	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr

Table 4.5: Computed 100-Year Discharges

Concentration Point	Area (sq. mi.)	Calculated Q (cfs)	Rounded Q (cfs)	Unit Discharge (cfs/sq mi)	Discharge Source or Graph
40C (9B_3)	1.304	1,246	1,200	920	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
40D (9B_1+2+3+4)	3.619	2,274	2,300	636	Belmont Mountains HEC-1 Results, 24hr
40E (9B_1+2+3+4+5)	5.399	3,238	3,200	593	Belmont Mountains HEC-1 Results, 24hr
40F (9B_6)	0.468	684	700	1,496	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
40G (9B_6+7)	1.655	1,338	1,300	785	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
40H (9B_6+7+8)	2.491	1,663	1,700	682	Belmont Mountains HEC-1 Results, 24hr
40I (9A+9B_6+7+8+9)	7.245	4,408	4,400	607	Belmont Mountains HEC-1 Results, 24hr
41	20.500		5,900	288	FCD 90-05
41A (9C_1)	1.406	1,273	1,300	925	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
41B (9C_1+2)	3.335	2,120	2,100	630	Belmont Mountains HEC-1 Results, 24hr
42	6.200		3,800	613	FCD 90-05
42A (9D_1)	1.189	1,215	1,200	1,009	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
42B (9D_1+2)	2.417	1,623	1,600	662	Belmont Mountains HEC-1 Results, 24hr
42C (9D_1+2+3)	4.128	2,550	2,500	606	Belmont Mountains HEC-1 Results, 24hr
42D (9D_4)	1.302	1,245	1,200	922	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
42E (9D_4+5)	1.985	1,425	1,400	705	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
43	26.700		7,900	296	FCD 90-05
43A (9E_1)	0.587	800	800	1,363	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
43B (9E_1+2)	2.274	1,546	1,500	660	Belmont Mountains HEC-1 Results <6.5 SQ MI, 24hr
43C (9D+9E_1+2+3)	8.893	5,378	5,400	607	Belmont Mountains HEC-1 Results, 24hr
44	34.200		7,900	231	FCD 90-05
44A (9F_1)	1.391	1,269	1,300	935	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
45	35.500		4,100	115	FCD 90-05
46	40.300		3,900	97	FCD 90-05
47	36.000		3,400	94	FCD 90-05
48	0.800		1,200	1,500	FCD 90-05 (6hr)
49	0.100		180	1,800	FCD 90-05 (6hr)
Belmont Foothills					
3	0.800		1,500	1,875	FCD 90-05 (6hr)
5	1.100	1,233	1,200	1,091	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
6	3.100		2,300	742	FCD 90-05
7A (1E+1F_1+2+1G_1)	4.339	2,744	2,700	622	Belmont Foothills HEC-1 Results, 24hr
9	6.900		3,400	493	FCD 90-05
12A (2F_1)	1.009	1,162	1,200	1,189	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
12B (2F_1+2)	2.622	2,243	2,200	839	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
12C (C12.2)	28.000	7,916	7,900	283	FCD 90-05
14	12.100		7,600	628	FCD 90-05
15	15.900		7,600	478	FCD 90-05
16	2.100		1,600	762	FCD 90-05
16A (2E_1)	0.938	1,105	1,100	1,173	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
17	21.000		7,500	357	FCD 90-05
17B (2D-1+2)	3.055	1,707	1,700	556	Belmont Mountains HEC-1 Results, <6.5 sq mi, 6hr
18	23.100		7,700	333	FCD 90-05
23	11.500		4,300	374	FCD 90-05
23A (4B_1)	0.769	964	1,000	1,300	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
23B (4B_1+2)	2.925	2,109	2,100	718	Belmont Foothills HEC-1 Results, 24hr
23C (4B_1 +2+3)	4.054	2,622	2,600	641	Belmont Foothills HEC-1 Results, 24hr
23I (4A_1+2+3+4+5)	2.230	1,760	1,800	807	Belmont Foothills HEC-1 Results, 24hr
23J (4A_1+2+3+4+5+6)	6.188	3,478	3,500	566	Belmont Foothills HEC-1 Results, 24hr
24	14.200		5,300	373	FCD 90-05
25	119.100		21,900	184	FCD 90-05
32A (5A_1)	0.678	883	900	1,327	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
32B (5A_1+2)	4.232	2,699	2,700	638	Belmont Foothills HEC-1 Results, 24hr
32C (5B_1)	0.910	1,082	1,100	1,209	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
32D (5B_1+2)	3.398	2,331	2,300	677	Belmont Foothills HEC-1 Results, 24hr
32E (5A)	8.000	3,847	3,800	479	FCD 90-05
33A (5C_1)	0.569	783	800	1,406	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
33B (5C_1+2)	1.614	1,494	1,500	929	Belmont Foothills HEC-1 Results, 6hr
35A (6A-1)	1.370	1,386	1,400	1,022	Belmont Foothills HEC-1 Results, 6hr
35B (6A-2)	1.010	1,163	1,200	1,188	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr

Table 4.5: Computed 100-Year Discharges

Concentration Point	Area (sq. mi.)	Calculated Q (cfs)	Rounded Q (cfs)	Unit Discharge (cfs/sq mi)	Discharge Source or Graph
35C (6A_1+2+3)	2.837	2,066	2,100	740	Belmont Foothills HEC-1 Results, 24hr
39B (9A_1+2)	3.467	2,362	2,400	692	Belmont Foothills HEC-1 Results, 24hr
Piedmont					
20					
21A (3C_1)	6.847	3,423	3,400	497	Piedmont HEC-1 Results, >1 sq mi, 24hr
21B (3C_1+2+3D)	10.427		5,100	489	485 cfs per sq mi (from avg of 3C & 3D original delineation), used instead for consistent results.
26	5.200		3,600	692	FCD 90-05
27	11.300		3,400	301	FCD 90-05
27A (7A+7B_2)	5.790		4,000	691	692 CFS PER SQ MI (FROM 7A ORIGINAL DELINEATION)
27B (7B_1)	3.441	2,081	2,100	610	Piedmont HEC-1 Results, >1 sq mi, 24hr
28	6.800		3,600	529	FCD 90-05
29A (7C+7D_1)	7.631		4,000	524	529 PER SQ MI (FROM 7C ORIGINAL DELINEATION)
50	2.000		1,400	700	FCD 90-05
51	7.400		2,600	351	FCD 90-05
52	4.500		2,900	644	FCD 90-05
52A (10D_1)	1.121	1,264	1,300	1,160	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
52B (10D_1+2)	1.361	1,343	1,300	955	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
55	7.300		2,500	342	FCD 90-05
56	1.400		1,100	786	FCD 90-05 (6hr)
57	14.600		3,700	253	FCD 90-05
58	20.300		4,600	227	FCD 90-05
59	37.000		6,900	186	FCD 90-05
59B (10F+10G+10H_1) +26% of CP60	11.640	3,750	4,100	352	Piedmont Concentration Points HEC-1 Results, 24hr (For Consistency, Discharge Assumed to Equal 59A)
59C (10D_1+2+3+10E)	7.507	3,658	3,700	493	Piedmont HEC-1 Results, >1 sq mi, 24hr
59D (10D +10E+10F+10G+10H_1+2) +26% of CP60	22.300	4,843	4,800	215	Piedmont Concentration Points HEC-1 Results, 24hr
61			6900	135	
61A (10I+10J_1+2) - 26% of CP60	6.891	3,438	3,400	493	Piedmont HEC-1 Results, >1 sq mi, 24hr
61B			5,700		Direct Discharge Addition from assumed coincident peaks from 59B & Split 14
63 (63C+63D+10K_5)	12.724	5,356	5,400	424	Piedmont HEC-1 Results, >1 sq mi, 24hr
63A (10K_1)	1.120	1,264	1,300	1,161	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
63B (10K1+10K_2+46% of 10K_1+ 23% of 60C)	2.727	1,796	1,800	660	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
63C (10K1+10K_2+10K_1+23% of 60C+10K_3)	4.529	2,539	2,500	552	Piedmont HEC-1 Results, >1 sq mi, 24hr
63D (92% of CP67+10K_4)	7.083	3,507	3,500	494	Piedmont HEC-1 Results, >1 sq mi, 24hr
67	6.200		3,800	613	FCD 90-05
68	15.100		3,300	219	FCD 90-05
69	3.800		2,600	684	FCD 90-05
69A (10T_1)	1.869	1,512	1,500	803	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
69B			900		Direct Discharge Addition from Non-Attenuating Reaches (300 cfs from Split 18 and 600 cfs from Split 16)
69C			900		Direct Discharge Addition from Non-Attenuating Reaches (400 cfs from Split 16 and 500 cfs from Split 17)
70	3.900		3,200	821	FCD 90-05
70A (10S_1)	0.835	1,020	1,000	1,198	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
71	12.000		4,900	408	FCD 90-05
72	27.100		7,200	266	FCD 90-05
76	16.800		6,600	393	FCD 90-05
77	19.900		6,000	302	FCD 90-05
79 (10W+10X -45% of 10W due to split)	5.615	2,965	3,000	534	FCD 90-05 Q was 4000 cfs, revised using Piedmont HEC-1 Results, >1 sq mi, 24hr
80	31.600		8,700	275	FCD 90-05
81	58.100		10,700	184	FCD 90-05
82	119.700		13,900	116	FCD 90-05
83	1.600	1,423	1,400	875	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
84	160.600		17,600	110	FCD 90-05
84A (10AA+10AB_1)	3.376	2,053	2,100	622	Piedmont HEC-1 Results, >1 sq mi, 24hr
85	2.200		1,500	682	FCD 90-05
87 (87B+87C +12B_4)	6.983	3,472	3,500	501	Piedmont HEC-1 Results, >1 sq mi, 24hr (Was 4.8 sq mi, 2,000 cfs in FCD 90-05)
87B (12B_1+2-57% of 12B_1+45% of 78)	4.948	2,706	2,700	546	Piedmont HEC-1 Results, >1 sq mi, 24hr
87C (12B_3 +57% of 12B_1)	0.996	1,152	1,200	1,205	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
88	13.300		3,300	248	FCD 90-05
89	18.600		2,900	156	FCD 90-05
90	26.100		5,000	192	FCD 90-05
90A (12E_1)	0.780	973	1,000	1,282	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr

Table 4.5: Computed 100-Year Discharges

Concentration Point	Area (sq. mi.)	Calculated Q (cfs)	Rounded Q (cfs)	Unit Discharge (cfs/sq mi)	Discharge Source or Graph
90B (12E_1+2)	1.390	1,353	1,400	1,007	Jackrabbit Wash HEC-1 Results 1<x<4 sq mi, 6hr
91	0.900		1,600	1,778	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
92	0.100		280	2,800	FCD 90-05 (6hr)
93	0.050		90	1,800	FCD 90-05 (6hr)
132 (25A)	0.709	912	900	1,269	Jackrabbit Wash HEC-1 Results <1sq mi, 6hr
133 (25A+B)	1.435	1,368	1,400	976	Jackrabbit Wash HEC-1 Results 1<x<4sq mi, 6hr
South of CAP					
94					
95	2.095		1,500	716	FCD 90-05
95A (15A_1)	0.802		600	748	716 cfs per Square Mile (Based on Unit Discharge From CP95), in order to maintain consistency with CP95 Q100 & upstream reservoir routing.
95B (15B_1)	1.612		1,200	744	716 cfs per Square Mile (Based on Unit Discharge From CP95), in order to maintain consistency with CP95 Q100 & upstream reservoir routing.
96	367.400		33,400	91	FCD 90-05
97	369.200		33,100	90	FCD 90-05
98	372.100		32,500	87	FCD 90-05
99	28.100		3,000	107	FCD 90-05
100	2.200		1,600	727	FCD 90-05
CAP 6	2.200	115	115		FCD 90-05
CAP 7	2.200	130	130		FCD 90-05
CAP 6+7	2.200	245	245		FCD 90-05
CAP 9	0.900	210	210		FCD 90-05

4.6 References

1. Arizona Department of Transportation, Highway Drainage Design Manual, Hydrology, Research Project No. HPR-PL-1-43(281), Prepared by NBS/Lowry Engineers & Planners, Inc., & George V. Sabol Consulting Engineers, Inc., March 1993.

2. Burgess & Niple, Inc., February 1991, Jackrabbit Wash Floodplain Delineation Study: Hydrology, Volumes 1 and 2, FCD 90-05, Prepared for the Flood Control District of Maricopa County.

3. Burgess & Niple, Inc., July, 1991, Jackrabbit Wash Floodplain Delineation Study, Contract Amendment Number One: Hydrologic Model Sensitivity Analyses, FCD 90-05, Prepared for the Flood Control District of Maricopa County.

4. Flood Control District of Maricopa County, December, 2000, Digital Orthophotography, 2' pixels.

5. Kimley-Horn and Associates, Inc., April, 2000, Douglas Ranch Master Drainage Study, Onsite Drainage Area Map, Scale: 1"=2000', CI=10'.

6. Kimley-Horn and Associates, Inc., April, 2000, Douglas Ranch Master Drainage Study, Existing Onsite Floodway/Floodplain Map, Scale: 1"=2000', CI=10'.

7. Pope, G. L., Rigasna, P. D., and Smith, C. F., 1998, Statistical Summaries of Streamflow Data and Characteristics for Selected Streamflow-Gaging Stations in Arizona Through Water Year 1996: U.S. Geological Survey, Water Resources Investigations Report 98-4225: Tucson, Arizona, 907 p.

8. Stanley Consultants, Inc., April, 1994, Powerline Wash and Tank Wash Flood Delineation Study, FCD 92-09, Prepared for the Flood Control District of Maricopa County.

9. Sverdrup Corporation, September 9, 1991, Location Plan for Site Drainage, Scale: 1"=1000', CI=2'.

10. Sverdrup Corporation, September 9, 1991, Toyota Arizona Proving Ground Drainage Subarea Boundaries and Concentration Points, Scale: 1"=2000', CI=20'

11. Thomas, B.E., Hjalmarson, H.W., Waltemeyer, S.D., 1994, Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States: U.S. Geological Survey, Open-File Report 93-419.

12. U.S. Geological Survey, May 4, 1997, Aerial Photograph, Roll 9873, Frame 13.

13. U.S. Geological Survey, May 24, 1997, Aerial Photographs, Roll 9877, Frames 27-28, 30-34, 47-57, 74-85, 100-111, 125-135, 150-159.

14. U.S. Geological Survey, May 31, 1997, Aerial Photographs, Roll 9883, Frames 12-20, 39-47, 67-74.

15. U.S. Geological Survey, June 29, 1997, Aerial Photographs, Roll 9898, Frames 20-22.

16. U.S. Geological Survey, Provisional 1989, 7.5 Minute Series (Topographic), Belmont Mountain quadrangle, Scale: 1"=2000', CI=40'.

17. U.S. Geological Survey, Provisional 1988, 7.5 Minute Series (Topographic), quadrangles include Daggs Tank and Wagner Wash Well, Scale: 1"=2000', CI=20'.

18. U.S. Geological Survey, Provisional 1989, 7.5 Minute Series (Topographic), Star Well quadrangle, Scale: 1"=2000', CI=10'.

19. U.S. Geological Survey, Provisional 1990, 7.5 Minute Series (Topographic), quadrangles include Outlaw Hill, Forepaugh Peak, Aguila, and Wickenburg SW, Scale: 1"=2000', CI=20'/10'.

20. U.S. Geological Survey, Provisional 1990, 7.5 Minute Series (Topographic), quadrangles include Vulture Mine, Wildcat Well, Flatiron Mountain, and Hot Rock Mountain, Scale: 1"=2000', CI=20'.

21. U.S. Geological Survey, Provisional 1990, 7.5 Minute Series (Topographic), quadrangles include Tiger Well and Black Butte, Scale: 1"=2000', CI=40'/20'.

22. U.S. Geological Survey, Provisional 1990, 7.5 Minute Series (Topographic), quadrangles include Vulture Peak, Little Horn Peak, and Hummingbird Spring, Scale: 1"=2000', CI=40'.

23. U.S. Geological Survey, 1964, Photoinspected 1978, 7.5 Minute Series (Topographic), Wickenburg quadrangle: 1"=2000', CI=20'/10'.

SECTION 5: HYDRAULIC ANALYSIS

5.1 Method Description

Manning's equation was applied to representative cross sections to determine the hydraulic characteristic of the adjacent river reach. Cross section spacing depends on the variability of the channel geometry along the study reach. On average, the cross section spacing is approximately 1700 feet. The U.S. Army Corp of Engineers HEC-RAS v. 3.0.1 was used to perform step-backwater profile calculations. Administrative floodways were developed using encroachment method 4 (equal conveyance encroachment) and encroachment method 1 as necessary.

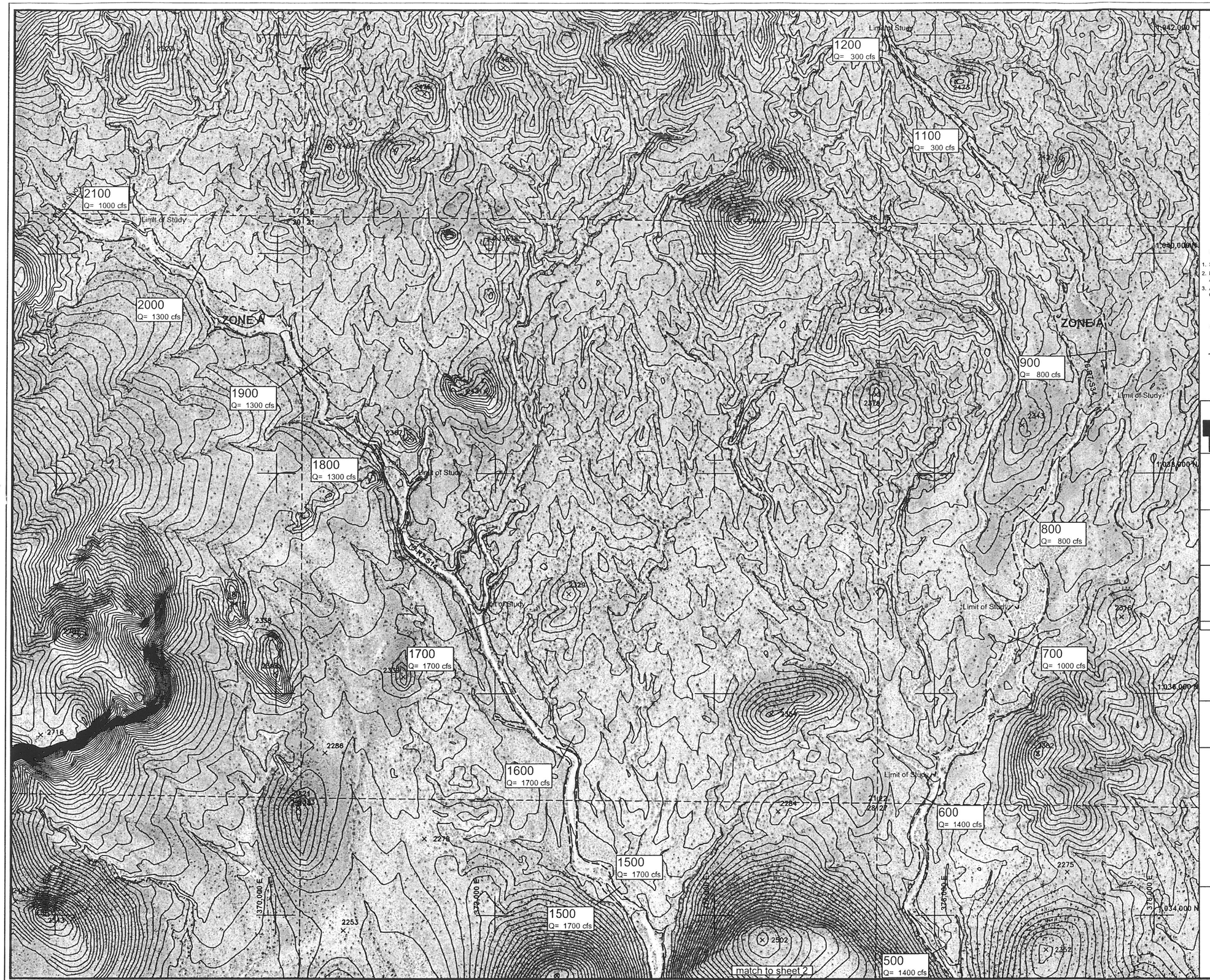
Cross section data were collected from the base map using various software tools available in AutoCAD Land Development Desktop Version 2. The base map used included that described in Section 5.2 (below).

An emphasis was placed on interpretation of surficial geology observed from the aerial base mapping and during field visits. Additionally, low-flow channel geometry was estimated using the aerial base as a guide, along with field visits and the survey data described in Section 3.1 of this Technical Data Notebook.

5.2 Work Study Maps

The Zone A delineation for Upper Daggs Wash and tributaries, Hassayampa River Tributaries and Jackrabbit Wash Tributaries is presented on a 1"=400', 10' contour interval base map with attendant orthographic aerial photography (see reference 4 of Chapter 4). The work study maps are presented with this Technical Data Notebook (TDN) on 47-24"x36" sheets. Also included are a general location map and a sheet index map. Reduced-scale copies of the work study maps are included at the end of this section. The full-size sheets are contained in Volumes 4 and 5 of the TDN.

The work study maps include cross-section locations, floodplain boundaries, zone designations, road names, a coordinate grid, section lines, corporate boundaries and stream names/numbers.



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION: ZONE A
- CORPORATE LIMITS: Corporate Limits
- COUNTY BOUNDARY: County Boundary
- ELEVATION REFERENCE MARK: AJ3618

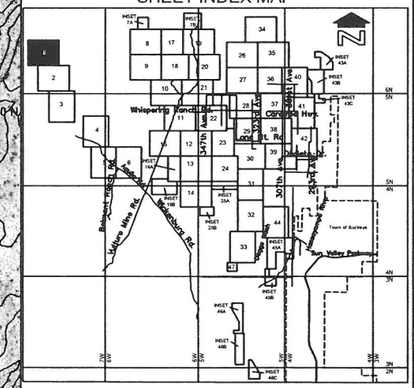
NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.28

ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3618	4LN3 (GDACS)	1040082.78	371932.23	2409.60

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

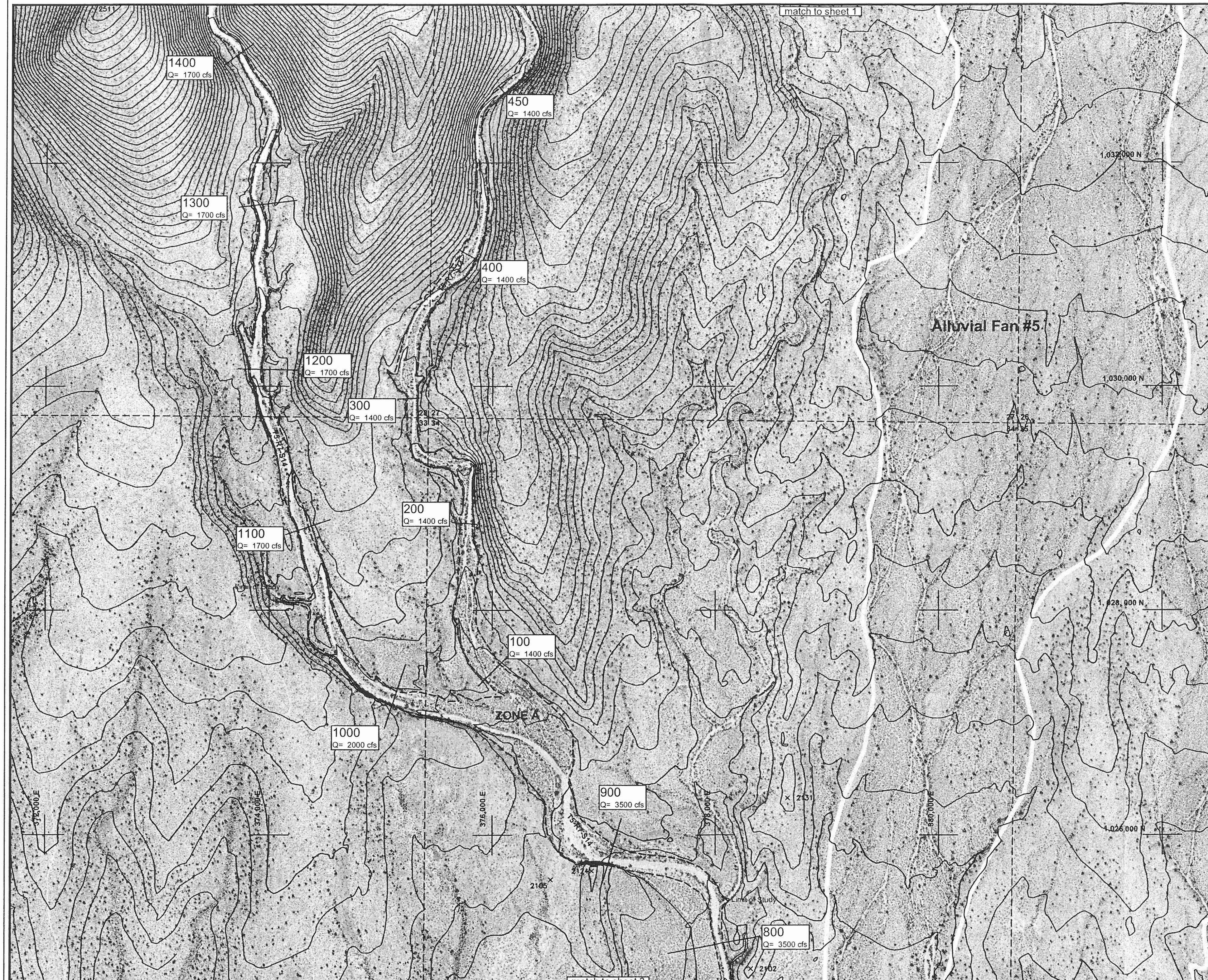
APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
Civil Engineers
Flood Hydrology
Land Development
(602) 335-8500
ARGUS CONSULTING

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

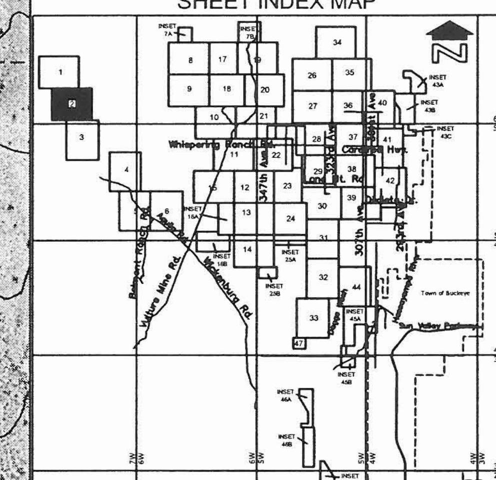
100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.24

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA - 480-752-2124

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES

ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, LLC

SHEET 2 OF 47

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

LEGEND

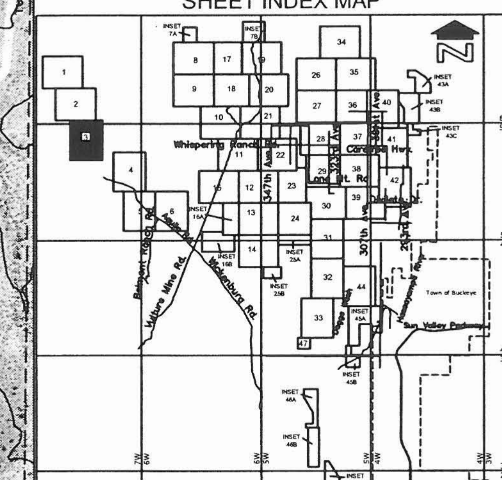
100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.19

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES

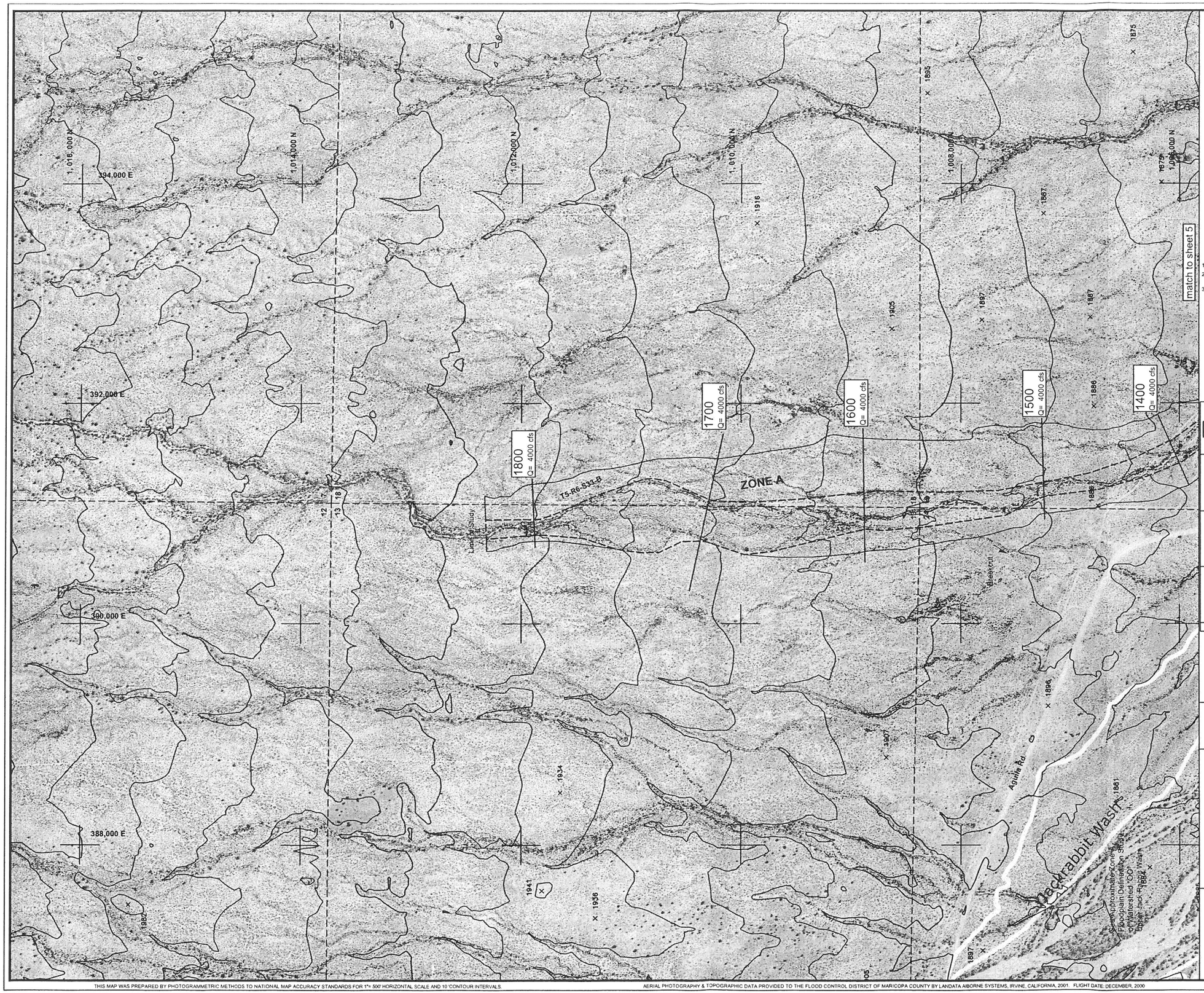
ARGUS CONSULTING

SHEET 3 OF 47

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
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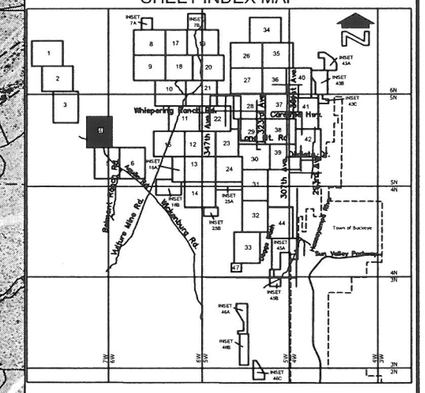
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.16

ELEVATION REFERENCE MARKS

SHEET INDEX MAP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Cotton Ln.
Watson Rd.
Miller Rd.
Sundance Rd.
Town of Buckeye
Sun Valley Parkway
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match to sheet 6

match to sheet 4

ZONE A

Limit of Study

75-R6-S30

75-R6-S33-B

Agua Fria

Belmont Ranch Rd.

Jackrabbit Wash

See Approximate Zone A Floodplain Delineation Study of Watershed "OO" - Upper Jack Rabbit Wash

100 Q= 2100 cfs

200 Q= 2100 cfs

300 Q= 2100 cfs

400 Q= 2100 cfs

800 Q= 3400 cfs

900 Q= 3400 cfs

1000 Q= 4000 cfs

1100 Q= 4000 cfs

1200 Q= 4000 cfs

1300 Q= 4000 cfs

1002,000 N

1000,000 N

998,000 N

996,000 E

398,000 E

394,000 E

392,000 E

390,000 E

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION ZONE A
- CORPORATE LIMITS Corporate Limits
- COUNTY BOUNDARY County Boundary
- ELEVATION REFERENCE MARK AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.12

ELEVATION REFERENCE MARKS

SHEET INDEX MAP

SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

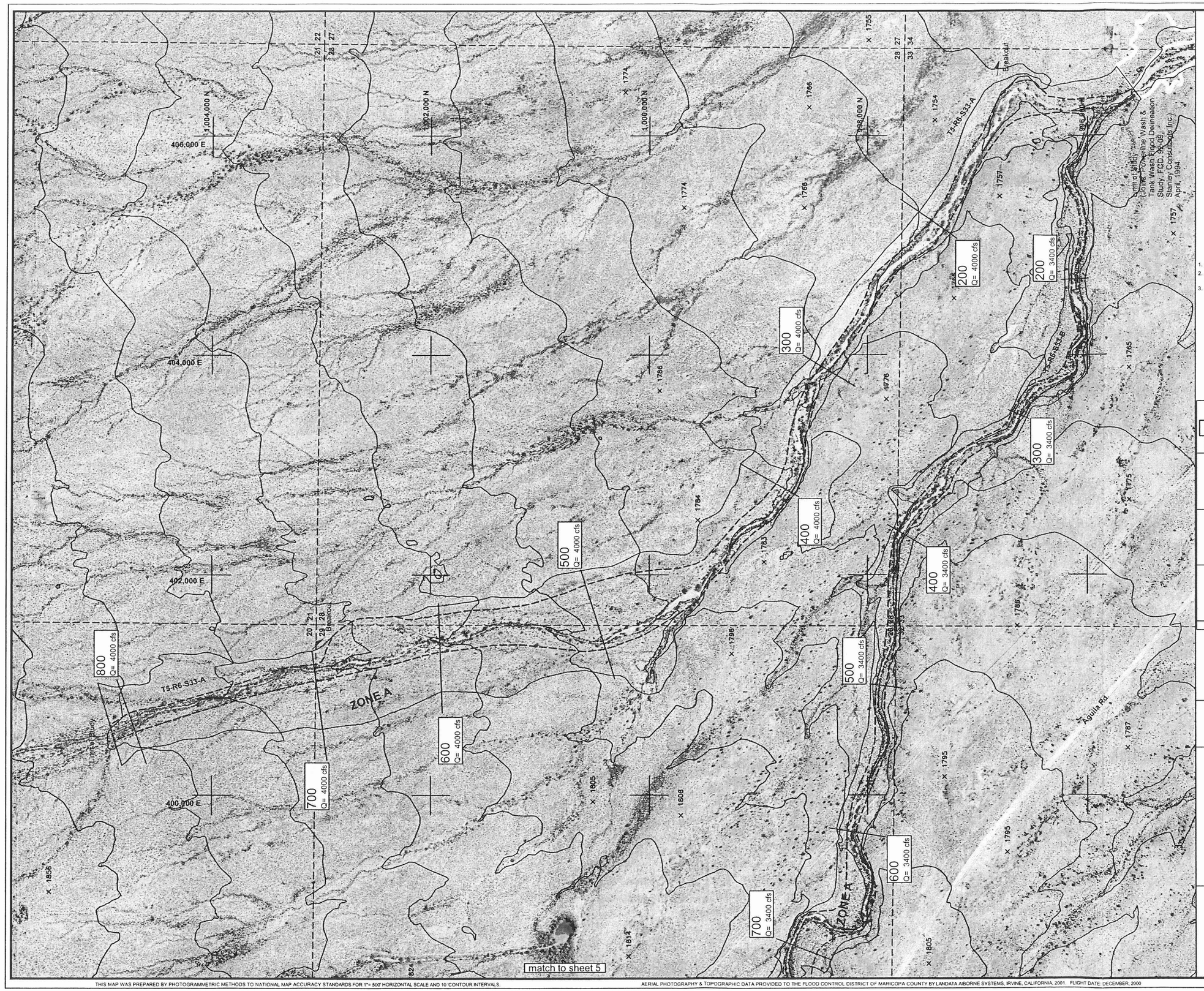
APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION: ZONE A
- CORPORATE LIMITS: Corporate Limits
- COUNTY BOUNDARY: County Boundary
- ELEVATION REFERENCE MARK: AJ3618

NOTES

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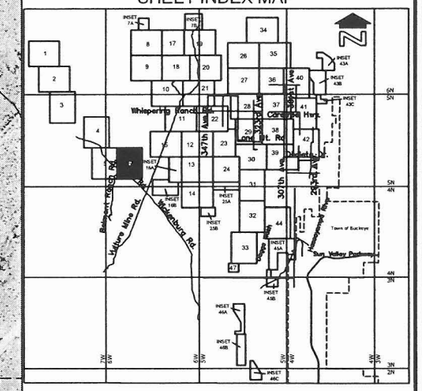
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

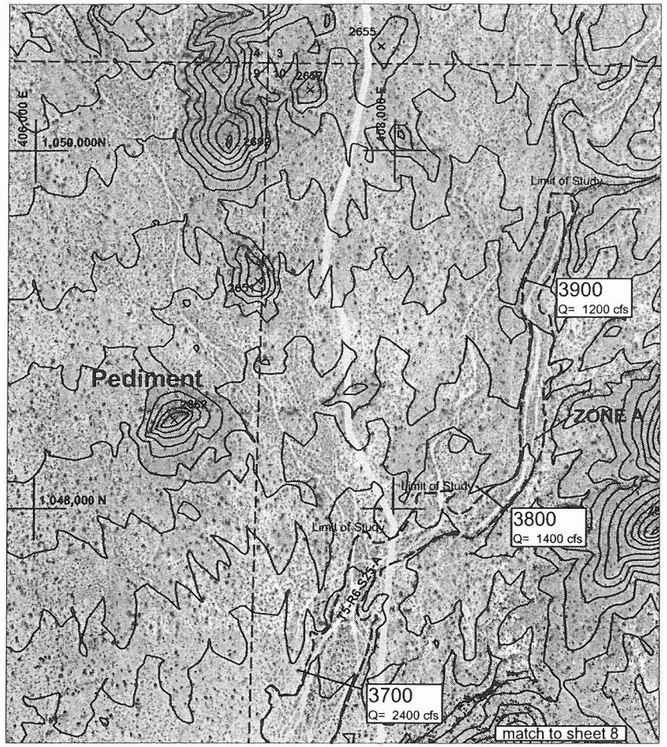
APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES Civil Engineers Water Resources Land Surveyors (602) 335-8500
ARGUS CONSULTING

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

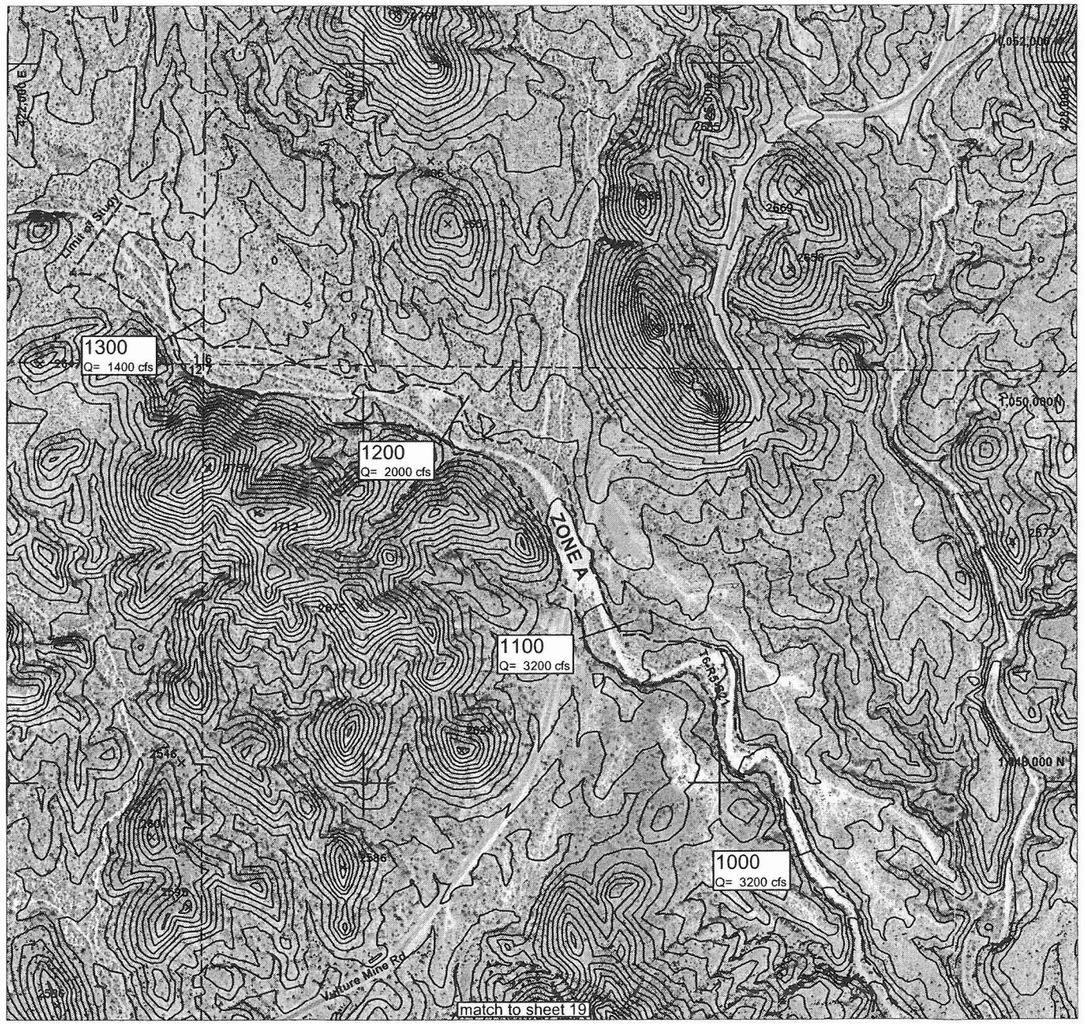
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001 FLIGHT DATE: DECEMBER, 2000

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



INSET 7A

INSET 7B



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
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- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION: ZONE A
- CORPORATE LIMITS: Corporate Limits
- COUNTY BOUNDARY: County Boundary
- ELEVATION REFERENCE MARK: AJ3618

NOTES

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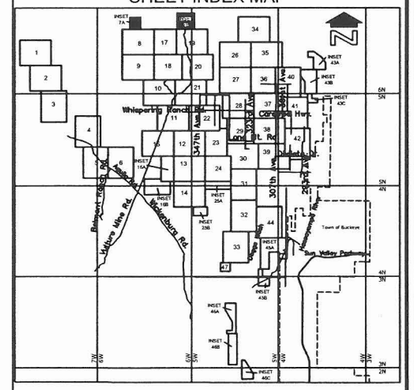
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: 7A: NGVD 29 = NAVD 88 - 2.33
   7B: NGVD 29 = NAVD 88 - 2.32

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 335-8500
ARGUS CONSULTING

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

match to sheet 7A

ZONE A

3600
Q= 2400 cfs

3500
Q= 2400 cfs

3400
Q= 2400 cfs

3300
Q= 2400 cfs

3200
Q= 2400 cfs

3100
Q= 2400 cfs

3000
Q= 2400 cfs

500
Q= 1100 cfs

400
Q= 1100 cfs

300
Q= 1300 cfs

200
Q= 2000 cfs

100
Q= 2400 cfs

Limit of Study

Pediment

15-R6-S25

15-R6-S22

404,000 E

406,000 E

410,000 E

1,046,000 N

1,044,000 N

1,042,000 N

1,840,000 N

1,838,000 N

match to sheet 9

match to sheet 11

AJ3617

LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

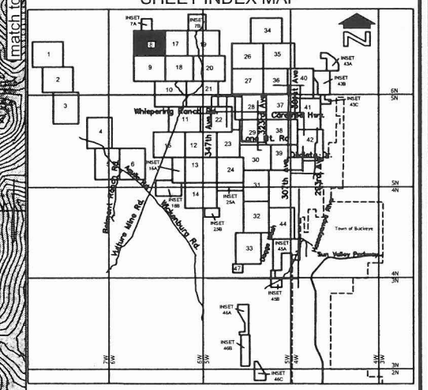
NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.28

ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3617	4LL3 (GDACS)	1041393.65	405155.84	2449.68

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA - 480-752-2124
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Hydrologists
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ARGUS CONSULTING

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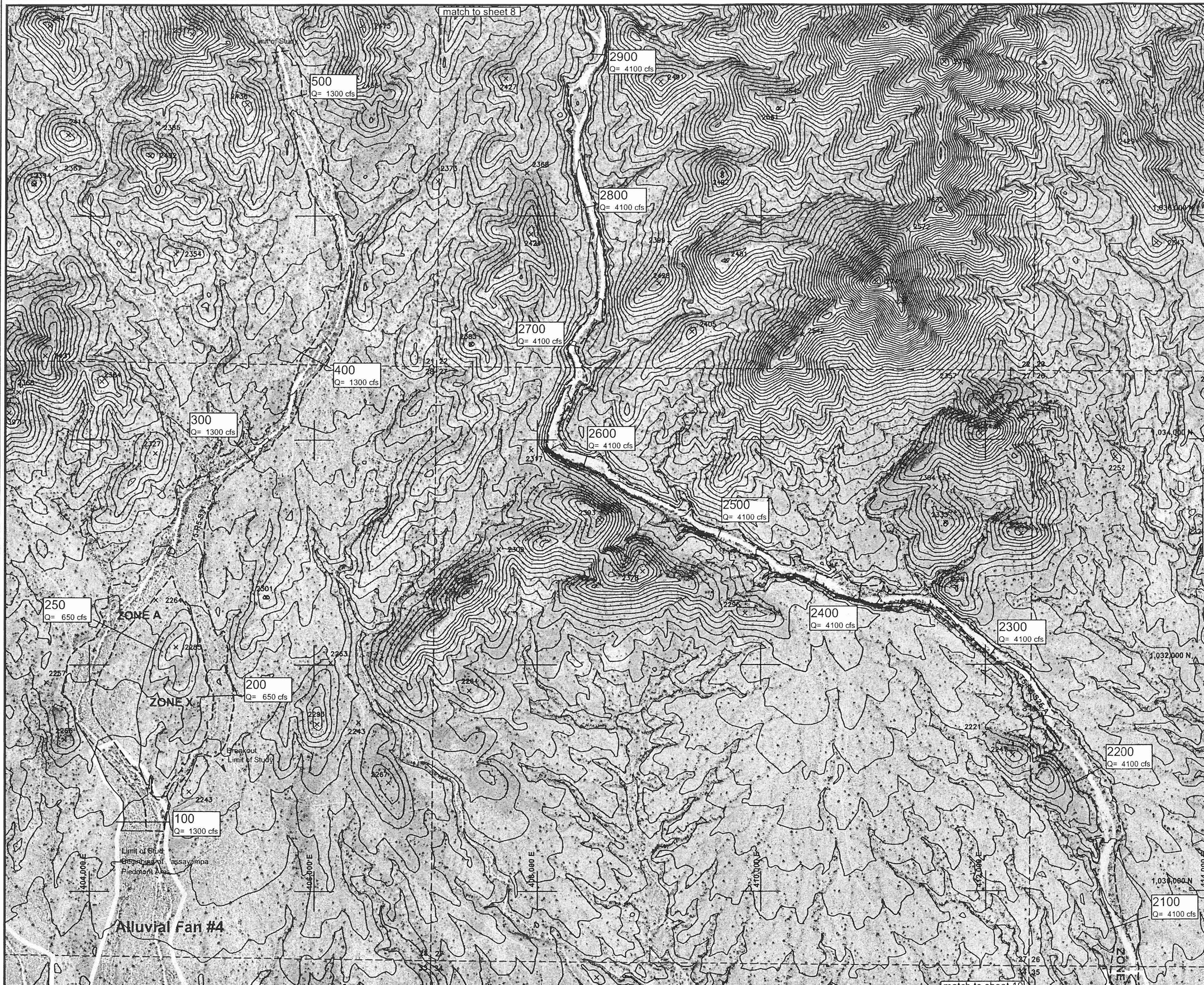
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

100-YR FLOODPLAIN BOUNDARY
100-YR ADMINISTRATIVE FLOODWAY
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
SECTION BOUNDARY
CROSS SECTION — 800 Q= 4000 cfs
ZONE DESIGNATION — ZONE A
CORPORATE LIMITS — Corporate Limits
COUNTY BOUNDARY — County Boundary
ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
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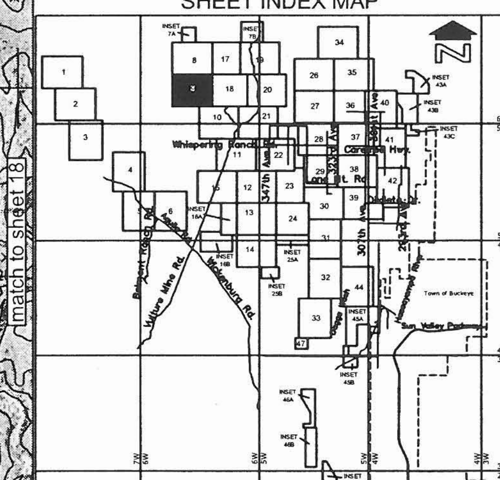
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
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APRIL, 2003

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TEMPE, ARIZONA - 480-752-2124
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WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

SHEET 9 OF 47

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

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

match to sheet 9

match to sheet 18

2050
Q= 4100 cfs

2025
Q= 4100 cfs

Breakout
Limit of Study

412,000 E

416,000 E

420,000 E

1,028,000 N

1,026,000 N

1,024,000 N

1,022,000 N

15 RGS35A

Alluvial Fan #3

1900
Q= 4100 cfs

1800
Q= 4100 cfs

1700
Q= 4100 cfs

1600
Q= 4100 cfs

1500
Q= 4100 cfs

1450
Q= 4100 cfs

1400
Q= 4100 cfs

3700
Q= 3100 cfs

3600
Q= 3100 cfs

3500
Q= 3100 cfs

3400
Q= 3300 cfs

3300
Q= 3300 cfs

3200
Q= 3500 cfs

3100
Q= 3500 cfs

ZONE A

ZONE X

Vulture Mine Rd.

Yuma Ranch Rd.

Breakout

match to sheet 21

match to sheet 11

LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

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ELEVATION REFERENCE MARKS

SHEET INDEX MAP

SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
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ARGUS CONSULTING

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

match to sheet 10

match to sheet 21

match to sheet 22

match to sheet 15

match to sheet 12

400
Q= 700 cfs

1400
Q= 4100 cfs

3000
Q= 3500 cfs

300
Q= 700 cfs

1300
Q= 3400 cfs

1275
Q= 3400 cfs

400
Q= 1400 cfs

2900
Q= 3500 cfs

800
Q= 2000 cfs

800
Q= 1800 cfs

700
Q= 2000 cfs

2800
Q= 1700 cfs

1200
Q= 200 cfs0

300
Q= 1400 cfs

200
Q= 700 cfs

600
Q= 2000 cfs

2700
Q= 1700 cfs

700
Q= 1800 cfs

1100
Q= 200 cfs0

200
Q= 1400 cfs

100
Q= 700 cfs

2600
Q= 1700 cfs

500
Q= 2000 cfs

1000
Q= 200 cfs0

600
Q= 1800 cfs

900
Q= 200 cfs0

2500
Q= 2400 cfs

100
Q= 1400 cfs

400
Q= 2000 cfs

500
Q= 1800 cfs

2400
Q= 800 cfs

300
Q= 3000 cfs

800
Q= 200 cfs0

2300
Q= 800 cfs

400
Q= 1800 cfs

300
Q= 2000 cfs

700
Q= 200 cfs0

200
Q= 3000 cfs

200
Q= 2000 cfs

ZONE A

ZONE X

Breakout

Breakout Limits of Study

1,020,000 N

1,018,000 N

1,016,000 N

1,014,000 N

1,012,000 N

416,000 E

418,000 E

420,000 E

422,000 E

424,000 E

426,000 E

T4-R6-S5

T5-R6-S12B

T5-R6-S12A

T5-R6-S18

T4-R6-S7B

T5-R6-S13

T5-R5-S7

Whispering Ranch Rd.

Olsen Rd.

Pain Wagon Tr.

Smokehouse Tr.

Dove Valley Rd.

Vulture Mine Rd.

1973

1932

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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ELEVATION REFERENCE MARKS

SHEET INDEX MAP

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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
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2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-3134
IN ASSOCIATION WITH
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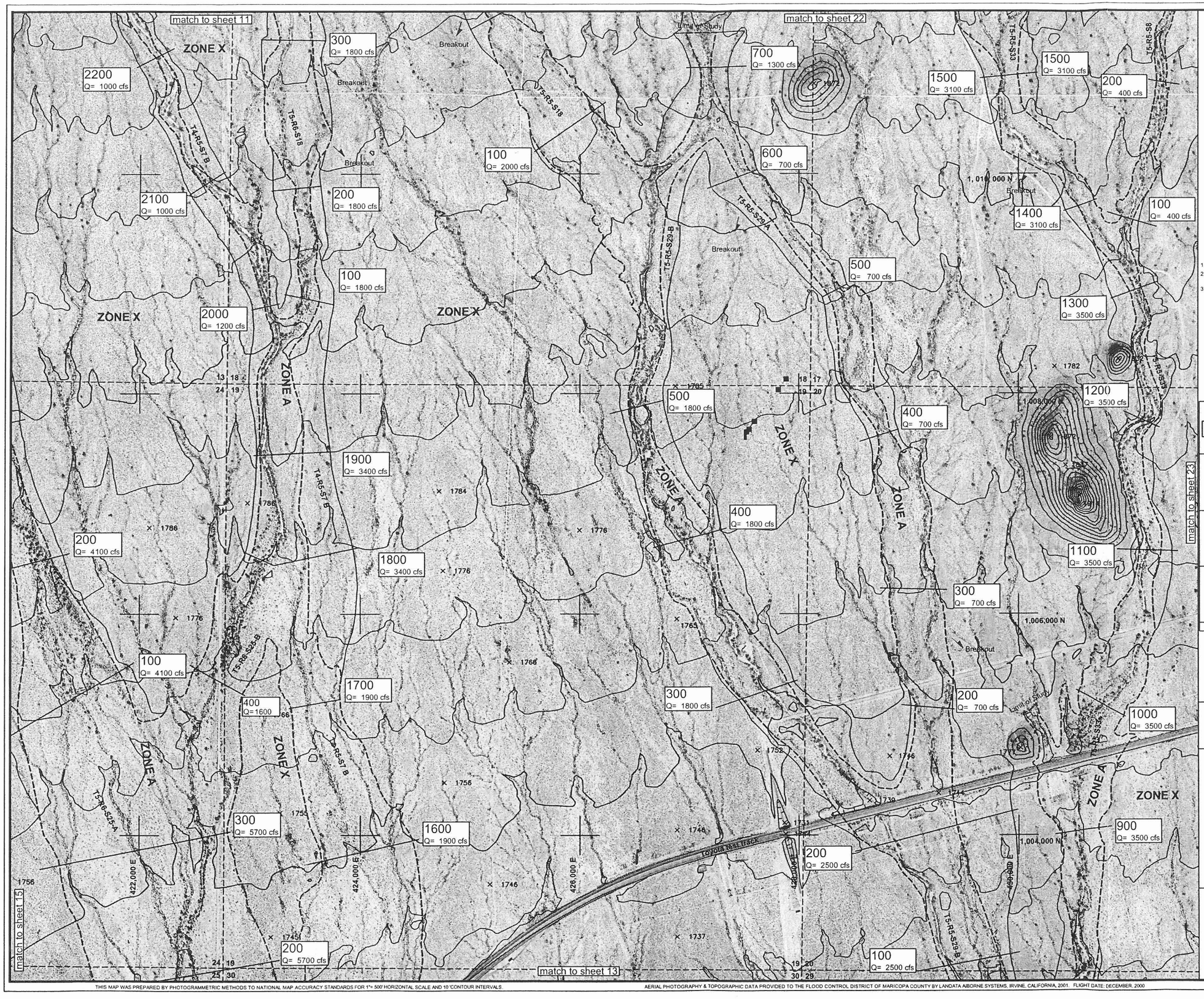
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
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NOTES

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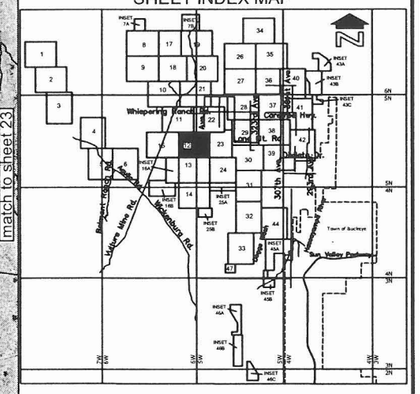
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

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& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

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

match to sheet 16A

match to sheet 12

200
Q= 5700 cfs

800
Q= 3500 cfs

700
Q= 5400 cfs

600
Q= 5400 cfs

1300
Q= 7600 cfs

500
Q= 5400 cfs

400
Q= 5400 cfs

1100
Q= 7600 cfs

600
Q= 4100 cfs

500
Q= 4100 cfs

ZONE A

ZONE X

Breakout

T4-R5-S7 B

T5-R5-S33

T4R5S7 A

T4R5S7 B

T4R6S1

422,000 E

424,000 E

426,000 E

428,000 E

430,000 E

1,002,000 N

1,000,000 N

998,000 N

996,000 N

994,000 N

match to sheet 24

match to sheet 14

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
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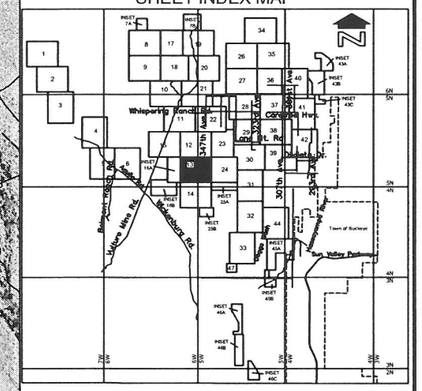
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2134
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ARGUS CONSULTING

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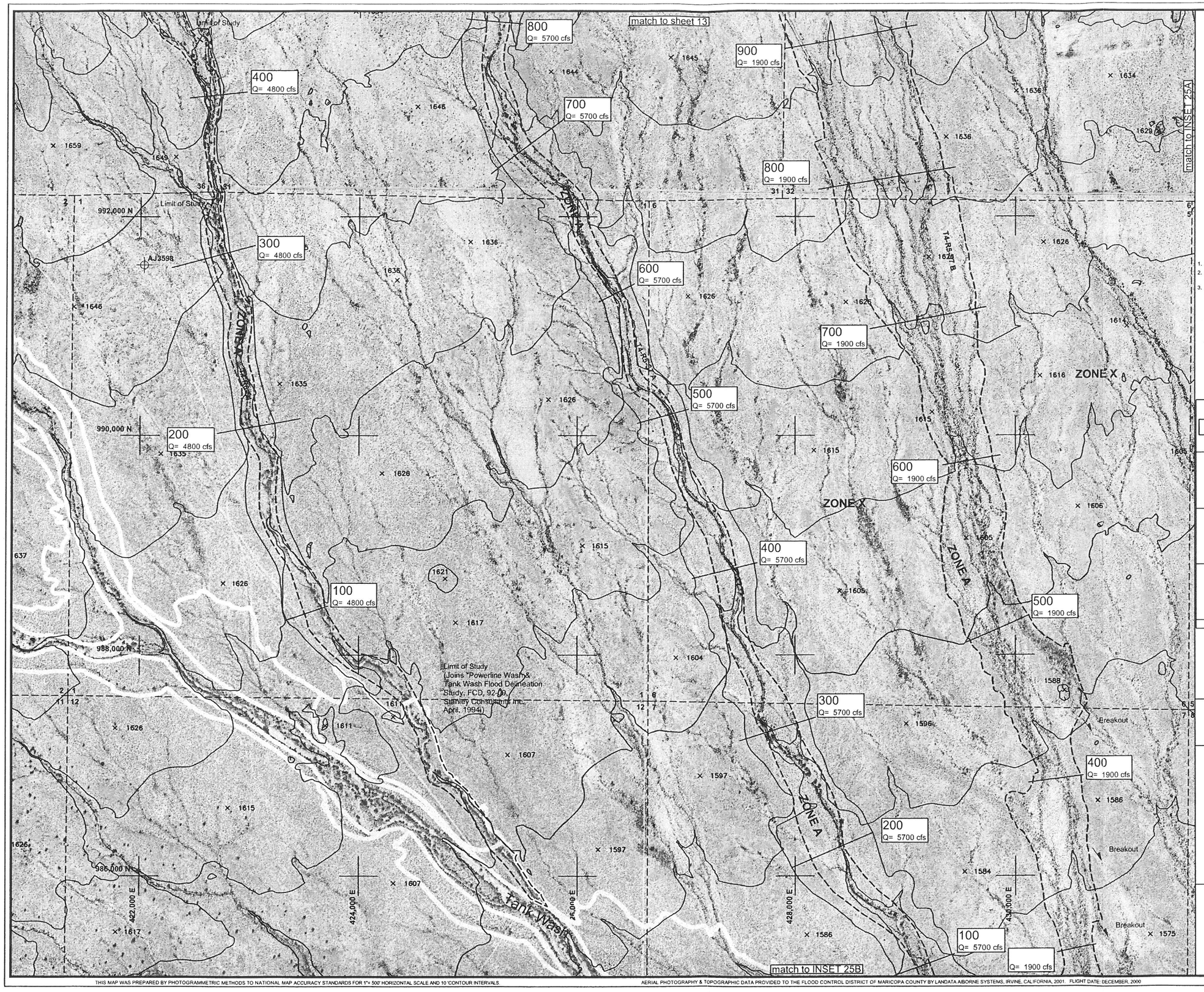
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
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- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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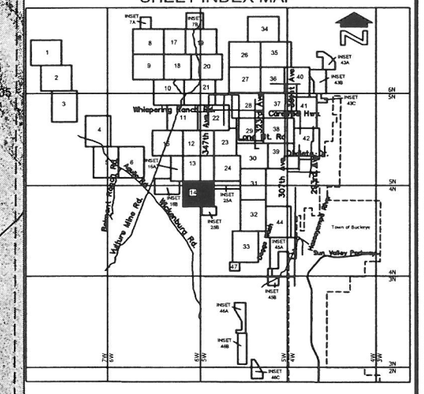
ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3598	41K2 (GDACS)	991563.33	422036.01	1644.29

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
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APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
Civil Engineers
Water Resources
Flood Hazards
(602) 335-8500
ARGUS CONSULTING
A CITY IN MOTION ADVISORY COMPANY, L.L.C.
Scottsdale, Arizona 480-766-1777

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AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

match to sheet 11

600
Q= 200 cfs0

ZONE X

ZONE A

100
Q= 3000 cfs
Breakout

500
Q= 200 cfs0

Breakout

ZONE X

1,010,000 N

1837

Vulture Mine Rd

1500
Q= 3700 cfs

Start of Study

1835

1836

15 14
22 23

1,008,000 N

1400
Q= 3700 cfs

1826

ZONE A

Harquahala Valley Canal

400
Q= 4100 cfs

13
24

300
Q= 4100 cfs

1795

1822

1816

1816

1300
Q= 3700 cfs

1797

Breakout

200
Q= 4100 cfs

1,006,000 N

1806

1805

1785

1795

1200
Q= 3700 cfs

100
Q= 4100 cfs

Breakout

1786

1765

1786

1,004,000 N

1785

412,000 E

414,000 E

416,000 E

418,000 E

420,000 E

1775

1765

1100
Q= 3700 cfs

1763

1774

1758

22 23
27 26

23 24
26 25

match to sheet 12

match to INSET 16A

LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

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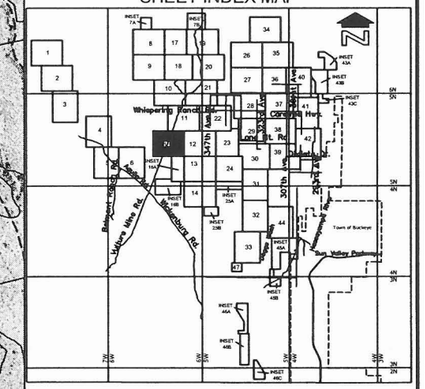
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA - 480-752-2124

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
602 955-8580

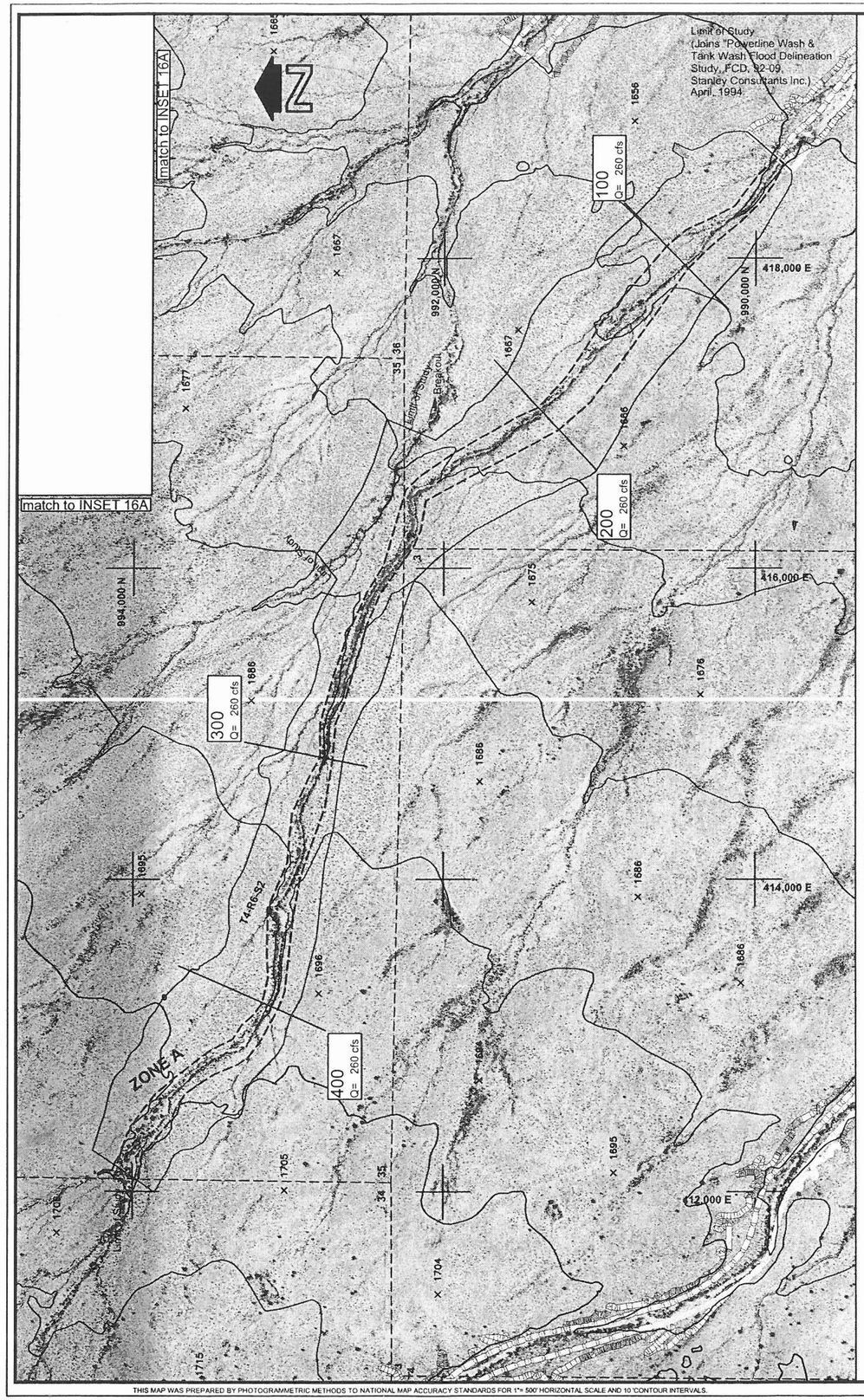
ARGUS CONSULTING
A CIVIL ENVIRONMENT COMPANY, L.L.C.
Scottsdale, Arizona 480-994-1111

SHEET 15 OF 47

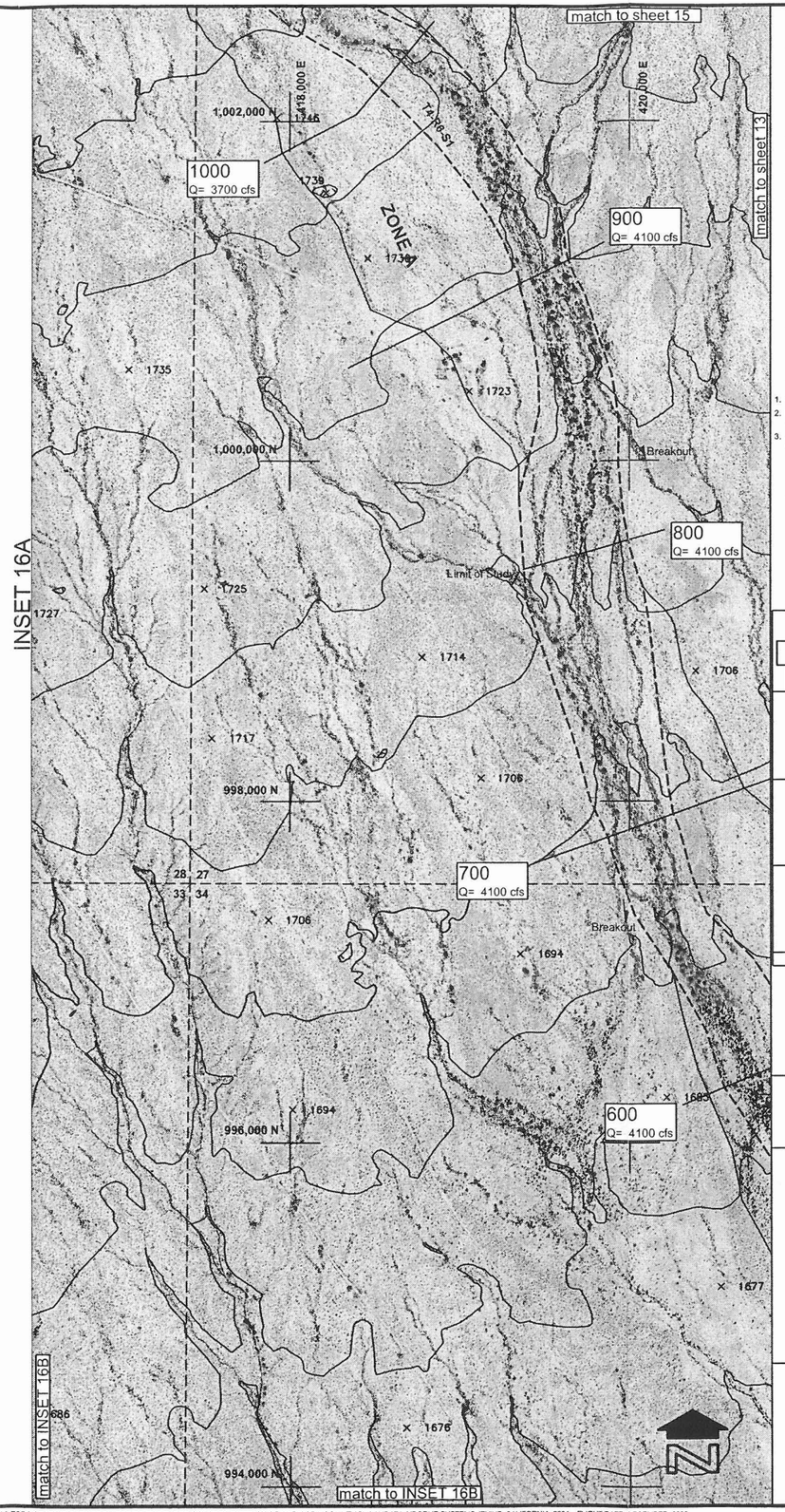
THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



INSET 16B



INSET 16A

LEGEND

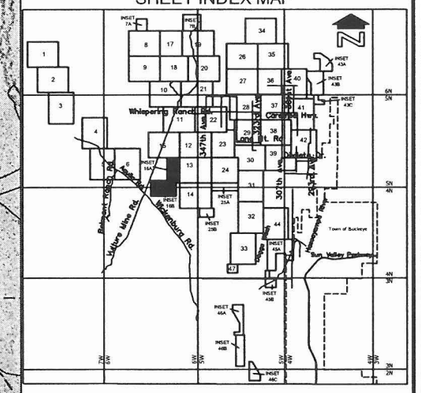
- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: 16A: NGVD 29 = NAVD 88 - 2.08; 16B: NGVD 29 = NAVD 88 - 2.08

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

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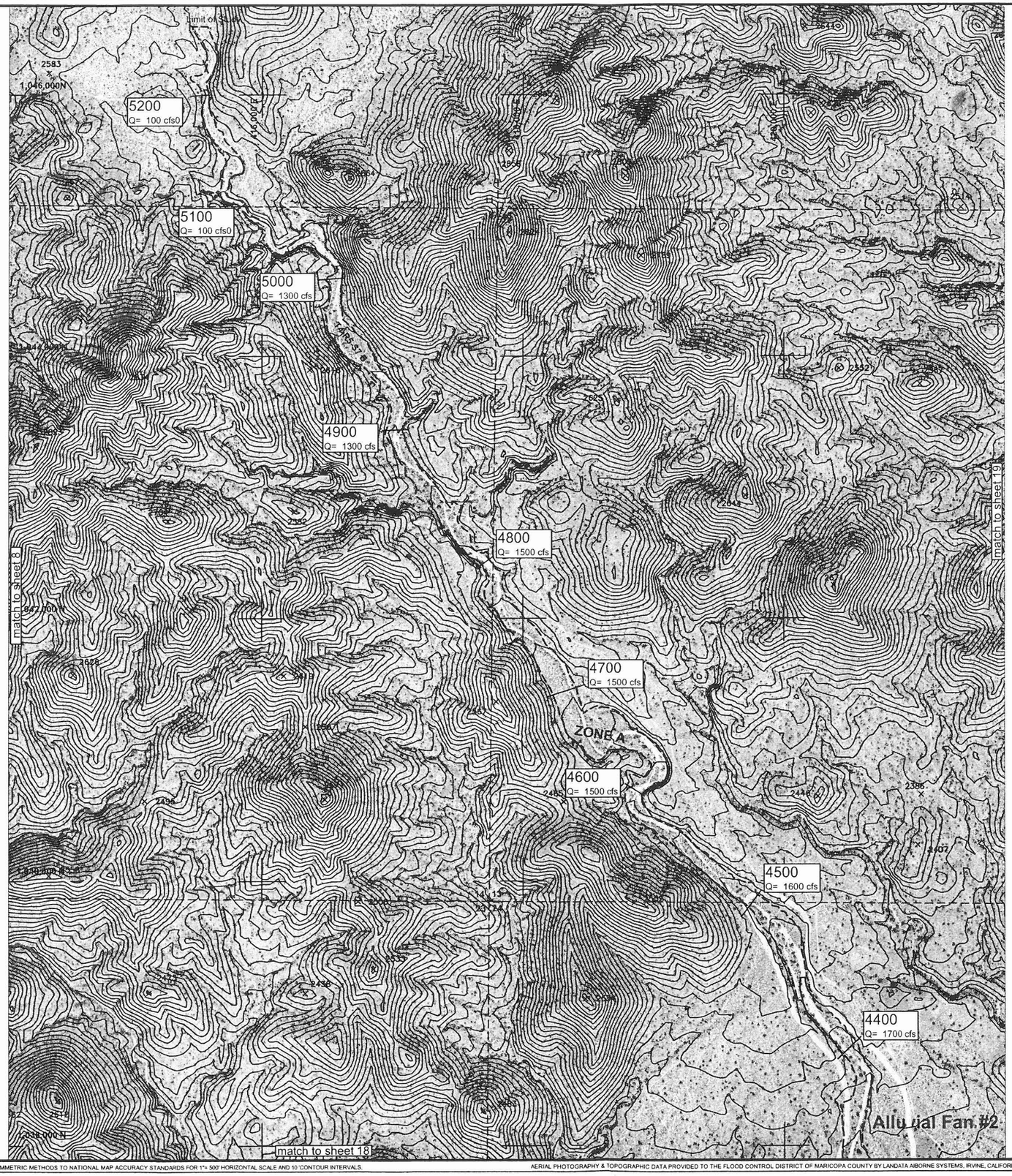
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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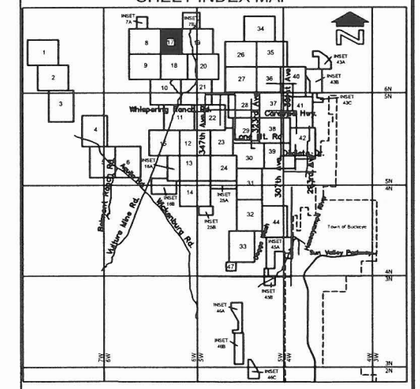
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.28

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

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HYDROLOGY & GEOMORPHOLOGY, INC.
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Civil Engineers
Hydrologists
Land Surveyors
(602) 955-6566
ARGUS CONSULTING
CIVIL ENGINEERING COMPANY, L.L.C.

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AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

match to sheet 17

match to sheet 19

match to sheet 20

match to sheet 9

match to sheet 10

match to sheet 21

4300
Q= 1700 cfs

500
Q= 100 cfs0

400
Q= 100 cfs0

300
Q= 1200 cfs

200
Q= 1400 cfs

100
Q= 2200 cfs

2100
Q= 2200 cfs

4200
Q= 2200 cfs

2000
Q= 500 cfs

4100
Q= 2200 cfs

1900
Q= 500 cfs

4000
Q= 2800 cfs

1800
Q= 500 cfs

3900
Q= 2800 cfs

1700
Q= 500 cfs

3800
Q= 2800 cfs

1600
Q= 500 cfs

ZONE A

ZONE X

Alluvial Fan #2

Breakout

Limit of Study

1,034,000 N

1,032,000 N

1,030,000 N

416,000 E

418,000 E

420,000 E

422,000 E

T4S R5 S 18

T4S R5 S 7

T4S R5 S 8

T4S R5 S 17

T4S R5 S 16

T4S R5 S 15

T4S R5 S 14

T4S R5 S 13

T3S R5 S 18

T3S R5 S 7

T3S R5 S 8

T3S R5 S 17

T3S R5 S 16

T3S R5 S 15

T3S R5 S 14

T3S R5 S 13

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

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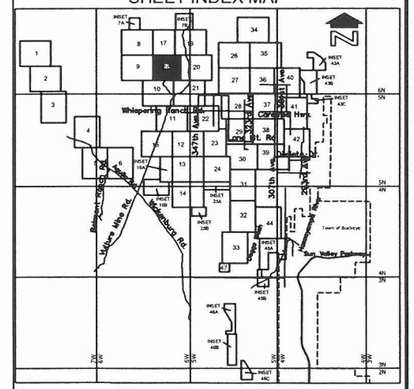
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

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Hydrologists
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(602) 335-8500

ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, L.L.C.

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

match to sheet 7B

match to sheet 11

match to sheet 18

match to sheet 20

900
Q= 3200 cfs

800
Q= 3700 cfs

700
Q= 4400 cfs

600
Q= 4400 cfs

500
Q= 4400 cfs

400
Q= 4400 cfs

4000
Q= 2400 cfs

3900
Q= 2400 cfs

3800
Q= 2400 cfs

ZONE A

Future Mingus Rd

Upper Jackrabbit Wash

Alluvial Fan #1

22,000 E

130,000 E

1,045,000 N

1,043,000 N

1,041,000 N

1,039,000 N

1,037,000 N

LEGEND

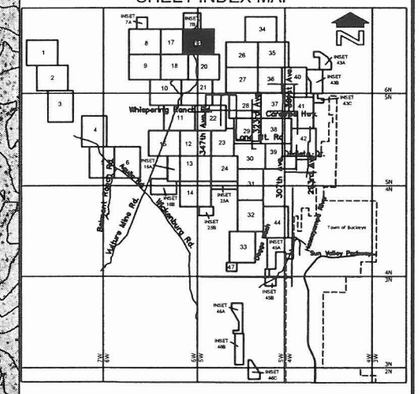
100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.26

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA 480-752-2124
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GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

match to sheet 19

match to sheet 18

match to sheet 21

3700
Q= 2400 cfs

3600
Q= 2400 cfs

3500
Q= 2400 cfs

3400
Q= 2400 cfs

3300
Q= 2400 cfs

3200
Q= 2400 cfs

3100
Q= 2400 cfs

3000
Q= 2900 cfs

300
Q= 4400 cfs

200
Q= 4400 cfs

100
Q= 5200 cfs

TR R5S24

ZONE A

Beginning of Special Piedmont Flood Hazard Zone

Alluvial Fan #1

Vulture Mine Rd.

1036,000 N

1034,000 N

1032,000 N

424,000 E

426,000 E

428,000 E

430,000 E

432,000 E

434,000 E

LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.21

ELEVATION REFERENCE MARKS

SHEET INDEX MAP

SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

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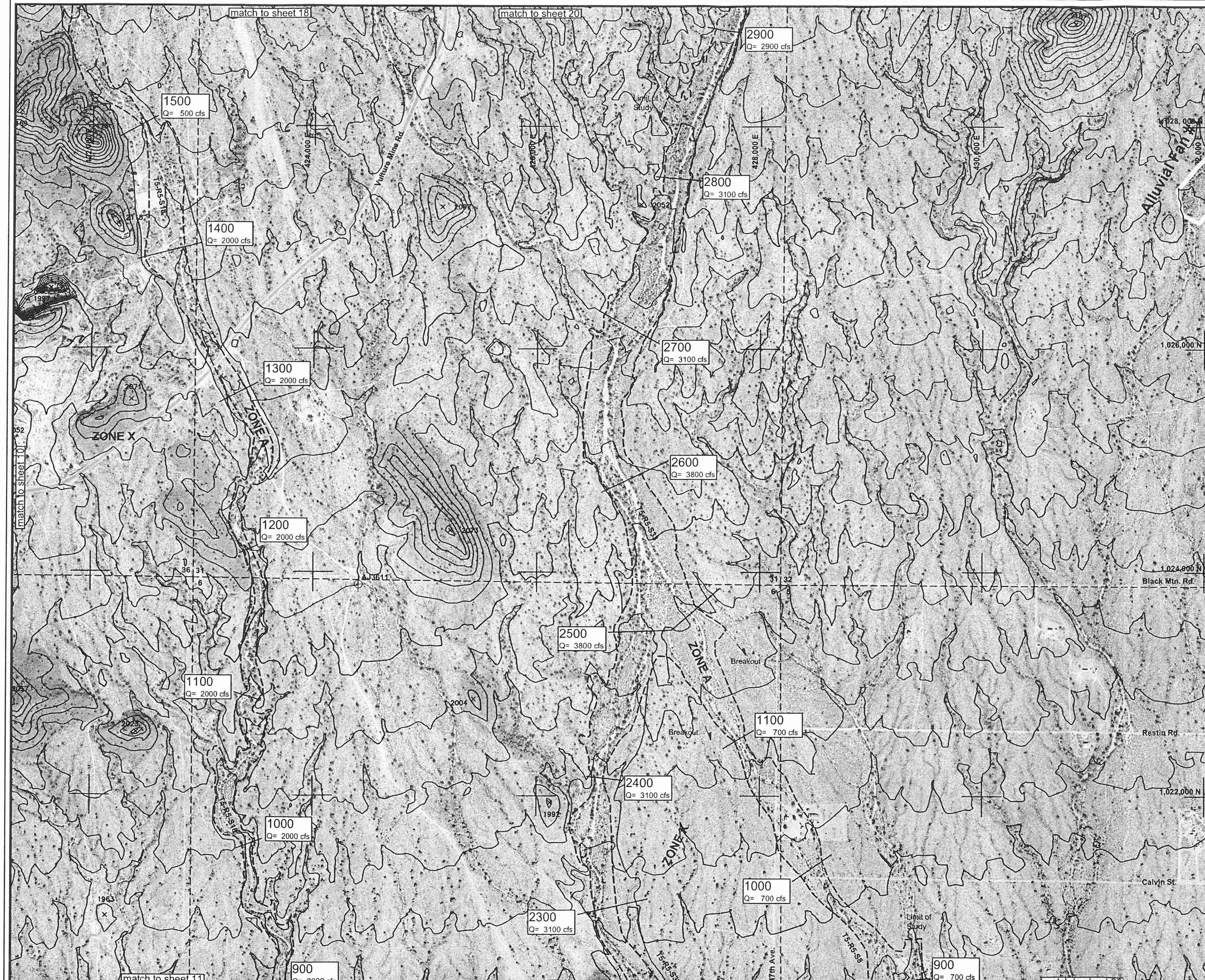

LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

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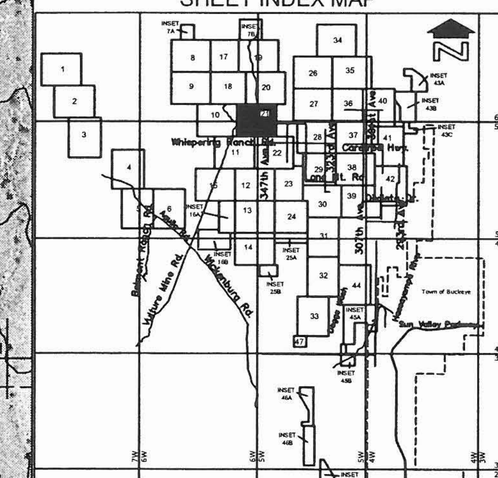
ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3611	4KK2 (GDACS)	1023891.29	424409.49	2009.25

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

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(JACKRABBIT WASH)
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HASSAYAMPA RIVER TRIBUTARIES
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APRIL, 2003

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

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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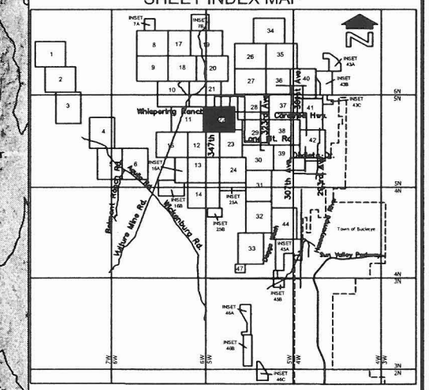
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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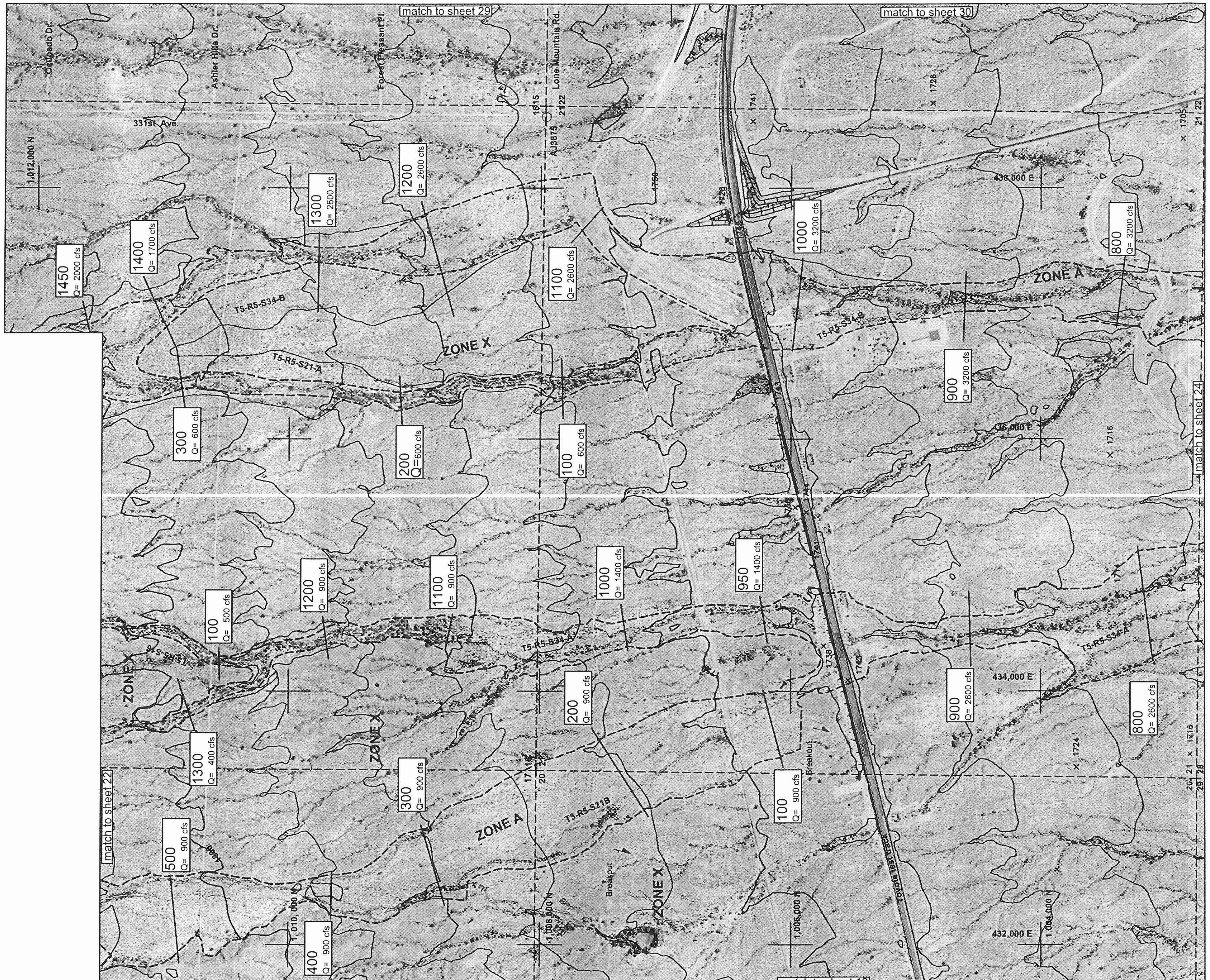

LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

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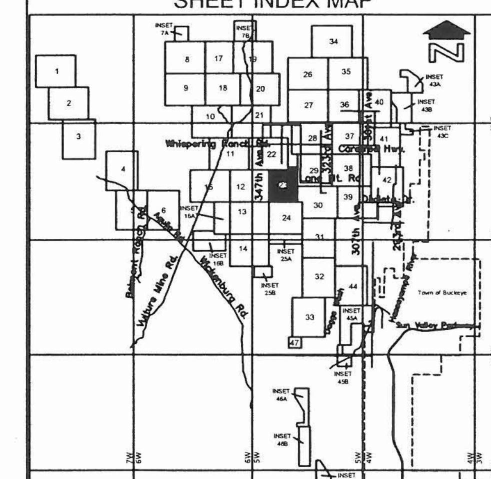
ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3875	4JJ2 (GDACS)	1007963.60	438567.35	1756.35

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

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

match to sheet 23

match to sheet 13

match to sheet 30

match to sheet 31

match to INSET 25A

700
Q= 2600 cfs

700
Q= 3200 cfs

600
Q= 2600 cfs

600
Q= 3200 cfs

500
Q= 2600 cfs

500
Q= 3200 cfs

400
Q= 2600 cfs

400
Q= 3200 cfs

300
Q= 3200 cfs

200
Q= 3200 cfs

100
Q= 3200 cfs

500
Q= 5400 cfs

400
Q= 5400 cfs

300
Q= 5400 cfs

200
Q= 2600 cfs

100
Q= 5400 cfs

100
Q= 2600 cfs

ZONE X

ZONE A

Breakout

Toyota test track

T5-R5-S34A

T5-R5-S34B

T5-R5-S33

1,002,000 N

1,000,000 N

998,000 N

996,000 N

994,000 N

434,000 E

436,000 E

438,000 E

440,000 E

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.04

ELEVATION REFERENCE MARKS

SHEET INDEX MAP

SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

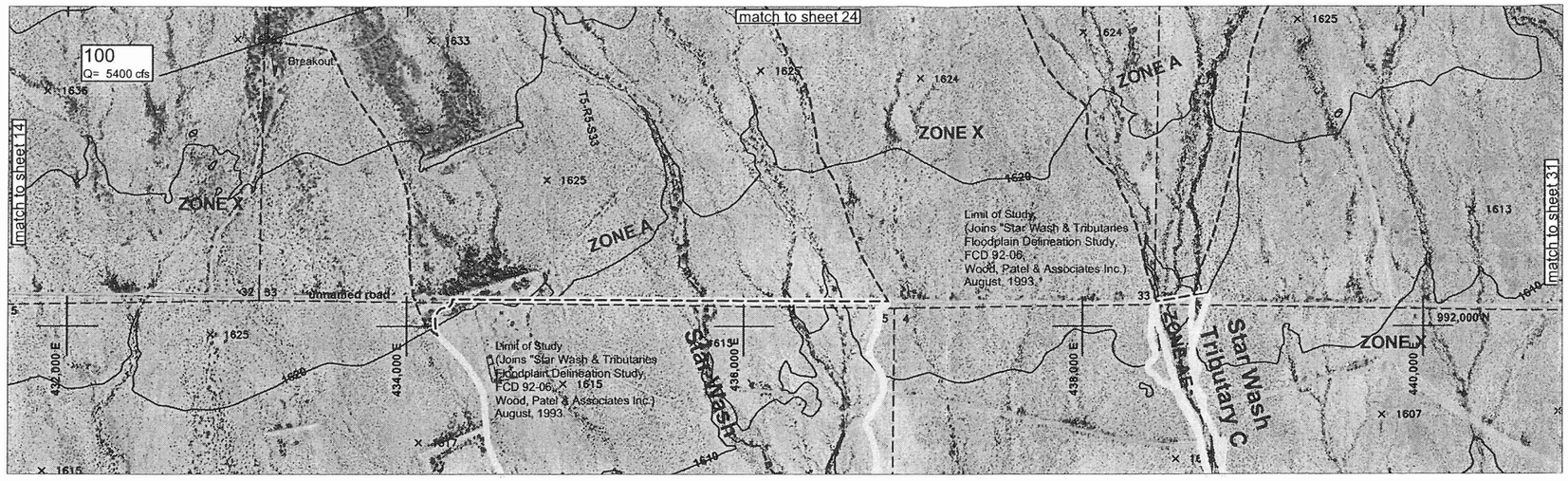
JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA - 480-752-3124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

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

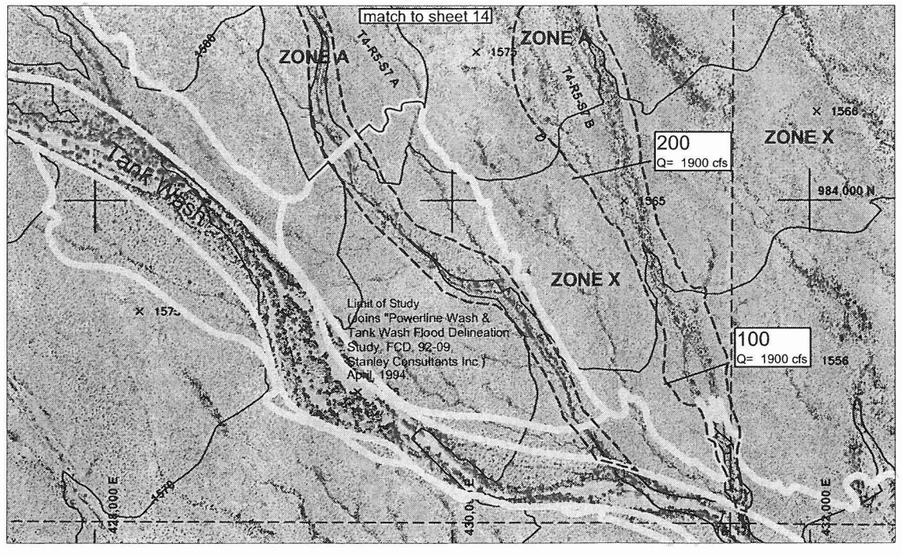
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

INSET 25A



INSET 25B



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
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- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
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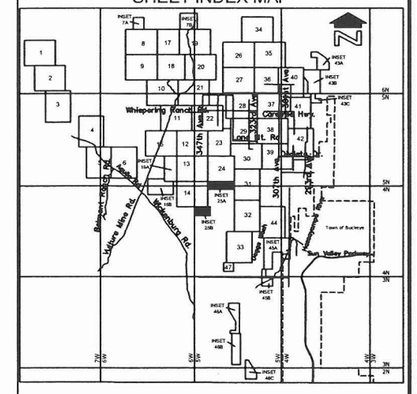
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: 25A: NGVD 29 = NAVD 88 - 2.04
   25B: NGVD 29 = NAVD 88 - 2.03

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480/752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 955-2500
ARGUS CONSULTING

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

match to sheet 34

match to sheet 35

match to sheet 27

1,042,000 N

1,040,000 N

1,038,000 N

1,036,000 N

1,034,000 N

1,032,000 N

440,000 E

442,000 E

444,000 E

446,000 E

Limit of Study

ZONE A

700
Q= 1400 cfs

600
Q= 1400 cfs

500
Q= 1400 cfs

400
Q= 1400 cfs

300
Q= 1400 cfs

200
Q= 1400 cfs

2100
Q= 1300 cfs

2000
Q= 1300 cfs

1900
Q= 1300 cfs

1800
Q= 1300 cfs

AJ3891

AJ3618

15 14
22 23

21 22
28 27

16 15
21 22

T4S R5E

T4S R5.5E

2198

2274

2128

2215

2218

2198

2167

2143

2521

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

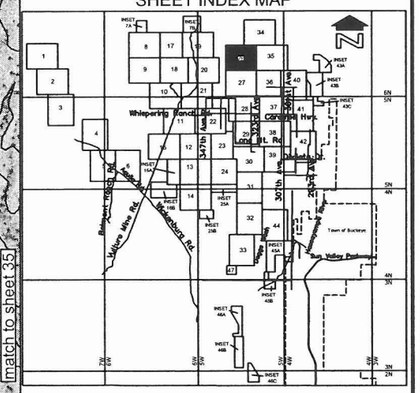
NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.19

ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3891	4LJ2 (GDACS)	1039591.15	443936.42	2188.79

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

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TEMPE, ARIZONA - 480-752-3134
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WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 335-8500
ARGUS CONSULTING
CIVIL ENVIRONMENTAL CONSULTANTS, L.L.C.

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AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

match to sheet 26

match to sheet 36

match to sheet 28

1,032,000 N

1,030,000 N

1,028,000 N

1,026,000 N

438,000 E

440,000 E

442,000 E

444,000 E

446,000 E

AJ3890

AJ3618

Alluvial Fan #2

ZONE A

ZONE X

Limit of Study

Breakout Limit of Study

100 Q= 1400 cfs

1700 Q= 1300 cfs

1900 Q= 1400 cfs

1800 Q= 1400 cfs

1700 Q= 300 cfs0

1600 Q= 4700 cfs

1600 Q= 3800 cfs

1500 Q= 2600 cfs

1500 Q= 3800 cfs

900 Q= 2100 cfs

1450 Q= 3800 cfs

1400 Q= 2600 cfs

800 Q= 2100 cfs

2100 Q= 300 cfs

T5-R5-S25-B

T5-R5-S24-B

T5-R5-S34-C

T5-R5-S10-A

T5-R5-S35

T5-R5-S26

T5-R5-S23-B

T5-R5-S22-B

T5-R5-S27-B

T5-R5-S35

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
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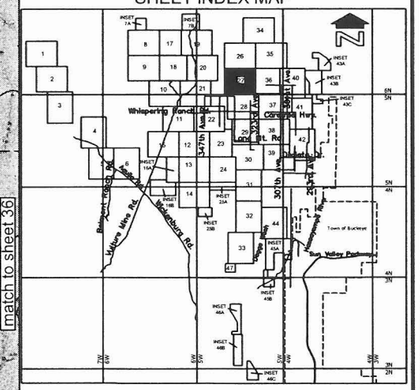
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.15

ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3890	4KJ2 (GDACS)	1028100.87	441793.27	2006.09

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(520) 322-0200

ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, L.L.C.
Scottsdale, Arizona (480) 796-1777

SHEET 27 OF 47

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

LEGEND

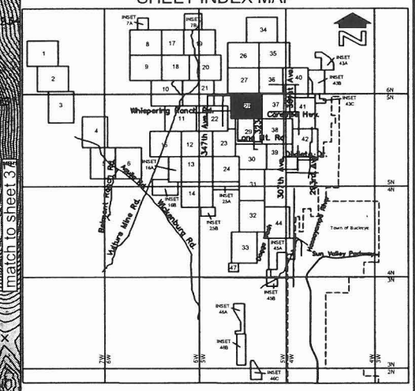
- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.11

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

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TEMPE, ARIZONA - 480-752-2124
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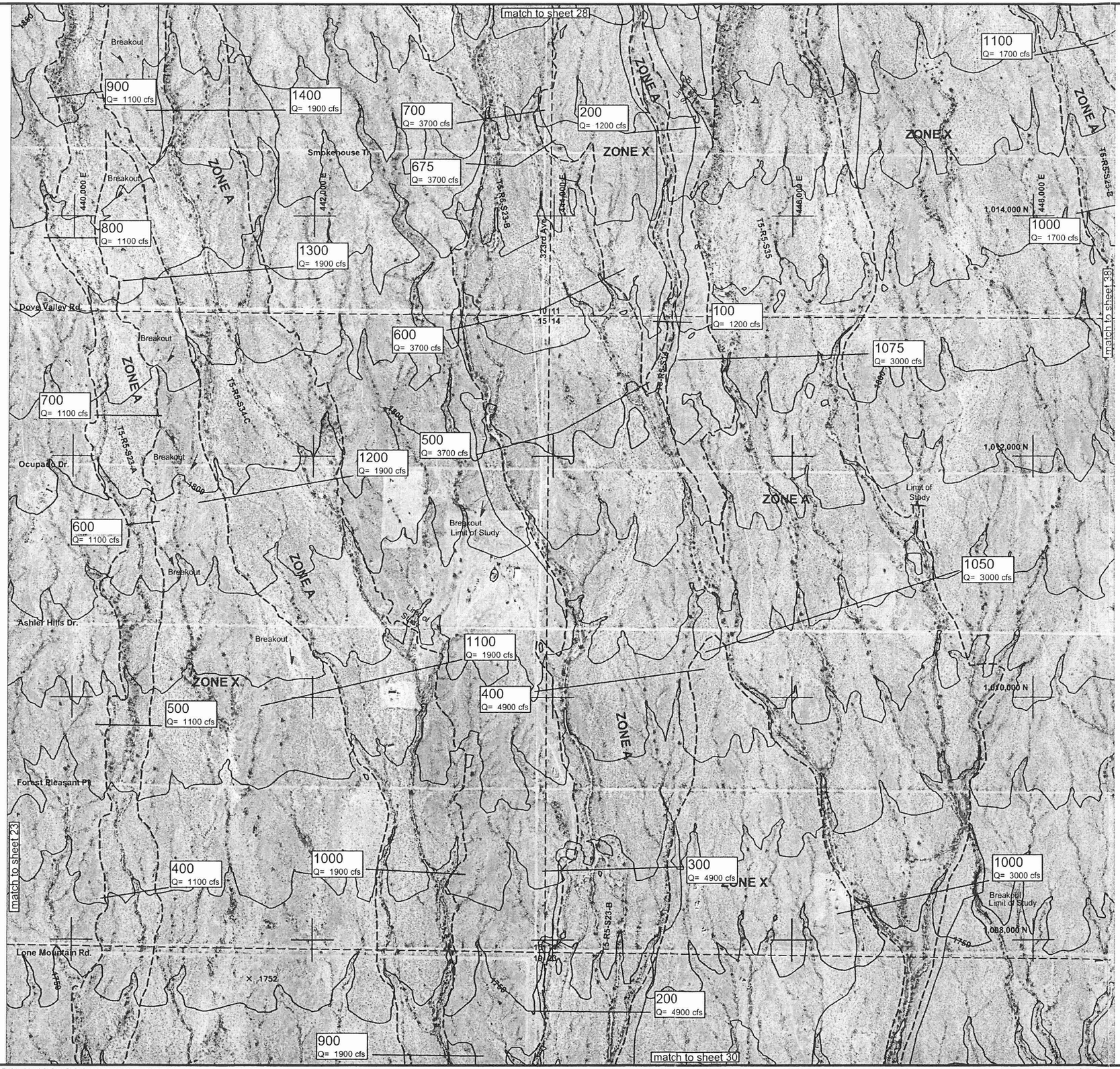
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
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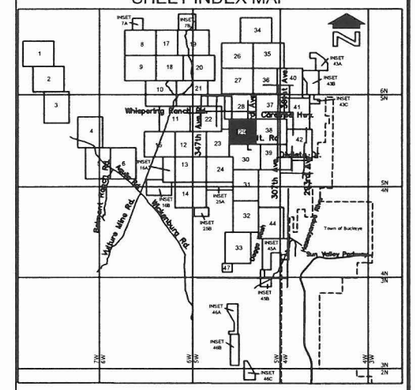
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
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2000CO19

HASSAYAMPA RIVER TRIBUTARIES
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APRIL, 2003

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ARGUS CONSULTING

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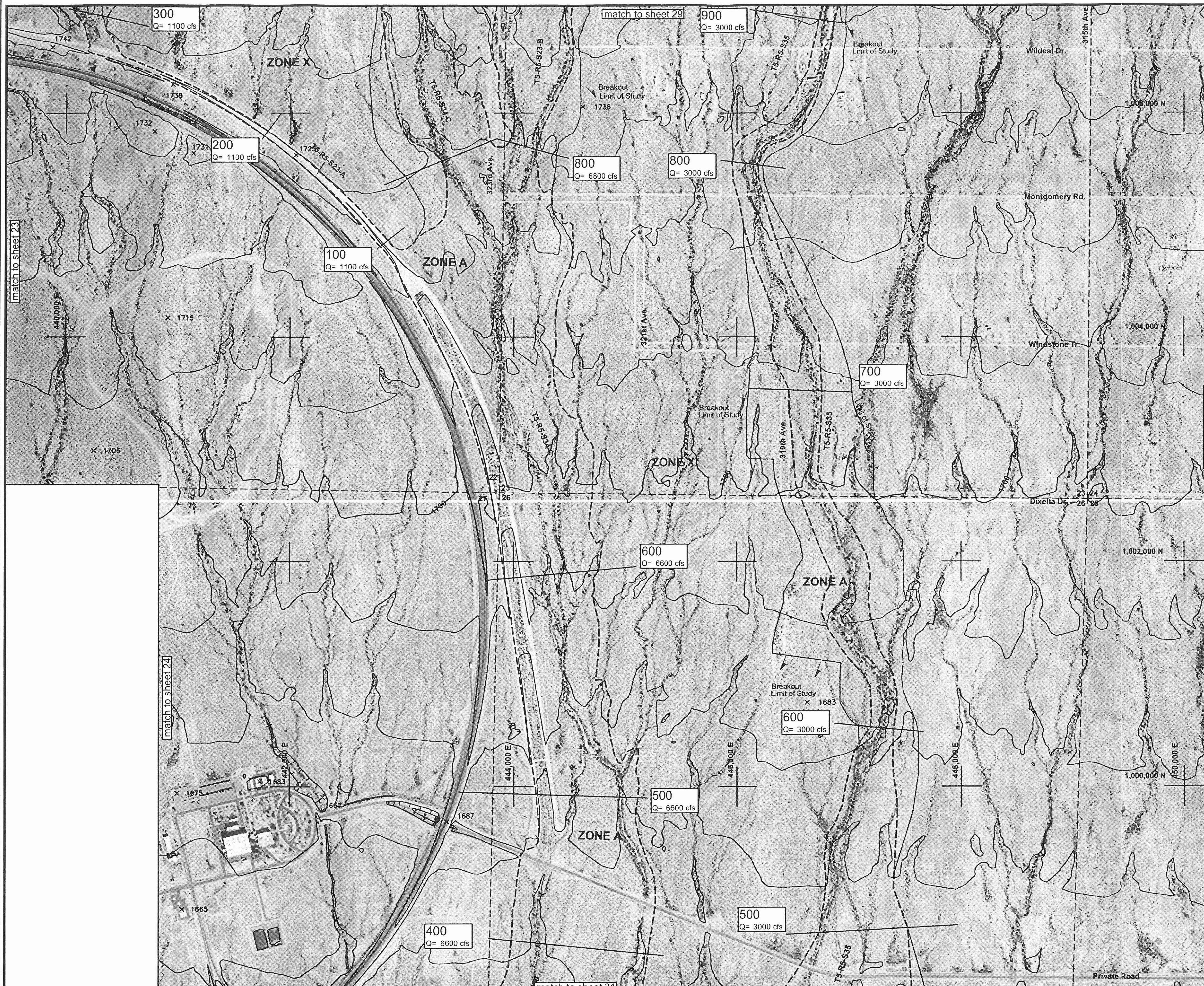
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

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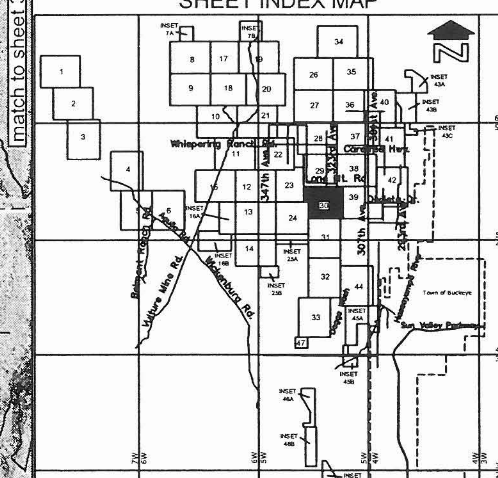
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

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APRIL, 2003

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TEMPE, ARIZONA - 480-752-2124

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES

ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, L.L.C.

SHEET 30 OF 47

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

LEGEND

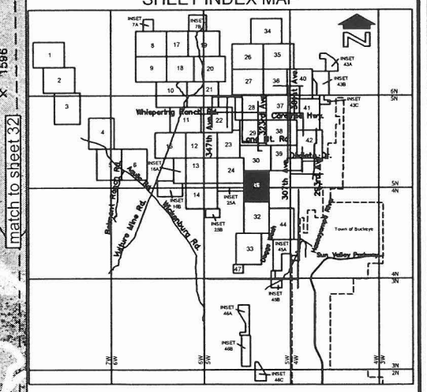
- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION: ZONE A
- CORPORATE LIMITS: Corporate Limits
- COUNTY BOUNDARY: County Boundary
- ELEVATION REFERENCE MARK: AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.02

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
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TEMPE, ARIZONA - 480-752-2134

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES Civil Engineers Consultants

ARGUS CONSULTING

SHEET 31 OF 47

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AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
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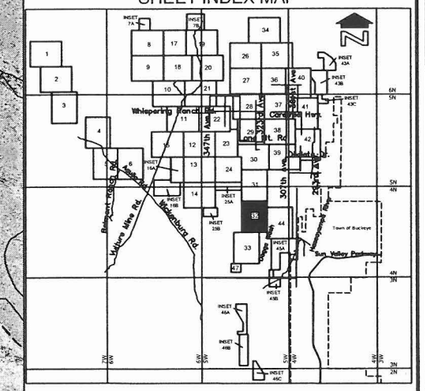
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NVAD 88 - 1.99

ELEVATION REFERENCE MARKS

SHEET INDEX MAP


INSET 1A
INSET 1B
INSET 1C
INSET 2A
INSET 2B
INSET 2C
INSET 3A
INSET 3B
INSET 3C
INSET 4A
INSET 4B
INSET 4C
Whispering Ranch
Cortez Park
Town of Buckeye
Sun Valley Parkway
Buckeye Rd.
Watson Rd.
Miller Rd.
347th Ave.
339th Ave.
331st Ave.
323rd Ave.
315th Ave.
307th Ave.
299th Ave.
291st Ave.
283rd Ave.
275th Ave.
267th Ave.
259th Ave.
251st Ave.
243rd Ave.
235th Ave.
227th Ave.
219th Ave.
211th Ave.
203rd Ave.
195th Ave.
187th Ave.
179th Ave.
171st Ave.
163rd Ave.
155th Ave.
147th Ave.
139th Ave.
131st Ave.
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18729th St.
18737th St.
18745th St.
18753rd St.
18761st St.
18769th St.
18777th St.
18785th St.
18793rd St.
18801st St.
18809th St.
18817th St.
18825th St.
18833rd St.
18841st St.
18849th St.
18857th St.
18865th St.
18873rd St.
18881st St.
18889th St.
18897th St.
18905th St.
18913th St.
18921st St.
18929th St.
18937th St.
18945th St.
18953rd St.
18961st St.
18969th St.
18977th St.
18985th St.
18993rd St.
19001st St.
19009th St.
19017th St.
19025th St.
19033rd St.
19041st St.
19049th St.
19057th St.
19065th St.
19073rd St.
19081st St.
19089th St.
19097th St.
19105th St.
19113th St.
19121st St.
19129th St.
19137th St.
19145th St.
19153rd St.
19161st St.
19169th St.
19177th St.
19185th St.
19193rd St.
19201st St.
19209th St.
19217th St.
19225th St.
19233rd St.
19241st St.
19249th St.
19257th St.
19265th St.
19273rd St.
19281st St.
19289th St.
19297th St.
19305th St.
19313th St.
19321st St.
19329th St.
19337th St.
19345th St.
19353rd St.
19361st St.
19369th St.
19377th St.
19385th St.
19393rd St.
19401st St.
19409th St.
19417th St.
19425th St.
19433rd St.
19441st St.
19449th St.
19457th St.
19465th St.
19473rd St.
19481st St.
19489th St.
19497th St.
19505th St.
19513th St.
19521st St.
19529th St.
19537th St.
19545th St.
19553rd St.
19561st St.
19569th St.
19577th St.
19585th St.
19593r

LEGEND

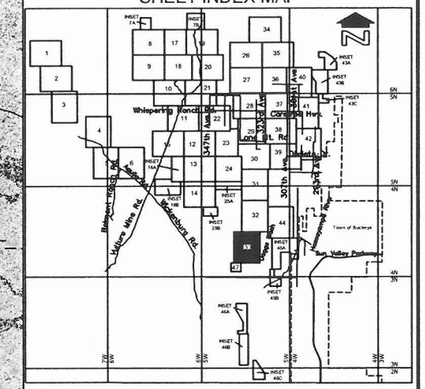
- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.01

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

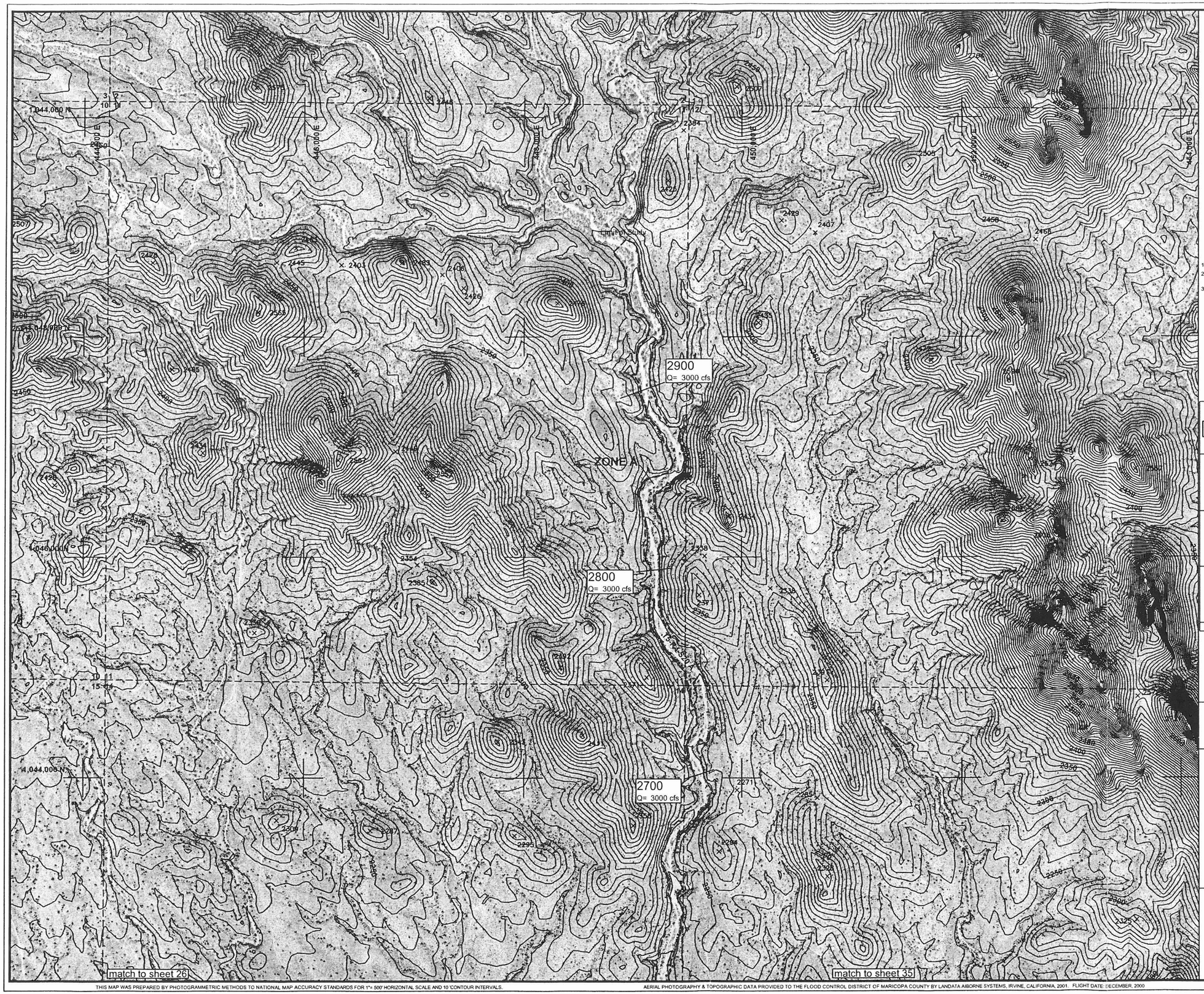
APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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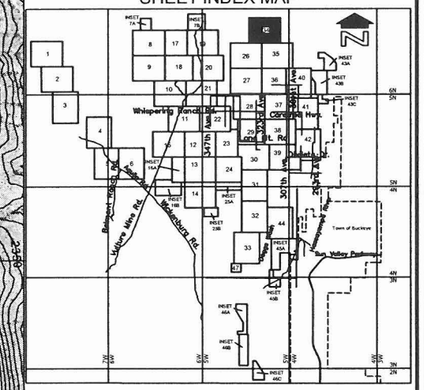
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.21

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
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APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 335-8500
ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, L.L.C.
Scottsdale, Arizona 480-941-1777

SHEET 34 OF 47

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

match to sheet 34

match to sheet 26

match to sheet 36

match to sheet 40

1,042,000 N

1,040,000 N

1,038,000 N

1,036,000 N

1,034,000 N

448,000 E

450,000 E

452,000 E

454,000 E

456,000 E

458,000 E

2600
Q= 3000 cfs

2500
Q= 3000 cfs

2400
Q= 3000 cfs

2300
Q= 3000 cfs

1600
Q= 2300 cfs

1500
Q= 2300 cfs

1400
Q= 2300 cfs

ZONE A

T5S R4E

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION: ZONE A
- CORPORATE LIMITS: Corporate Limits
- COUNTY BOUNDARY: County Boundary
- ELEVATION REFERENCE MARK: AJ3618

NOTES

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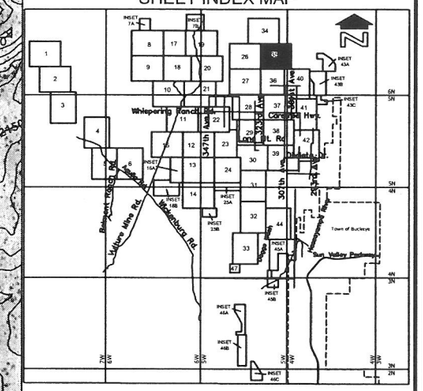
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

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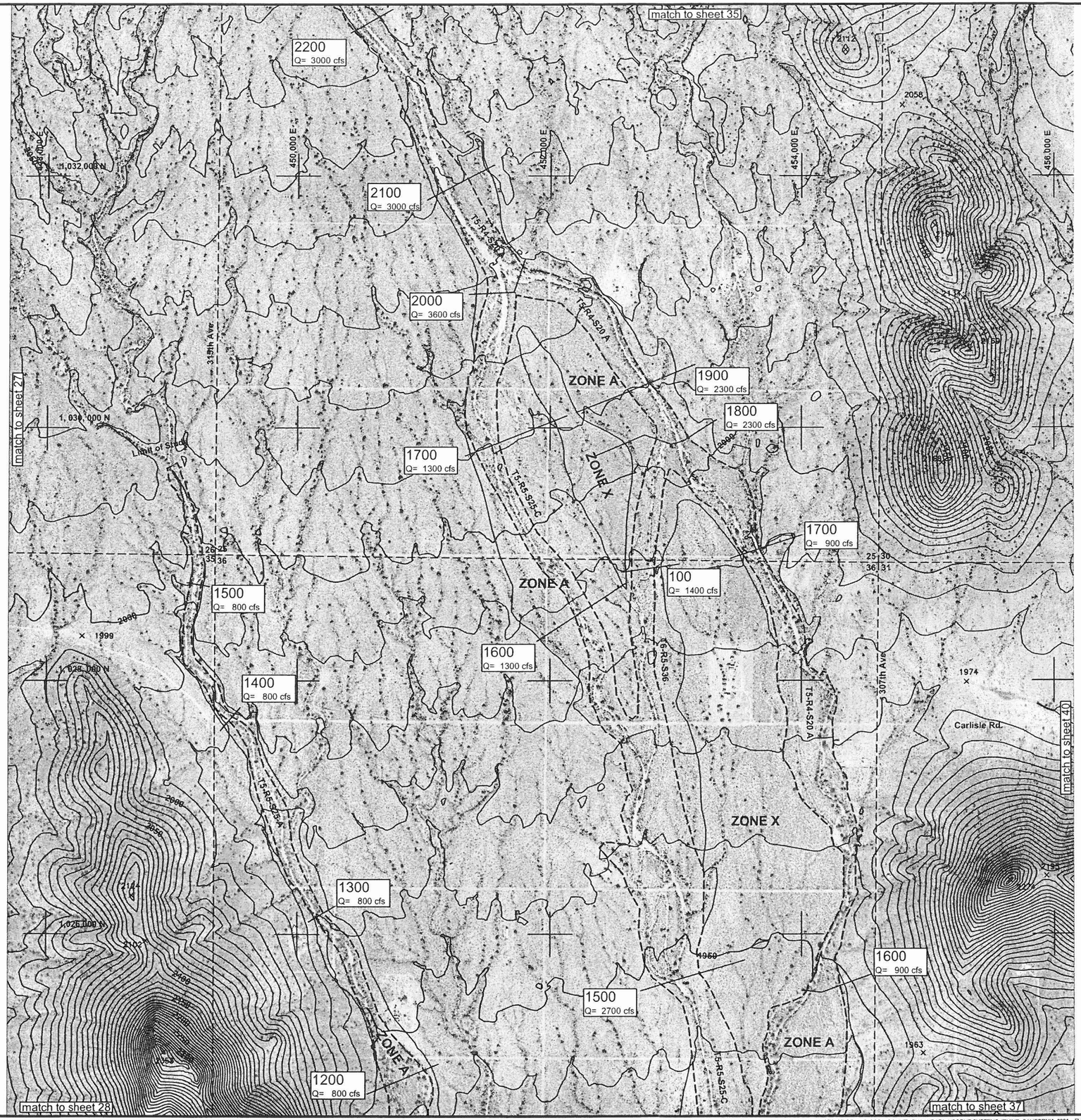
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
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- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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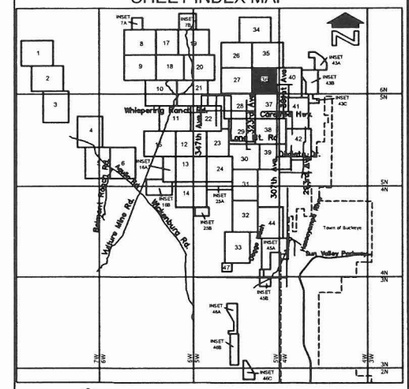
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

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TEMPE, ARIZONA - 480-752-2124
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ARGUS CONSULTING

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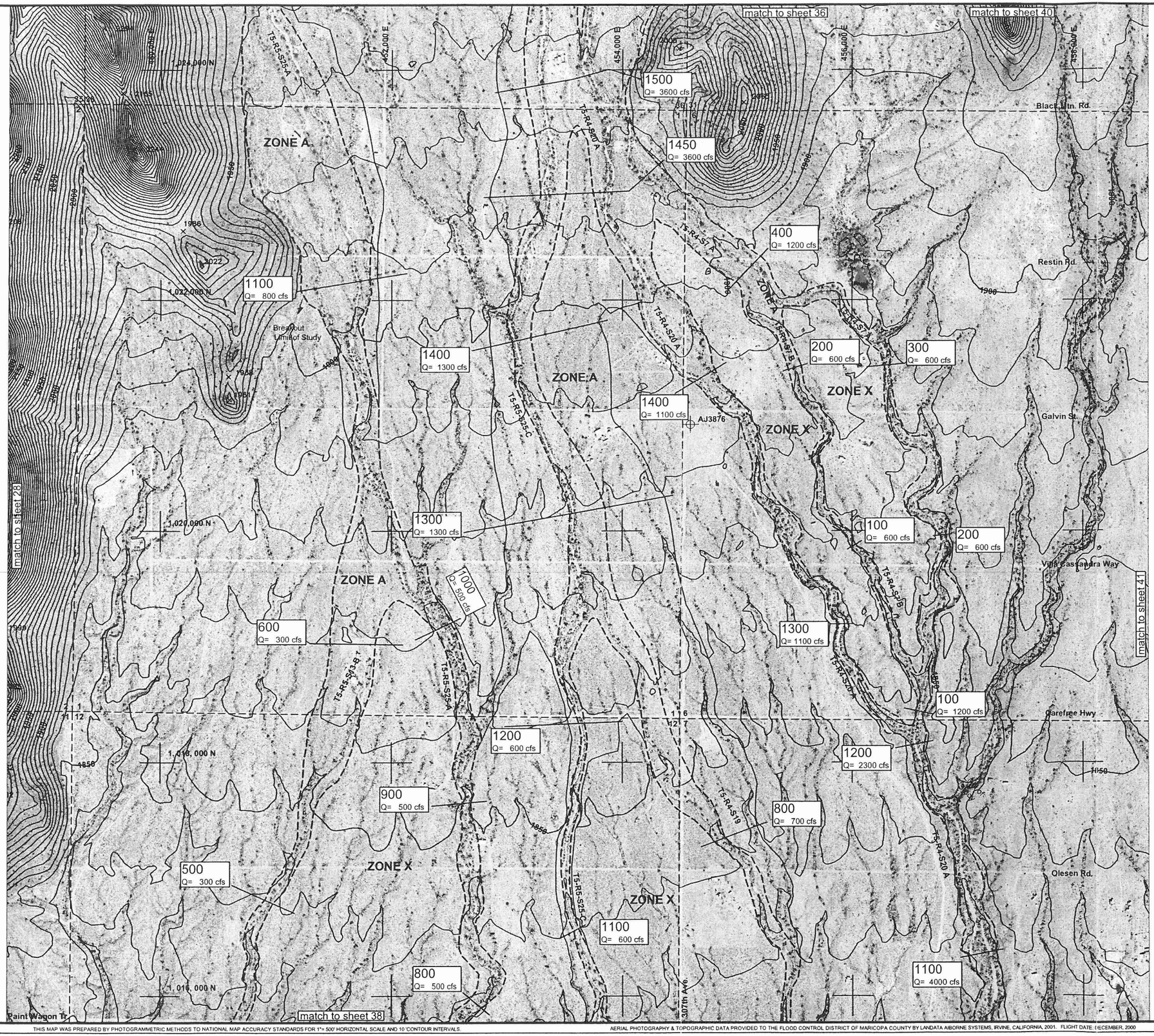
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
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- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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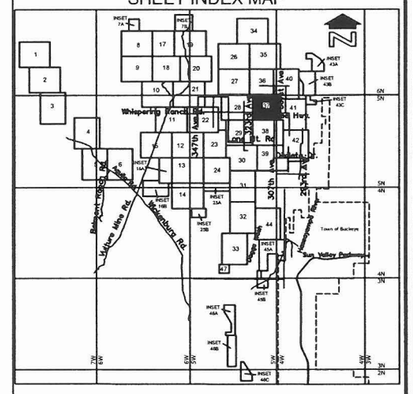
ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3876	4KI2 (GDACS)	1020923.84	454596.89	1884.94

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

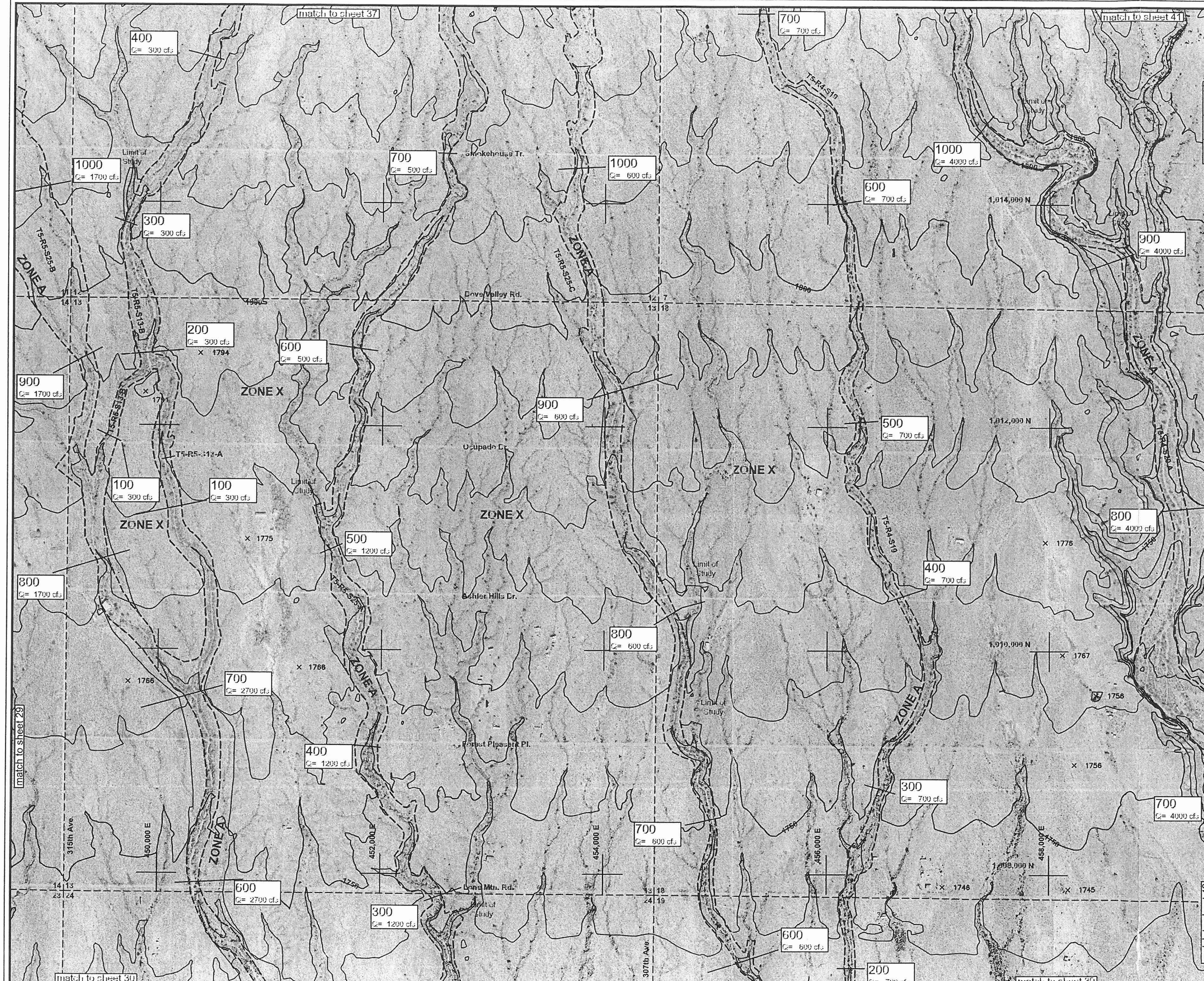
APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY INC
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, L.L.C.

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3518

NOTES

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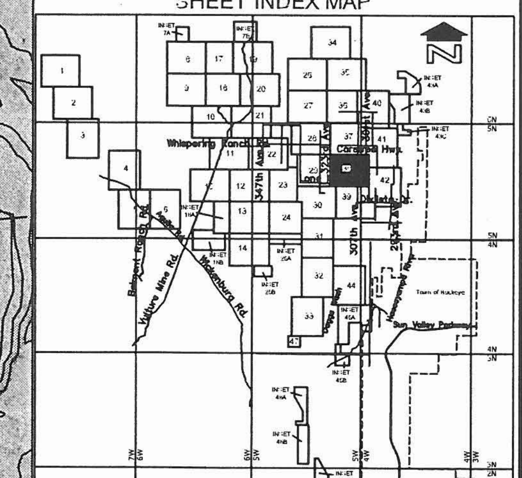
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000C019

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003 (updated June, 2004)

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES Civil Engineers Hydrologists Land Surveyors

ARGUS CONSULTING

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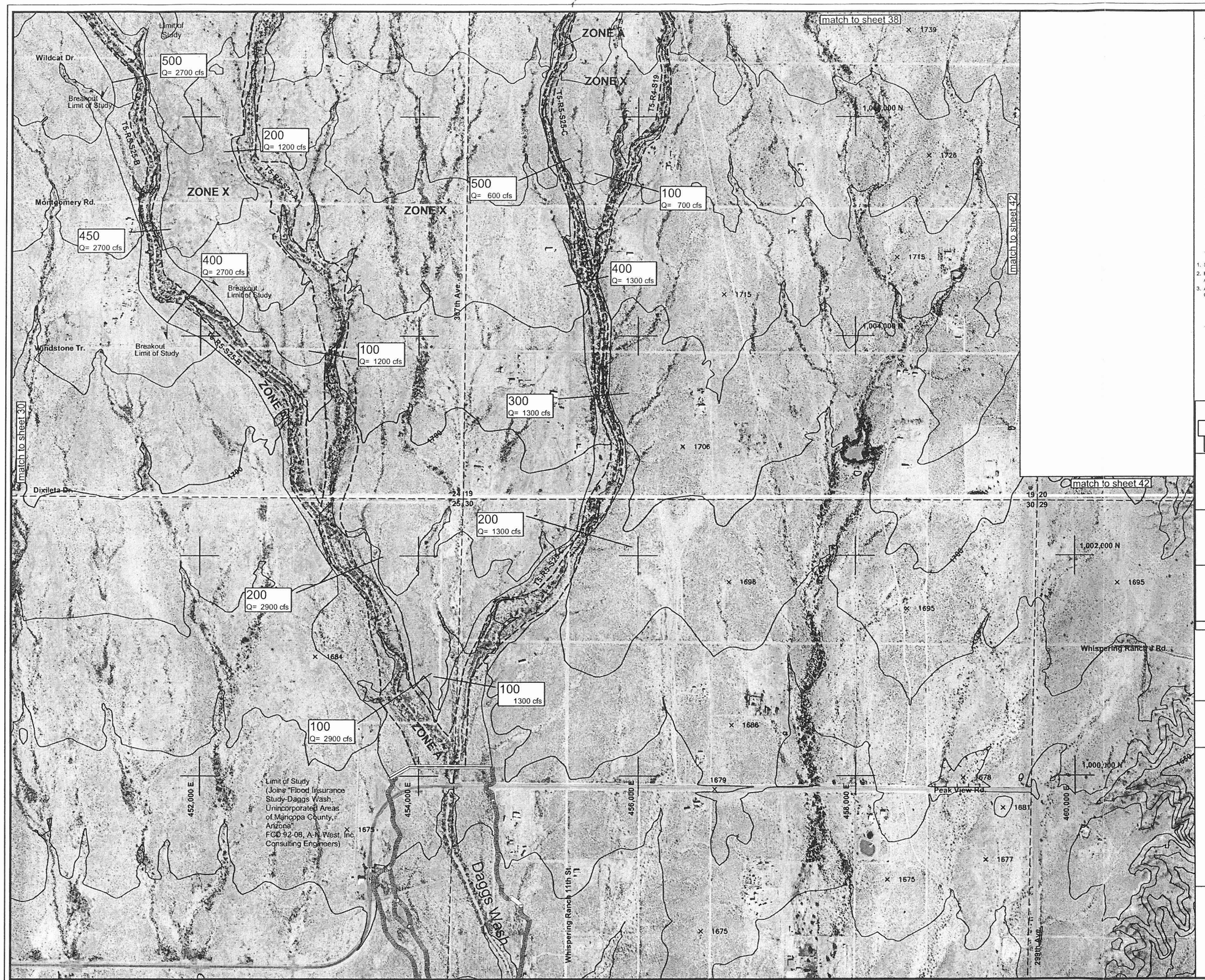
GROUND CONTROL SURVEY DATA PROVIDED BY REF CONSULTING, PHOENIX, ARIZONA



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

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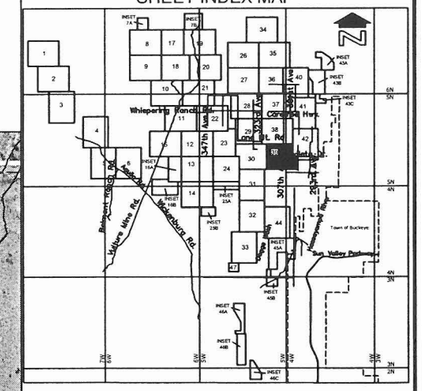
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
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ARGUS CONSULTING

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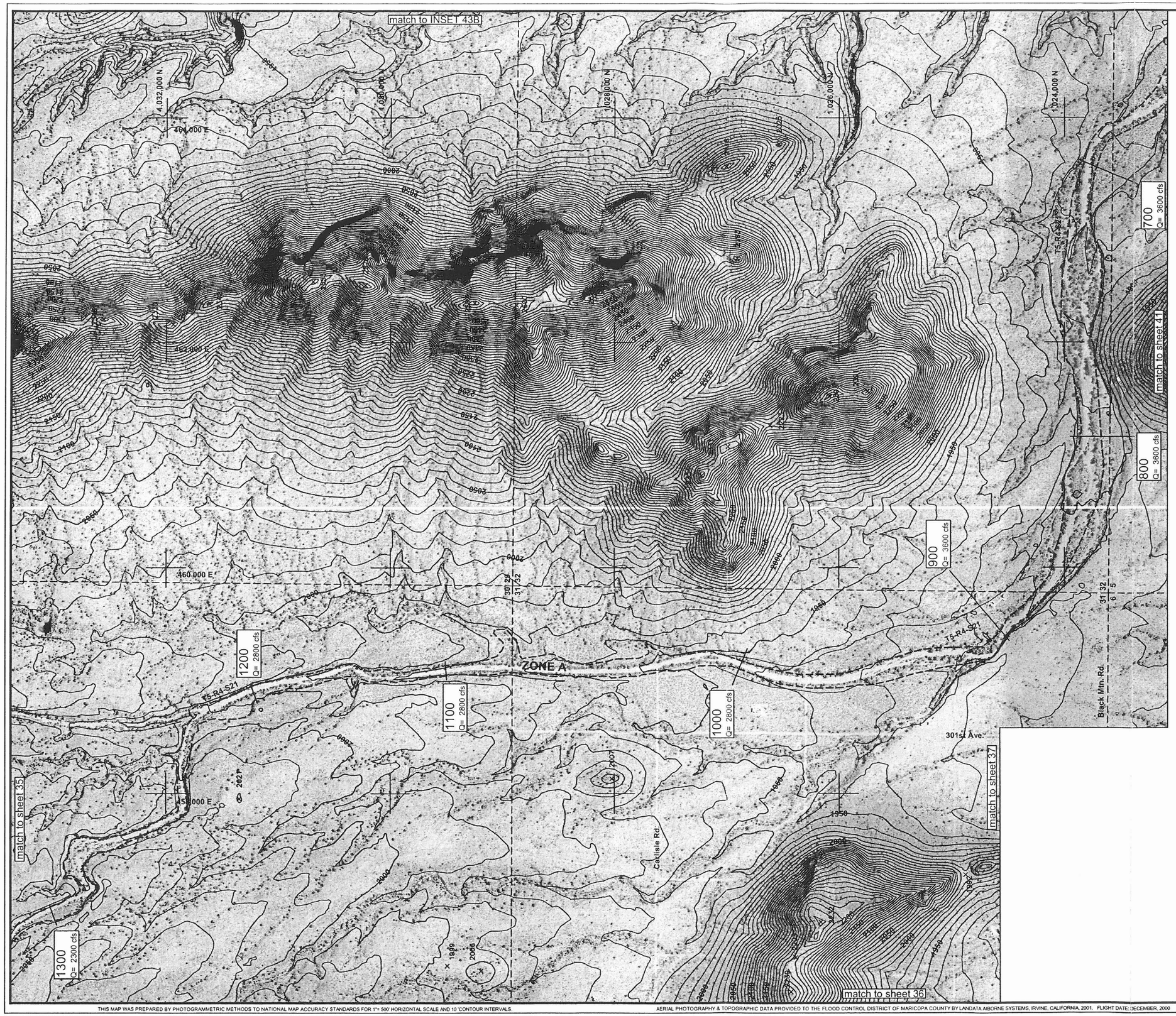
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
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- ELEVATION REFERENCE MARK — AJ3618

NOTES

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2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
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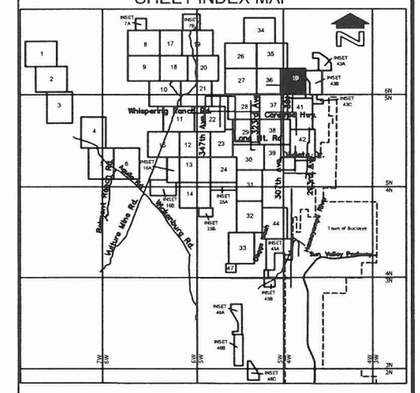
ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-3134
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ARGUS CONSULTING

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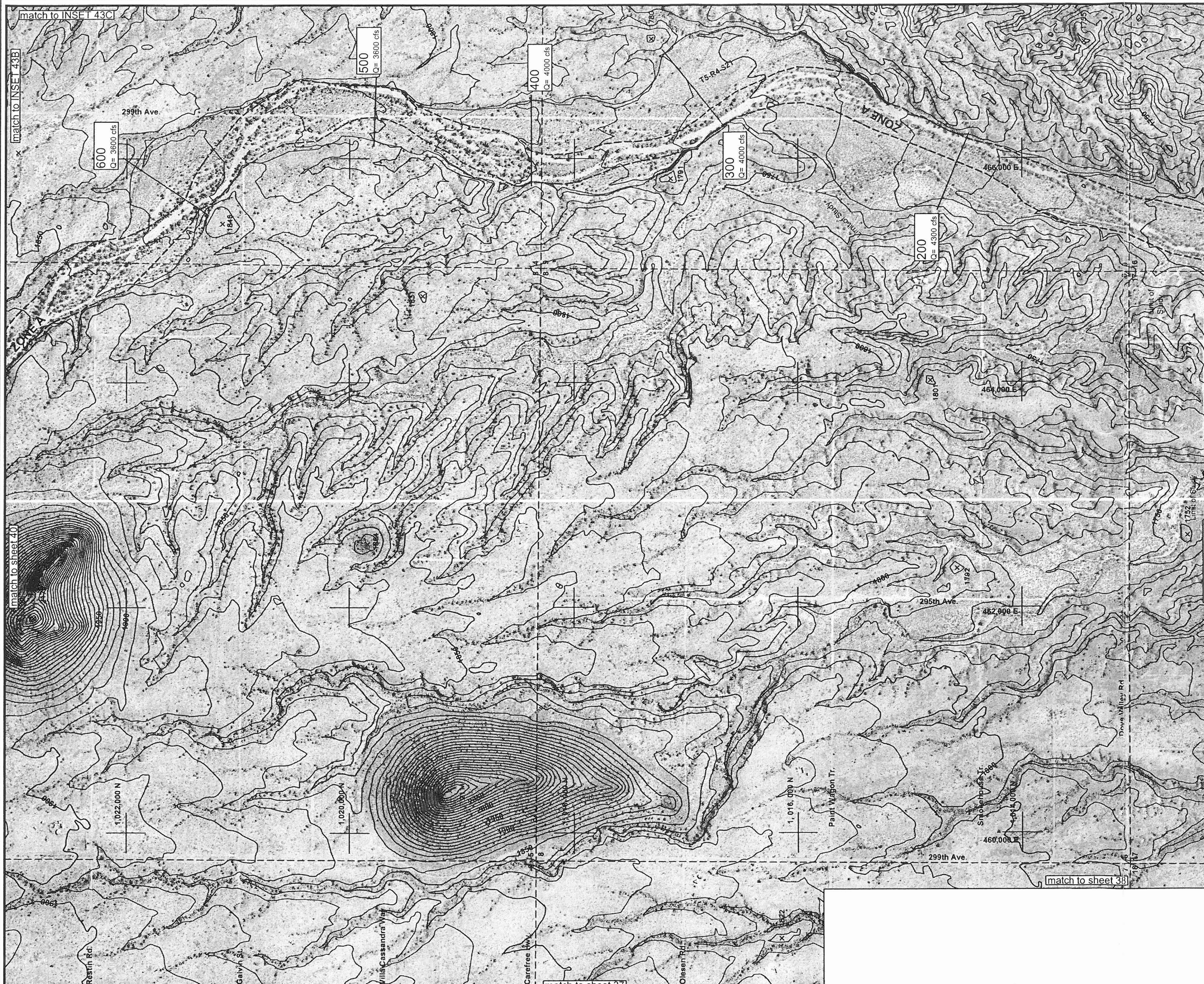
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



LEGEND

100-YR FLOODPLAIN BOUNDARY	
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100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
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1. SECTION BOUNDARIES PROVIDED BY FCDMC
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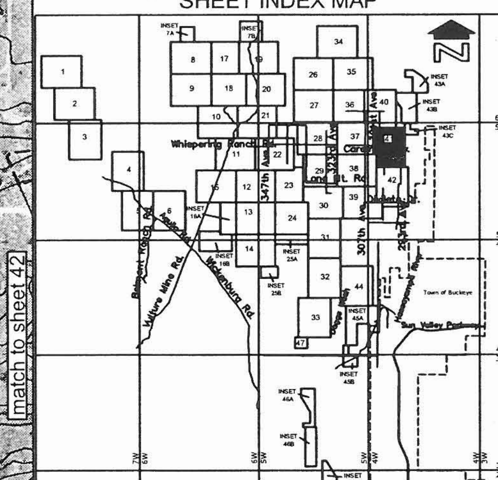
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.05

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES

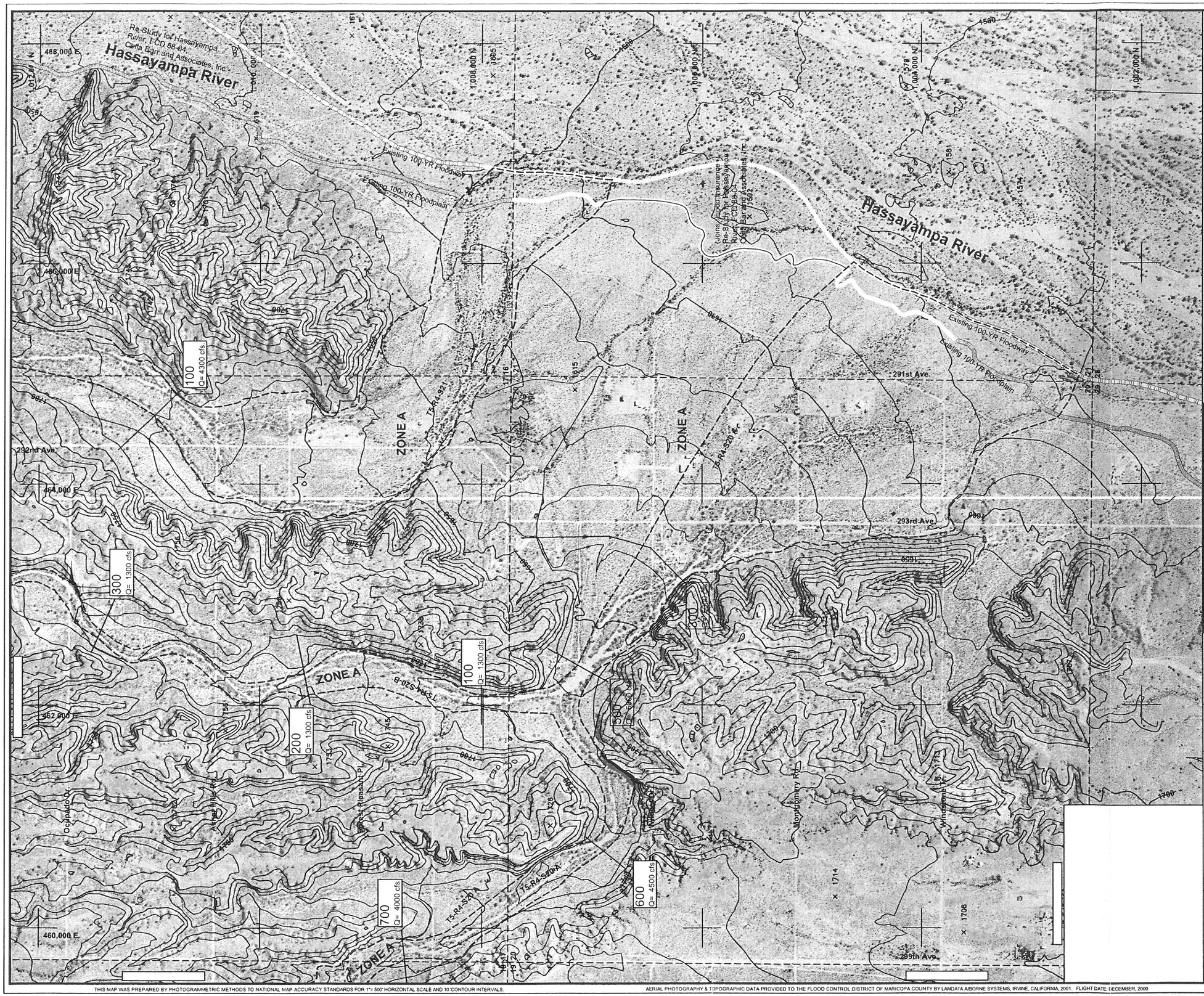
ARGUS CONSULTING

SHEET 41 OF 47

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

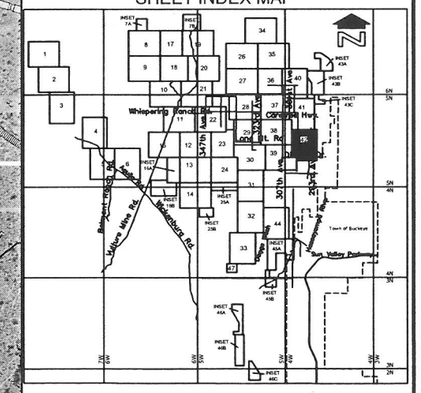
- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION ZONE A
- CORPORATE LIMITS Corporate Limits
- COUNTY BOUNDARY County Boundary
- ELEVATION REFERENCE MARK AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.01

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

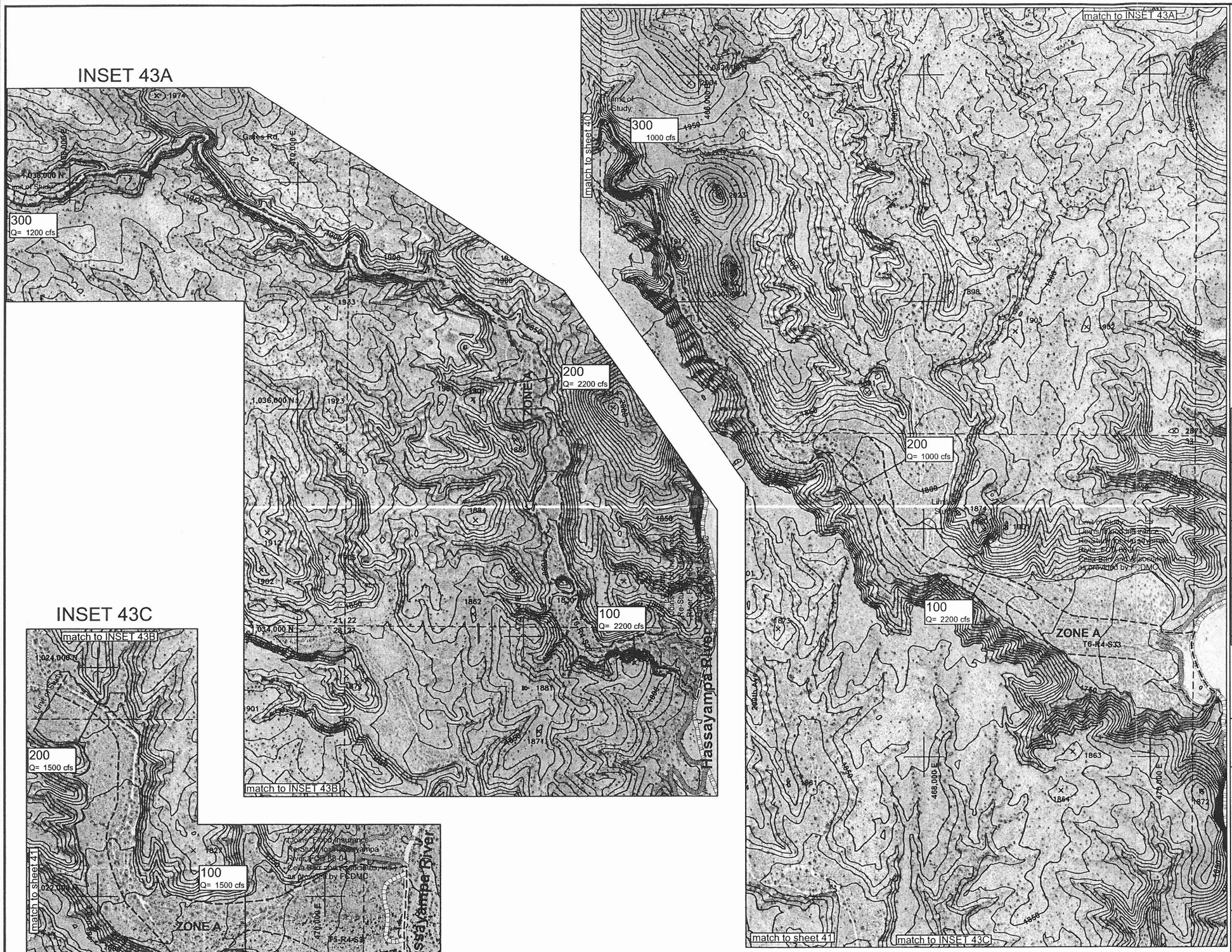
APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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



LEGEND

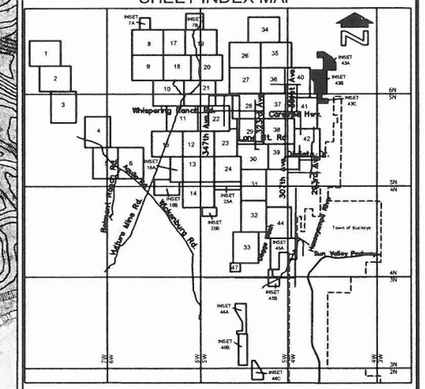
- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800, Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: 43A; NGVD 29 = NAVD 88 - 2.08
   43B; NGVD 29 = NAVD 88 - 2.07
   43C; NGVD 29 = NAVD 88 - 2.05

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

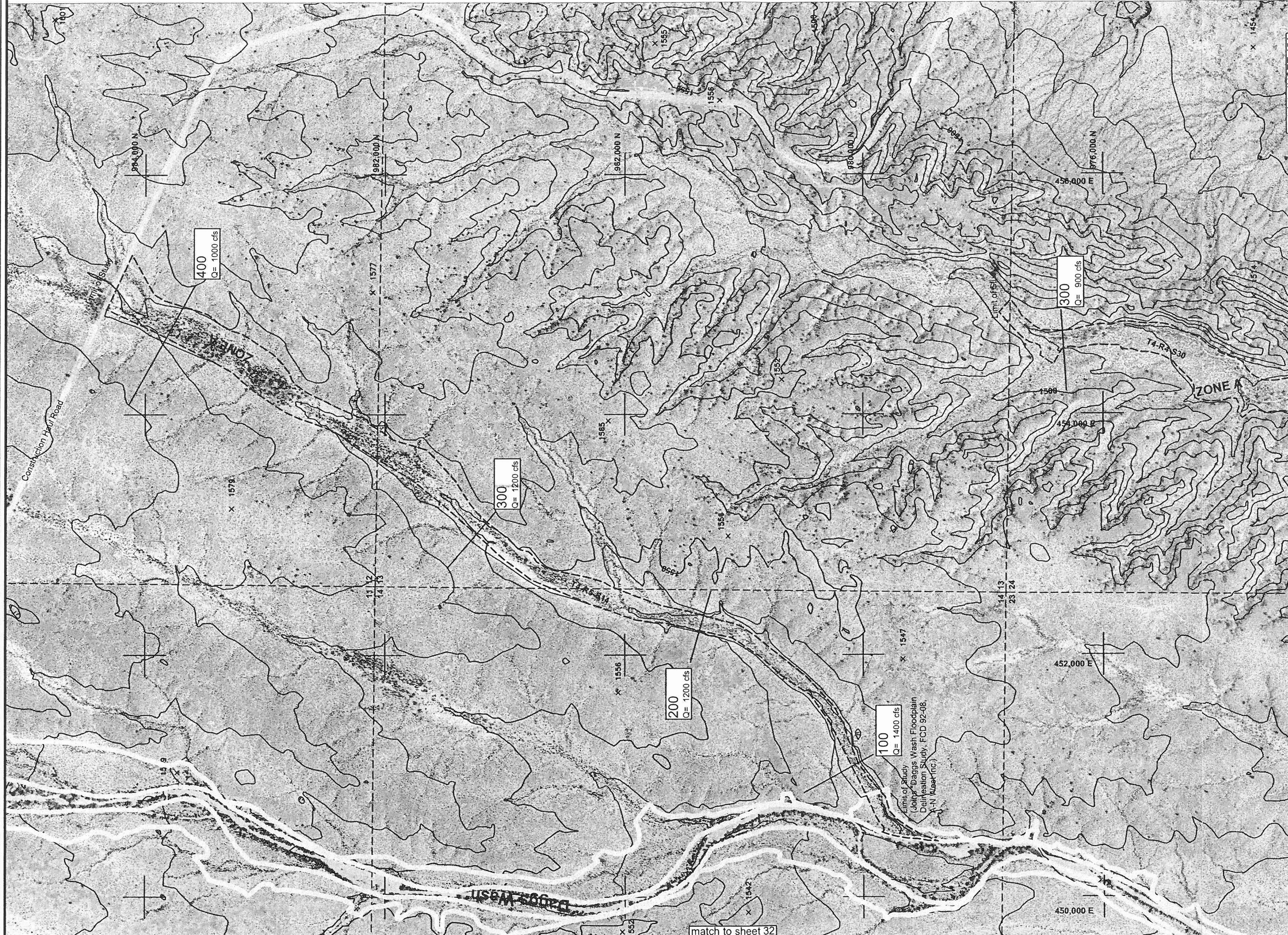
WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



LEGEND

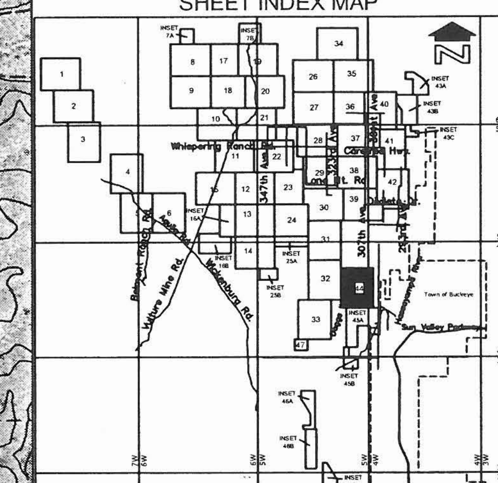
100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 1.99

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"

(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
TEMPE, ARIZONA

IN ASSOCIATION WITH

WOOD/PATEL ASSOCIATES

ARGUS CONSULTING

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AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

INSET 45B

INSET 45A

match to sheet 44

match to INSET 45A

match to INSET 45B

Town of Buckeye

Limit of Study (Joins Flood Insurance Re-Study for Hassayampa River, FCD 88-04, Cella Barr and Associates, Inc.)

Existing 100-YR Floodplain

Existing 100-YR Floodway

Construction Haul Road

Hassayampa River

CAP Canal

ZONE A

100 Q= 1400 cfs

200 Q= 1100 cfs

100 Q= 210 cfs

200 Q= 210 cfs

458,000 E

456,000 E

452,000 E

974,000 N

972,000 N

970,000 N

968,000 N

966,000 N

964,000 N

960,000 N

454,000 E

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION 800 Q= 4000 cfs
- ZONE DESIGNATION: ZONE A
- CORPORATE LIMITS: Corporate Limits
- COUNTY BOUNDARY: County Boundary
- ELEVATION REFERENCE MARK: AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: 45A: NGVD 29 = NAVD 88 - 1.98; 45B: NGVD 29 = NAVD 88 - 2.00

ELEVATION REFERENCE MARKS

SHEET INDEX MAP

SCALE IN FEET

400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

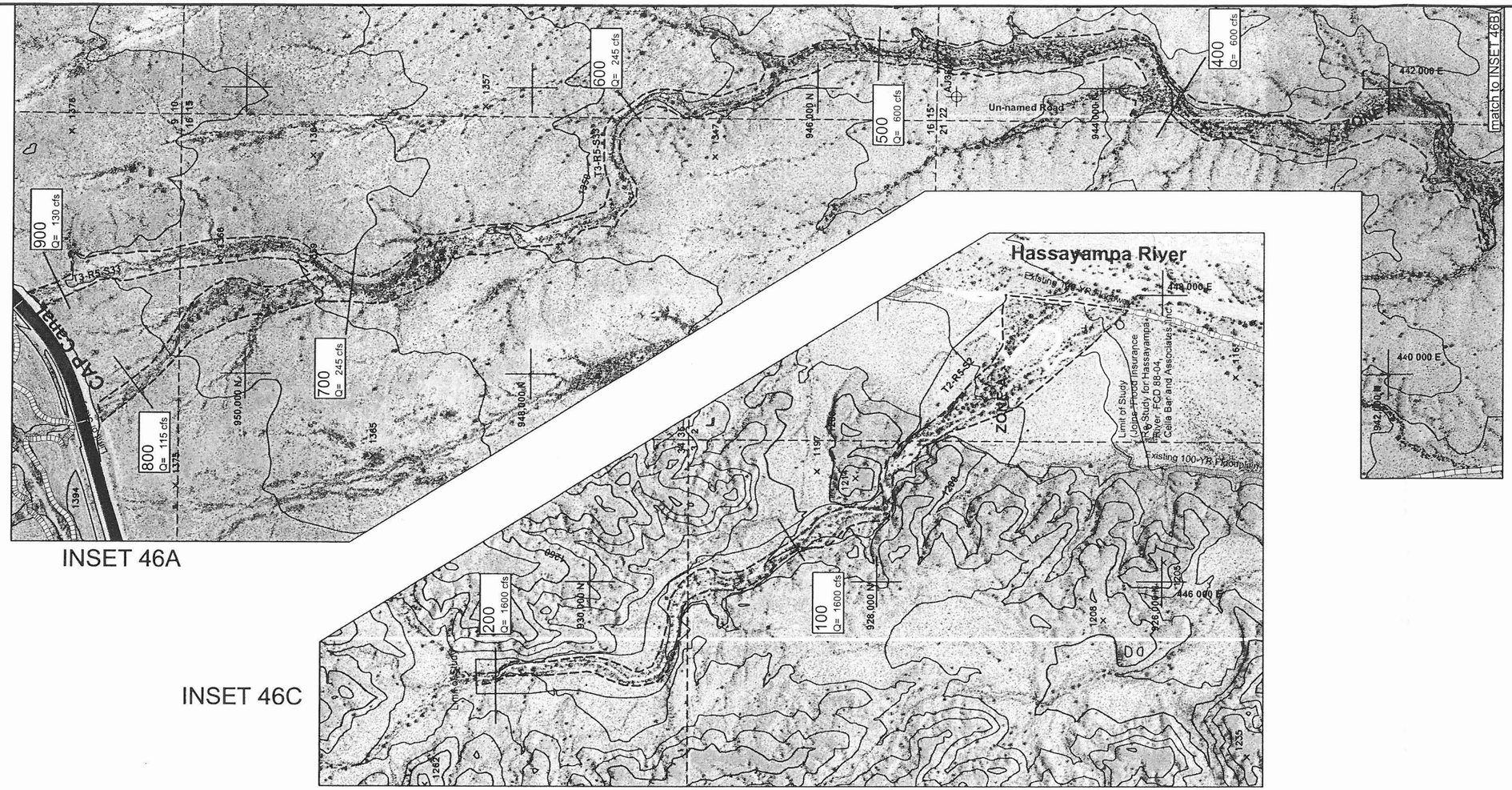
WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES & LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

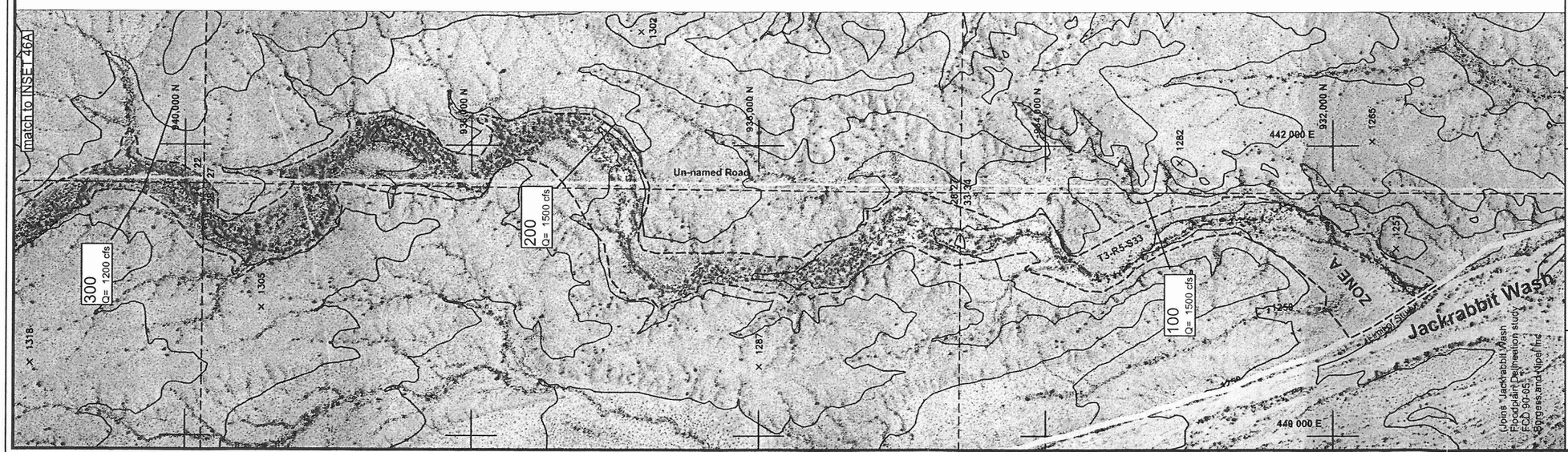
JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARIZONA CONSULTING

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000
GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA



INSET 46C

INSET 46B



LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- 100-YR ADMINISTRATIVE FLOODWAY
- 100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)
- 100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)
- SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)
- SECTION BOUNDARY
- CROSS SECTION — 800 Q= 4000 cfs
- ZONE DESIGNATION — ZONE A
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- ELEVATION REFERENCE MARK — AJ3618

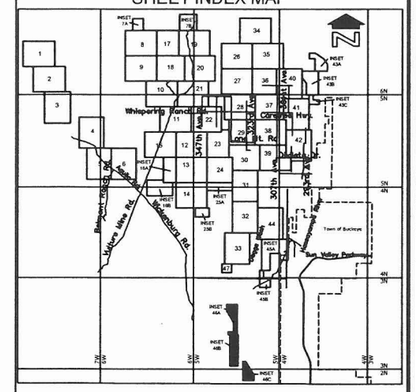
NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: 46A: NGVD 29 = NAVD 88 - 2.03
   46B: NGVD 29 = NAVD 88 - 2.05
   46C: NGVD 29 = NAVD 88 - 2.06

ELEVATION REFERENCE MARKS

NGS PID	Station Designation	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
AJ3852	4FJ2 (GDACS)	945034.88	441948.52	1337.18

SHEET INDEX MAP



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

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
ARGUS CONSULTING

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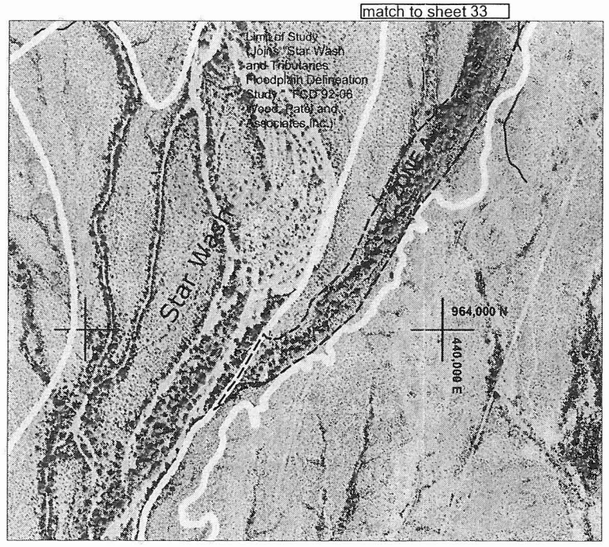
AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

match to sheet 33



LEGEND

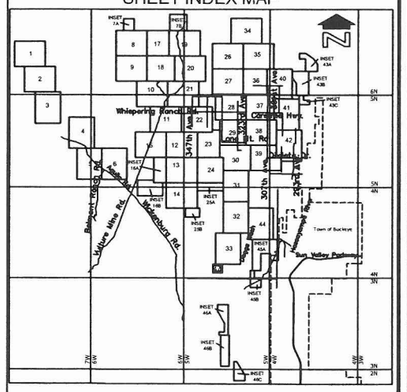
100-YR FLOODPLAIN BOUNDARY	
100-YR ADMINISTRATIVE FLOODWAY	
100-YR FLOODPLAIN BOUNDARY (EXISTING OR CONCURRENT STUDY)	
100-YR FLOODWAY (EXISTING OR CONCURRENT STUDY)	
SPECIAL PIEDMONT AREA BOUNDARY (SEE SECTION 6 OF THE TDN)	
SECTION BOUNDARY	
CROSS SECTION	800 Q= 4000 cfs
ZONE DESIGNATION	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY BOUNDARY	County Boundary
ELEVATION REFERENCE MARK	AJ3618

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. CONVERSION FACTOR: NGVD 29 = NAVD 88 - 2.02

ELEVATION REFERENCE MARKS

SHEET INDEX MAP



N

SCALE IN FEET
400' 0' 400' 800'

CONTOUR INTERVAL = 10 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF

WATERSHED "OO"
(JACKRABBIT WASH)
2000CO19

HASSAYAMPA RIVER TRIBUTARIES
& LOWER JACKRABBIT WASH TRIBUTARIES

APRIL, 2003

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA 480-752-2134
IN ASSOCIATION WITH
WOOD/PATEL ASSOCIATES
Civil Engineers
Flood Hydrology
Flood Damages
(602) 265-2800
ARGUS CONSULTING
A CIVIL ENGINEERING CONSULTANCY, L.L.C.

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

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIBORNE SYSTEMS, IRVINE, CALIFORNIA, 2001. FLIGHT DATE: DECEMBER, 2000

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

HEC-RAS Plan: 1 River: T2R5S2 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1600.00	1201.37	1200.68	6.17	90.28	267.38	177.09	3.36	0.051		0.60
1	100	1600.00	1201.60	1200.53	6.27	179.00	251.00	72.00	3.60	0.050		0.59
1	200	1600.00	1224.63	1224.32	7.32	79.69	315.47	235.78	4.63	0.056	0.0087	0.62
1	200	1600.00	1225.52	1224.66	8.65	171.66	233.95	62.30	5.52	0.054	0.0087	0.67

HEC-RAS Plan: 1 River: T3R5S1 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	210.00	1321.14	1321.04	3.11	32.62	330.44	297.82	0.64	0.060		0.68
1	100	210.00	1321.18	1321.03	3.22	60.58	257.49	196.91	0.68	0.060		0.69
1	200	210.00	1336.72	1336.61	4.22	107.75	216.72	108.97	1.72	0.048	0.0145	0.72
1	200	210.00	1336.86	1336.63	4.50	133.00	172.00	39.00	1.86	0.045	0.0145	0.73

HEC-RAS Plan: t3r5s33_east River: t3r5s33_east Reach: t3r5s33_east

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t3r5s33_east	100	1500.00	1252.41	1251.46	5.22	135.19	387.68	252.49	3.41	0.061		0.50
t3r5s33_east	100	1500.00	1252.41	1251.46	5.22	135.19	387.68	252.49	3.41	0.061		0.50
t3r5s33_east	200	1500.00	1282.34	1281.76	3.11	34.32	552.93	518.60	3.34	0.056	0.0062	0.42
t3r5s33_east	200	1500.00	1282.34	1281.76	3.11	34.32	552.93	518.60	3.34	0.056	0.0062	0.42
t3r5s33_east	300	1200.00	1302.97	1301.93	2.90	375.05	609.03	233.98	2.97	0.060	0.0059	0.36
t3r5s33_east	300	1200.00	1302.97	1301.93	2.90	375.05	609.03	233.98	2.97	0.060	0.0059	0.36
t3r5s33_east	400	600.00	1321.17	1320.05	2.13	277.01	463.53	186.52	2.67	0.060	0.0050	0.31
t3r5s33_east	400	600.00	1321.17	1320.05	2.13	277.01	463.53	186.52	2.67	0.060	0.0050	0.31
t3r5s33_east	500	600.00	1332.15	1331.19	2.95	93.14	248.09	154.95	2.15	0.062	0.0049	0.35
t3r5s33_east	500	600.00	1332.15	1331.19	2.95	93.14	248.09	154.95	2.15	0.062	0.0049	0.35
t3r5s33_east	600	245.00	1341.91		2.32	131.15	208.59	77.44	1.91	0.060	0.0054	0.35
t3r5s33_east	600	245.00	1341.91		2.32	131.15	208.59	77.44	1.91	0.060	0.0054	0.35
t3r5s33_east	700	245.00	1358.09	1357.58	1.71	195.07	383.57	188.50	1.08	0.060	0.0063	0.33
t3r5s33_east	700	245.00	1358.09	1357.58	1.71	195.07	383.57	188.50	1.08	0.060	0.0063	0.33
t3r5s33_east	900	130.00	1372.75	1372.40	1.69	230.28	348.90	118.63	0.75	0.060	0.0070	0.37
t3r5s33_east	900	130.00	1372.75	1372.40	1.69	230.28	348.90	118.63	0.75	0.060	0.0070	0.37

HEC-RAS Plan: t3r5s33_west River: t3r5s33_west Reach: t3r5s33_west

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t3r5s33_west	800	115	1375.35	1374.98	1.74	199.03	302.58	103.55	0.85	0.06		0.38
t3r5s33_west	800	115	1375.35	1374.98	1.74	199.03	302.58	103.55	0.85	0.06		0.38

HEC-RAS Plan: 1 River: T4R4S30 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1400.00	1419.11	1418.91	7.57	18.34	780.39	762.05	3.11	0.047		0.85
1	100	1400.00	1419.11	1418.98	7.57	18.34	780.39	762.05	3.11	0.047		0.85
1	200	1100.00	1458.99	1458.84	6.85	173.74	297.39	123.65	2.99	0.041	0.0140	0.81
1	200	1100.00	1458.99	1458.84	6.85	173.75	297.38	123.63	2.99	0.041	0.0140	0.81
1	300	900.00	1489.75	1488.49	3.14	173.27	315.95	142.68	3.75	0.040	0.0055	0.39
1	300	900.00	1489.76	1488.49	3.14	173.27	315.96	142.69	3.75	0.040	0.0055	0.39

HEC-RAS Plan: t4r5s7a River: t4r5s7a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	5700.00	1580.18	1579.60	7.89	27.34	567.43	540.09	8.18	0.052		0.55
1	100	5700.00	1580.98	1578.96	8.53	251.00	362.78	111.79	8.98	0.051		0.56
1	200	5700.00	1589.13	1588.09	5.00	0.00	801.00	801.00	8.13	0.052	0.0066	0.51
1	200	5700.00	1589.62		5.10	288.00	606.00	318.00	8.62	0.050	0.0066	0.48
1	300	5700.00	1595.65	1594.20	4.22	65.98	661.36	595.38	5.65	0.052	0.0071	0.41
1	300	5700.00	1596.10	1594.50	4.82	176.00	490.00	314.00	6.10	0.050	0.0071	0.44
1	400	5700.00	1605.35		7.69	31.31	595.05	563.75	5.35	0.059	0.0062	0.62
1	400	5700.00	1606.36		8.70	203.39	399.12	195.73	6.36	0.058	0.0062	0.63
1	500	5700.00	1617.92	1617.31	8.80	28.55	459.66	431.10	8.92	0.053	0.0056	0.58
1	500	5700.00	1618.70	1617.17	9.26	135.43	267.89	132.46	9.70	0.052	0.0056	0.58
1	600	5700.00	1625.80		7.96	40.29	328.93	288.64	8.80	0.053	0.0062	0.53
1	600	5700.00	1626.79		8.69	134.00	222.56	88.56	9.79	0.051	0.0062	0.55
1	700	5700.00	1638.95	1638.89	9.91	116.08	684.22	568.14	5.95	0.050	0.0099	0.77
1	700	5700.00	1639.85	1639.27	10.16	350.93	531.02	180.09	6.85	0.050	0.0099	0.73
1	800	5700.00	1651.48		7.31	27.83	476.41	448.58	6.48	0.050	0.0093	0.59
1	800	5700.00	1651.62		7.33	121.97	332.56	210.59	6.62	0.050	0.0093	0.58

HEC-RAS Plan: t4r5s7b River: t4r5s7b Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1900.00	1558.62	1558.11	4.46	11.12	358.36	347.24	3.62	0.051		0.53
1	100	1900.00	1558.62	1558.11	4.46	11.12	358.36	347.24	3.62	0.051		0.53
1	200	1900.00	1568.12	1567.51	4.46	50.29	403.01	352.72	4.12	0.052	0.0073	0.52
1	200	1900.00	1568.12		4.46	50.29	403.01	352.72	4.12	0.052	0.0073	0.52
1	300	1900.00	1577.33	1576.67	4.29	27.43	319.59	292.15	3.33	0.050	0.0083	0.52
1	300	1900.00	1577.33	1576.67	4.29	27.43	319.59	292.15	3.33	0.050	0.0083	0.52
1	400	1900.00	1588.41	1587.82	3.67	21.68	464.99	443.32	2.41	0.051	0.0079	0.47
1	400	1900.00	1588.41	1587.82	3.67	21.68	464.99	443.32	2.41	0.051	0.0079	0.47
1	500	1900.00	1598.94	1598.46	3.07	3.75	577.82	574.07	1.94	0.050	0.0075	0.48
1	500	1900.00	1598.94	1598.46	3.07	3.75	577.82	574.07	1.94	0.050	0.0075	0.48
1	600	1900.00	1610.98	1610.40	4.09	73.11	468.54	395.43	2.98	0.050	0.0071	0.52
1	600	1900.00	1610.98	1610.40	4.09	73.11	468.54	395.43	2.98	0.050	0.0071	0.52
1	700	1900.00	1621.78	1621.39	2.66	94.37	922.03	827.66	2.78	0.050	0.0082	0.46
1	700	1900.00	1621.78	1621.39	2.66	94.37	922.03	827.66	2.78	0.050	0.0082	0.46
1	800	1900.00	1632.72	1632.39	2.60	108.25	1132.72	1024.47	2.72	0.050	0.0084	0.48
1	800	1900.00	1632.72	1632.39	2.60	108.25	1132.72	1024.47	2.72	0.050	0.0084	0.48
1	900	1900.00	1642.22	1641.30	3.53	98.63	1163.47	1064.84	2.22	0.055	0.0075	0.42
1	900	1900.00	1642.22	1641.30	3.53	98.63	1163.47	1064.84	2.22	0.055	0.0075	0.42
1	1100	7600.00	1666.74	1666.74	5.51	125.31	2397.46	1487.01	2.74	0.055	0.0068	1.01
1	1100	7600.00	1666.74	1666.74	5.51	125.31	2397.46	1487.01	2.74	0.055	0.0068	1.01
1	1300	7600.00	1693.43	1692.52	2.33	20.32	2671.51	2393.06	5.43	0.055	0.0102	0.35
1	1300	7600.00	1693.43	1692.52	2.33	20.32	2671.51	2393.06	5.43	0.055	0.0102	0.35
1	1600	1900.00	1749.82	1749.82	5.10	58.77	904.37	538.37	2.82	0.055	0.0104	0.93
1	1600	1900.00	1749.82	1749.82	5.10	58.77	904.37	538.37	2.82	0.055	0.0104	0.93
1	1700	1900.00	1764.77	1763.97	3.19	5.66	450.35	444.69	3.77	0.051	0.0100	0.40
1	1700	1900.00	1764.77	1763.97	3.19	5.66	450.35	444.69	3.77	0.051	0.0100	0.40
1	1800	3400.00	1779.80	1779.67	4.62	48.90	1071.24	962.85	2.80	0.052	0.0123	0.82
1	1800	3400.00	1780.07	1779.95	5.25	472.00	1037.00	565.00	3.07	0.050	0.0123	0.86

HEC-RAS Plan: t4r5s7b River: t4r5s7b Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1900	3400.00	1790.14	1789.35	5.53	0.00	659.67	509.43	4.14	0.051	0.0090	0.53
1	1900	3400.00	1791.11	1789.97	6.61	248.71	636.00	387.29	5.11	0.049	0.0090	0.56
1	2000	1200.00	1805.54	1805.54	7.48	12.91	246.24	233.33	3.54	0.053	0.0113	0.75
1	2000	1200.00	1806.13	1806.13	10.16	84.00	129.32	45.32	4.13	0.051	0.0113	0.93
1	2100	1000.00	1820.94	1820.75	5.45	7.86	370.75	362.89	2.94	0.052	0.0122	0.58
1	2100	1000.00	1821.95		5.47	153.12	213.90	60.78	3.95	0.051	0.0122	0.50
1	2200	1000.00	1835.49	1835.36	6.01	67.65	349.52	281.86	2.49	0.053	0.0113	0.70
1	2200	1000.00	1836.00	1835.97	9.12	125.00	177.69	52.69	3.00	0.052	0.0113	0.96
1	2300	800.00	1850.74	1850.32	6.37	82.21	195.79	113.57	3.74	0.053	0.0103	0.60
1	2300	800.00	1851.71	1850.37	5.71	104.40	155.41	51.01	4.71	0.053	0.0103	0.47
1	2400	800.00	1865.19	1864.69	3.35	61.65	321.53	259.87	2.19	0.050	0.0121	0.60
1	2400	800.00	1864.84	1864.69	4.86	66.98	307.43	158.16	1.84	0.050	0.0121	0.84
1	2500	2400.00	1880.00	1879.69	3.50	15.23	764.34	749.11	2.00	0.050	0.0126	0.59
1	2500	2400.00	1880.10	1879.70	3.42	113.00	696.00	583.00	2.10	0.050	0.0126	0.55
1	2600	1700.00	1894.44	1894.11	3.24	7.63	609.69	561.73	3.43	0.050	0.0109	0.57
1	2600	1700.00	1894.37	1894.11	3.47	8.50	603.99	552.64	3.37	0.050	0.0109	0.63
1	2700	1700.00	1908.03	1907.97	6.25	0.00	339.00	339.00	3.03	0.051	0.0128	0.70
1	2700	1700.00	1908.13	1907.97	5.81	0.00	339.00	339.00	3.13	0.051	0.0128	0.64
1	2800	1700.00	1922.67	1922.37	2.21	15.88	1249.25	1155.59	1.67	0.055	0.0134	0.46
1	2800	1700.00	1922.63	1922.37	2.35	17.81	1246.98	1141.99	1.63	0.055	0.0134	0.50
1	2900	3500.00	1938.55	1938.53	5.81	0.00	1289.00	1289.00	1.55	0.051	0.0149	0.83
1	2900	3500.00	1938.58	1938.53	5.59	0.00	1289.00	1289.00	1.58	0.051	0.0149	0.79
1	3000	3500.00	1959.67	1959.66	6.26	65.94	972.95	907.01	2.67	0.048	0.0144	0.76
1	3000	3500.00	1959.66	1959.66	6.33	68.38	970.87	902.49	2.66	0.048	0.0144	0.77
1	3100	3500.00	1977.77	1977.43	3.74	111.19	1196.84	1080.02	1.77	0.055	0.0153	0.61
1	3100	3500.00	1977.78	1977.43	3.70	105.88	1197.56	1086.33	1.78	0.055	0.0153	0.60
1	3200	3500.00	1995.86	1995.63	6.14	24.26	699.18	674.93	3.86	0.049	0.0115	0.70
1	3200	3500.00	1995.85	1995.63	6.19	26.51	697.71	671.20	3.84	0.049	0.0115	0.71

HEC-RAS Plan: t4r5s7b River: t4r5s7b Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	3300	3300.00	2012.60	2012.29	4.27	16.01	722.79	706.79	2.60	0.047	0.0125	0.66
1	3300	3300.00	2012.72	2012.38	4.49	175.00	700.00	525.00	2.72	0.045	0.0125	0.67
1	3400	3300.00	2028.18	2027.72	5.21	81.95	925.73	544.88	3.18	0.050	0.0122	0.68
1	3400	3300.00	2028.20	2027.72	5.20	85.00	726.00	342.83	3.20	0.050	0.0122	0.67
1	3500	3100.00	2054.29	2054.14	6.32	161.96	658.01	317.87	2.29	0.045	0.0166	0.88
1	3500	3100.00	2054.29	2054.14	6.34	176.00	658.00	303.68	2.28	0.045	0.0166	0.88
1	3600	3100.00	2071.25	2070.87	7.17	12.27	308.91	296.63	4.25	0.051	0.0100	0.63
1	3600	3100.00	2072.17	2071.14	8.43	99.00	189.16	90.16	5.17	0.047	0.0100	0.67
1	3700	3100.00	2088.65	2088.65	8.61	65.56	223.28	157.72	3.65	0.045	0.0124	1.00
1	3700	3100.00	2088.89	2088.65	7.78	62.43	225.01	162.58	3.89	0.045	0.0124	0.88
1	3800	2800.00	2109.82	2108.85	6.45	85.98	216.78	130.80	4.82	0.050	0.0141	0.62
1	3800	2800.00	2109.57	2108.85	6.96	87.28	216.49	129.21	4.57	0.050	0.0141	0.70
1	3900	2800.00	2132.21	2132.21	9.65	2.68	104.32	101.63	4.21	0.045	0.0219	1.00
1	3900	2800.00	2132.21	2132.21	9.65	2.68	104.32	101.63	4.21	0.045	0.0219	1.00
1	4000	2800.00	2151.40	2150.99	10.01	22.99	100.31	77.32	5.40	0.040	0.0135	0.85
1	4000	2800.00	2151.40	2150.99	10.01	22.99	100.31	77.32	5.40	0.040	0.0135	0.85
1	4100	2200.00	2174.07	2174.07	10.71	35.09	95.45	60.36	5.07	0.050	0.0181	1.00
1	4100	2200.00	2174.07	2174.07	10.71	35.09	95.45	60.36	5.07	0.050	0.0181	1.00
1	4200	2200.00	2218.62	2218.62	6.88	61.68	308.08	246.40	2.62	0.046	0.0352	0.99
1	4200	2200.00	2218.62	2218.62	6.88	61.68	308.08	246.40	2.62	0.046	0.0352	0.99
1	4300	1700.00	2313.09	2313.09	7.71	30.98	349.26	318.28	2.09	0.054	0.0263	0.97
1	4300	1700.00	2313.09	2313.09	7.71	30.98	349.26	318.28	2.09	0.054	0.0263	0.97
1	4400	1700.00	2338.74	2338.64	7.11	53.44	185.71	132.27	2.74	0.050	0.0229	0.92
1	4400	1700.00	2338.74	2338.64	7.11	53.44	185.71	132.27	2.74	0.050	0.0229	0.92
1	4500	1600.00	2366.89	2366.71	7.21	40.85	157.60	116.76	2.89	0.045	0.0205	0.86
1	4500	1600.00	2366.89	2366.71	7.21	40.85	157.60	116.76	2.89	0.045	0.0205	0.86
1	4600	1500.00	2395.41	2395.41	8.04	18.48	122.36	103.88	2.41	0.045	0.0229	0.98
1	4600	1500.00	2395.41	2395.41	8.04	18.48	122.36	103.88	2.41	0.045	0.0229	0.98

HEC-RAS Plan: t4r5s7b River: t4r5s7b Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	4700	1500.00	2423.58	2423.47	5.95	70.32	254.40	184.07	1.58	0.045	0.0227	0.90
1	4700	1500.00	2423.58	2423.47	5.95	70.32	254.40	184.07	1.58	0.045	0.0227	0.90
1	4800	1500.00	2449.13	2449.13	9.40	48.16	111.54	63.37	3.13	0.045	0.0203	0.98
1	4800	1500.00	2449.13	2449.13	9.40	48.16	111.54	63.37	3.13	0.045	0.0203	0.98
1	4900	1300.00	2472.23	2471.97	5.88	35.87	167.24	131.37	2.23	0.045	0.0194	0.79
1	4900	1300.00	2472.23	2471.97	5.88	35.87	167.24	131.37	2.23	0.045	0.0194	0.79
1	5000	1300.00	2500.20	2500.20	7.23	15.61	129.46	113.85	2.19	0.045	0.0215	1.01
1	5000	1300.00	2500.20	2500.20	7.23	15.61	129.46	113.85	2.19	0.045	0.0215	1.01
1	5100	1000.00	2525.48	2525.48	9.67	15.30	55.70	40.40	3.48	0.045	0.0215	0.97
1	5100	1000.00	2525.48	2525.48	9.67	15.30	55.70	40.40	3.48	0.045	0.0215	0.97
1	5200	1000.00	2552.92	2552.92	8.53	11.69	69.92	58.22	2.92	0.045	0.0279	0.98
1	5200	1000.00	2552.92	2552.92	8.53	11.69	69.92	58.22	2.92	0.045	0.0279	0.98

HEC-RAS Plan: t4r5s14 River: T4R5S14 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1400.00	1527.61	1526.75	5.73	128.01	309.76	181.74	4.61	0.050		0.51
1	100	1400.00	1528.33	1526.68	6.14	151.00	204.84	53.84	5.33	0.046		0.51
1	200	1200.00	1538.70	1538.08	4.61	188.54	353.35	164.81	2.70	0.045	0.0071	0.57
1	200	1200.00	1538.83	1538.07	4.37	210.00	338.00	128.00	2.83	0.045	0.0071	0.53
1	300	1200.00	1551.02		3.99	112.91	316.41	203.50	3.52	0.046	0.0056	0.46
1	300	1200.00	1550.97		4.19	113.16	243.60	130.44	3.47	0.045	0.0056	0.49
1	400	1000.00	1569.10	1568.72	3.11	203.59	541.02	337.43	1.10	0.046	0.0067	0.52
1	400	1000.00	1569.18	1568.73	2.97	203.59	502.00	298.41	1.18	0.045	0.0067	0.48

HEC-RAS Plan: 1 River: T4R5S33 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2100.00	1455.49	1454.16	2.72	318.18	747.86	429.68	3.49	0.055		0.30
1	100	2100.00	1455.57	1454.16	2.76	362.00	658.00	296.00	3.57	0.055		0.30
1	200	2100.00	1469.37	1468.57	4.00	329.32	647.10	317.77	2.87	0.055	0.0050	0.50
1	200	2100.00	1469.38	1468.57	3.99	328.79	613.00	284.21	2.88	0.055	0.0050	0.50
1	300	2100.00	1483.49	1482.33	2.89	238.54	827.72	551.00	3.49	0.058	0.0050	0.32
1	300	2100.00	1483.54		2.93	238.60	731.44	458.09	3.54	0.058	0.0050	0.32
1	400	2100.00	1499.22	1498.56	3.61	125.30	484.97	359.67	2.22	0.055	0.0057	0.50
1	400	2100.00	1499.23	1498.55	3.58	124.82	485.21	360.39	2.23	0.055	0.0057	0.49
1	500	1400.00	1524.65	1523.65	3.90	86.57	664.87	506.56	4.65	0.057	0.0061	0.39
1	500	1400.00	1524.72	1523.62	3.97	147.56	613.00	406.56	4.72	0.057	0.0061	0.39
1	600	1400.00	1541.28	1540.66	3.25	292.09	718.57	399.75	3.98	0.058	0.0063	0.47
1	600	1400.00	1541.71	1540.93	3.76	503.53	718.74	215.21	4.41	0.055	0.0063	0.49
1	700	1400.00	1551.48	1550.15	2.77	113.55	379.81	266.26	3.48	0.055	0.0051	0.31
1	700	1400.00	1551.61	1550.16	2.74	135.00	331.00	196.00	3.61	0.055	0.0051	0.30
1	800	1400.00	1565.30	1564.87	4.08	158.92	412.33	253.42	2.30	0.055	0.0063	0.61
1	800	1400.00	1565.25	1564.87	4.23	159.47	411.31	251.84	2.25	0.055	0.0063	0.64
1	900	1400.00	1580.94	1579.99	2.66	295.93	674.87	378.94	1.94	0.056	0.0072	0.34
1	900	1400.00	1581.16		2.78	376.00	609.00	233.00	2.16	0.055	0.0072	0.33

HEC-RAS Plan: t4r6s1 River: t4r6s1 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	4800.00	1619.29	1618.16	6.46	33.97	399.09	365.12	6.29	0.057		0.52
1	100	4800.00	1620.33	1618.69	7.13	43.00	223.54	180.54	7.33	0.056		0.52
1	200	4800.00	1631.60	1630.49	6.88	236.39	596.00	359.62	6.60	0.051	0.0063	0.58
1	200	4800.00	1632.02		6.71	376.00	525.00	149.00	7.02	0.050	0.0063	0.54
1	300	4800.00	1641.48		5.97	239.79	472.52	232.73	7.48	0.050	0.0054	0.47
1	300	4800.00	1641.51		6.03	262.00	417.00	155.00	7.51	0.050	0.0054	0.47
1	400	4800.00	1651.85	1651.30	8.95	223.82	389.56	165.74	6.85	0.050	0.0075	0.77
1	400	4800.00	1652.01	1651.22	8.80	246.00	372.00	126.00	7.01	0.050	0.0075	0.75
1	500	4100.00	1669.73	1668.67	3.73	225.59	882.18	521.13	4.73	0.050	0.0098	0.43
1	500	4100.00	1669.75	1668.67	3.76	275.00	882.35	472.44	4.75	0.050	0.0098	0.44
1	600	4100.00	1682.71	1682.10	3.46	62.24	1335.55	921.16	3.71	0.057	0.0086	0.55
1	600	4100.00	1683.63	1683.05	5.24	662.31	1235.00	506.22	4.63	0.052	0.0086	0.64
1	700	4100.00	1697.97	1697.41	4.16	188.31	1048.36	853.64	2.97	0.052	0.0084	0.54
1	700	4100.00	1698.46	1697.56	4.28	637.00	1055.75	418.75	3.46	0.050	0.0084	0.50
1	800	4100.00	1712.92	1712.21	4.03	221.81	862.18	628.79	3.92	0.050	0.0084	0.55
1	800	4100.00	1712.88		4.34	262.00	860.48	579.91	3.88	0.050	0.0084	0.60
1	900	4100.00	1727.89		5.06	235.40	1186.45	361.90	3.89	0.050	0.0089	0.56
1	900	4100.00	1728.02		4.85	234.18	560.00	325.82	4.02	0.050	0.0089	0.53
1	1000	3700.00	1744.08	1743.60	5.00	70.63	1194.50	1123.88	5.08	0.050	0.0096	0.66
1	1000	3700.00	1744.01	1743.61	5.30	89.00	503.00	414.00	5.01	0.050	0.0096	0.72
1	1100	3700.00	1763.22	1762.78	4.57	98.35	832.80	734.45	4.22	0.049	0.0101	0.57
1	1100	3700.00	1763.67	1762.81	4.94	515.00	819.00	304.00	4.66	0.045	0.0101	0.55
1	1200	3700.00	1782.32	1781.92	5.73	0.00	555.28	534.81	2.32	0.055	0.0115	0.79
1	1200	3700.00	1782.89	1782.62	7.61	169.35	467.00	294.21	2.89	0.051	0.0115	0.90
1	1300	3700.00	1802.81	1802.16	4.22	7.18	609.19	587.66	2.81	0.048	0.0106	0.58
1	1300	3700.00	1803.22	1802.48	4.33	180.00	613.00	433.00	3.21	0.045	0.0106	0.54
1	1400	3700.00	1822.26	1821.81	6.15	0.00	525.24	525.24	4.26	0.051	0.0105	0.83
1	1400	3700.00	1822.70	1822.66	7.81	307.00	548.96	241.96	4.70	0.045	0.0105	0.98

HEC-RAS Plan: t4r6s1 River: t4r6s1 Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	3700.00	1835.88	1835.39	5.40	0.00	503.00	503.00	3.88	0.048	0.0108	0.59
1	1500	3700.00	1836.55		5.44	136.00	343.00	207.00	4.55	0.045	0.0108	0.53

HEC-RAS Plan: t4r6s2 River: t4r6s2a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2600.00	1659.34	1659.17	6.55	103.69	829.36	725.67	5.34	0.052		0.60
1	100	2600.00	1660.17	1659.72	7.31	386.75	587.00	200.25	6.17	0.049		0.61
1	200	2600.00	1668.09	1667.63	5.01	117.09	970.00	852.91	3.09	0.055	0.0083	0.53
1	200	2600.00	1668.93	1667.90	5.78	414.00	607.70	193.70	3.93	0.052	0.0083	0.54
1	300	2600.00	1684.92	1683.68	6.76	258.73	644.22	302.48	5.42	0.046	0.0051	0.58
1	300	2600.00	1685.23	1683.68	6.73	494.94	579.12	84.18	5.72	0.045	0.0051	0.55
1	400	2600.00	1696.12		8.32	76.16	780.57	704.40	6.12	0.050	0.0062	0.64
1	400	2600.00	1696.18		8.51	575.29	685.84	110.55	6.18	0.049	0.0062	0.66

HEC-RAS Plan: 1 River: T5R4S3 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1500.00	1728.02	1727.77	4.04	123.91	579.25	455.34	2.02	0.056		0.64
1	100	1500.00	1728.17	1727.80	4.23	168.00	425.00	257.00	2.17	0.055		0.63
1	200	1400.00	1783.85	1783.85	7.31	130.31	516.76	386.45	1.84	0.059	0.0207	1.03
1	200	1400.00	1784.82	1784.82	9.32	129.18	222.38	93.20	2.82	0.052	0.0207	1.04

HEC-RAS Plan: t5r4s7a River: T5R4S7A Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1200.00	1839.43	1838.54	6.69	81.40	150.04	68.64	4.43	0.055		0.65
1	100	1200.00	1839.43	1838.54	6.69	81.40	150.04	68.64	4.43	0.055		0.65
1	200	600.00	1856.01	1854.51	4.59	44.78	87.02	42.24	4.01	0.055	0.0107	0.46
1	200	600.00	1856.01	1854.51	4.59	44.77	87.02	42.25	4.01	0.055	0.0107	0.46
1	300	600.00	1875.77	1875.50	6.78	126.09	170.07	43.98	2.77	0.055	0.0123	0.84
1	300	600.00	1875.77	1875.50	6.78	126.10	170.06	43.97	2.77	0.055	0.0123	0.84
1	400	1200.00	1897.04	1896.71	5.10	92.58	398.89	306.32	3.04	0.055	0.0130	0.58
1	400	1200.00	1897.04	1896.71	5.10	92.54	398.90	306.36	3.04	0.055	0.0130	0.58

HEC-RAS Plan: t5r4s7b River: T5R4S7B Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	600.00	1859.29	1858.80	6.49	59.83	104.82	44.99	3.29	0.055		0.70
1	100	600.00	1859.29	1858.80	6.49	59.83	104.82	44.99	3.29	0.055		0.70
1	200	600.00	1884.22	1883.97	6.07	55.75	175.32	119.57	3.21	0.051	0.0142	0.67
1	200	600.00	1884.22	1883.97	6.07	55.74	175.33	119.59	3.21	0.051	0.0142	0.67

HEC-RAS Plan: 1 River: T5R4S19 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	700.00	1718.15	1717.45	4.62	261.93	357.14	95.21	3.15	0.050		0.58
1	100	700.00	1718.15	1717.45	4.62	261.93	357.14	95.21	3.15	0.050		0.58
1	200	700.00	1733.41	1732.54	4.79	82.91	181.43	98.52	3.41	0.045	0.0080	0.55
1	200	700.00	1733.41		4.79	82.91	181.42	98.51	3.41	0.045	0.0080	0.55
1	300	700.00	1747.35		5.48	85.31	152.62	67.31	3.35	0.050	0.0085	0.63
1	300	700.00	1747.35		5.48	85.31	152.62	67.31	3.35	0.050	0.0085	0.63
1	400	700.00	1767.27	1766.69	6.92	199.00	261.64	62.64	4.27	0.050	0.0104	0.65
1	400	700.00	1767.27	1766.69	6.92	199.00	261.63	62.63	4.27	0.050	0.0104	0.65
1	500	700.00	1783.05	1782.19	4.30	113.47	201.61	88.14	3.05	0.050	0.0105	0.54
1	500	700.00	1783.05	1782.19	4.30	113.46	201.62	88.16	3.05	0.050	0.0105	0.54
1	600	700.00	1801.33		5.79	161.34	215.97	54.63	3.33	0.050	0.0091	0.63
1	600	700.00	1801.33		5.79	161.34	215.97	54.63	3.33	0.050	0.0091	0.63
1	700	700.00	1820.56		4.97	55.24	138.11	82.87	3.56	0.050	0.0097	0.57
1	700	700.00	1820.56		4.97	55.23	138.11	82.88	3.56	0.050	0.0097	0.57
1	800	700.00	1839.48	1839.02	4.02	85.84	481.13	154.44	2.48	0.051	0.0116	0.60
1	800	700.00	1839.72	1839.26	4.49	383.99	482.44	98.45	2.72	0.050	0.0116	0.63

HEC-RAS Plan: t5r4s20a River: T5R4S20A Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	300	5000.00	1638.71	1638.25	4.00	175.68	1600.55	1424.87	2.71	0.054		0.64
1	300	5000.00	1639.71	1638.99	5.91	1124.81	1597.00	472.19	3.71	0.051		0.70
1	500	5000.00	1658.26	1658.26	9.01	140.54	523.52	382.98	3.26	0.045	0.0149	1.02
1	500	5000.00	1658.99	1658.99	10.14	309.00	466.00	157.00	3.99	0.040	0.0149	1.01
1	600	4500.00	1685.72	1685.68	8.71	24.99	394.21	369.22	3.72	0.043	0.0149	0.88
1	600	4500.00	1686.22	1685.96	9.55	74.00	208.00	134.00	4.22	0.040	0.0149	0.90
1	700	4000.00	1710.90	1710.73	7.32	82.18	426.17	343.99	2.90	0.043	0.0128	0.82
1	700	4000.00	1711.32	1710.93	7.83	79.41	258.00	178.59	3.32	0.040	0.0128	0.82
1	800	4000.00	1749.93	1749.93	9.57	67.00	456.17	389.17	3.93	0.047	0.0137	0.89
1	800	4000.00	1749.90	1749.90	11.05	230.00	385.00	155.00	3.90	0.046	0.0137	1.04
1	900	4000.00	1774.53	1774.41	9.34	24.18	250.88	226.70	6.53	0.041	0.0095	0.80
1	900	4000.00	1775.09	1774.12	8.82	28.00	123.00	95.00	7.09	0.040	0.0095	0.71
1	1000	4000.00	1802.12	1802.00	10.89	88.78	198.46	109.68	5.11	0.050	0.0131	0.89
1	1000	4000.00	1802.00	1802.00	11.22	89.53	197.98	108.46	5.00	0.050	0.0131	0.93
1	1100	4000.00	1820.62	1820.03	7.53	57.51	305.73	248.22	6.62	0.042	0.0098	0.66
1	1100	4000.00	1820.68	1820.03	7.40	57.29	307.29	250.00	6.68	0.042	0.0098	0.64
1	1200	2300.00	1837.49	1837.49	9.41	73.13	188.16	115.03	4.49	0.041	0.0100	0.95
1	1200	2300.00	1837.49	1837.49	9.41	73.13	188.16	115.03	4.49	0.041	0.0100	0.95
1	1300	1100.00	1852.32	1851.47	5.12	52.37	146.68	94.32	3.32	0.040	0.0125	0.60
1	1300	1100.00	1852.32	1851.47	5.12	52.37	146.68	94.32	3.32	0.040	0.0125	0.60
1	1400	1100.00	1886.85	1886.85	5.79	109.11	329.34	220.23	1.85	0.046	0.0141	0.98
1	1400	1100.00	1886.85	1886.85	5.79	109.11	329.34	220.23	1.85	0.046	0.0141	0.98
1	1450	3600.00	1914.56	1914.28	2.81	27.34	1618.91	1591.57	1.56	0.055	0.0147	0.54
1	1450	3600.00	1914.74	1914.39	3.14	57.00	1172.00	1115.00	1.74	0.056	0.0147	0.55
1	1500	3600.00	1926.54	1926.19	3.15	87.82	1278.00	1190.18	2.54	0.057	0.0106	0.52
1	1500	3600.00	1926.60	1926.15	3.19	97.00	1036.00	939.00	2.60	0.057	0.0106	0.51
1	1600	900.00	1947.21	1947.03	3.74	227.85	536.63	308.78	1.21	0.051	0.0129	0.72
1	1600	900.00	1947.20	1947.07	4.02	264.00	536.59	272.59	1.20	0.050	0.0129	0.78

HEC-RAS Plan: t5r4s20a River: T5R4S20A Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1700	900.00	1990.72	1990.52	4.64	56.07	516.17	441.14	2.72	0.055	0.0117	0.53
1	1700	900.00	1991.41	1990.93	5.14	355.66	492.80	137.14	3.41	0.052	0.0117	0.52
1	1800	2300.00	2004.54	2004.14	4.39	28.56	814.21	510.31	2.54	0.057	0.0131	0.76
1	1800	2300.00	2005.50		5.73	260.25	541.00	280.75	3.50	0.052	0.0131	0.80
1	1900	2300.00	2011.66	2011.38	5.28	164.31	1013.72	849.41	2.16	0.058	0.0163	0.72
1	1900	2300.00	2012.63	2011.91	6.57	405.00	581.02	176.02	3.13	0.057	0.0163	0.71
1	2000	3600.00	2029.05	2028.65	5.02	0.00	595.00	595.00	3.05	0.050	0.0114	0.74
1	2000	3600.00	2029.28		5.16	64.00	489.00	425.00	3.28	0.048	0.0114	0.71
1	2100	3000.00	2040.39		6.14	60.48	532.65	472.17	3.39	0.057	0.0133	0.75
1	2100	3000.00	2041.24	2041.00	8.43	231.88	459.00	227.12	4.24	0.053	0.0133	0.87
1	2200	3000.00	2060.92	2059.87	10.29	120.66	352.31	231.65	3.92	0.055	0.0130	0.92
1	2200	3000.00	2061.18		9.16	118.55	356.13	237.58	4.18	0.055	0.0130	0.79
1	2300	3000.00	2082.51	2082.05	6.32	140.22	371.09	230.87	2.51	0.046	0.0142	0.71
1	2300	3000.00	2082.31	2082.05	6.93	140.93	368.66	227.72	2.30	0.046	0.0142	0.81
1	2400	3000.00	2114.49	2114.49	9.58	212.43	357.96	145.53	3.49	0.046	0.0148	0.94
1	2400	3000.00	2114.56	2114.49	9.32	211.13	358.26	147.13	3.56	0.046	0.0148	0.90
1	2500	3000.00	2158.42	2157.96	8.79	155.79	263.27	107.48	4.42	0.046	0.0147	0.81
1	2500	3000.00	2158.35	2157.96	8.98	155.83	263.04	107.21	4.35	0.046	0.0147	0.84
1	2600	3000.00	2206.05	2205.86	9.61	211.51	356.37	144.86	4.05	0.049	0.0152	0.95
1	2600	3000.00	2206.12	2205.86	9.37	210.74	356.96	146.22	4.12	0.049	0.0152	0.91
1	2700	3000.00	2240.55	2240.09	10.62	100.62	191.69	91.06	4.55	0.048	0.0153	0.88
1	2700	3000.00	2240.46		10.85	100.85	190.92	90.07	4.46	0.048	0.0153	0.91
1	2800	3000.00	2270.19	2270.19	11.56	106.72	194.28	87.57	6.19	0.047	0.0139	0.87
1	2800	3000.00	2270.19	2270.19	11.56	106.72	194.28	87.57	6.19	0.047	0.0139	0.87
1	2900	3000.00	2296.29	2296.08	9.83	139.13	235.01	95.88	4.29	0.045	0.0152	0.90
1	2900	3000.00	2296.29	2296.08	9.83	139.13	235.01	95.88	4.29	0.045	0.0152	0.90

HEC-RAS Plan: 1 River: T5R420B Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1300.00	1671.53	1671.11	5.61	59.95	184.77	124.82	2.53	0.040		0.73
1	100	1300.00	1671.53	1671.11	5.61	59.95	184.77	124.82	2.53	0.040		0.73
1	200	1300.00	1700.34	1700.34	5.85	295.53	551.58	256.05	2.34	0.042	0.0173	1.02
1	200	1300.00	1700.44	1700.44	5.99	356.00	552.57	196.57	2.44	0.040	0.0173	1.00
1	300	1300.00	1729.96	1729.52	5.72	163.82	471.65	307.83	1.96	0.051	0.0149	0.72
1	300	1300.00	1730.83	1730.16	7.24	310.36	385.00	74.64	2.83	0.047	0.0149	0.76

HEC-RAS Plan: Plan 01 River: T5R4S21 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	4300.00	1672.63	1671.83	5.37	150.49	646.66	496.17	3.63	0.058		0.57
1	100	4300.00	1672.75	1671.85	5.45	161.00	438.00	277.00	3.75	0.058		0.57
1	200	4300.00	1726.52	1726.32	7.95	147.08	737.34	590.25	4.52	0.056	0.0141	0.89
1	200	4300.00	1727.50	1727.27	9.97	151.00	378.48	227.48	5.50	0.057	0.0141	0.95
1	300	4000.00	1760.30	1760.30	7.66	138.31	974.52	836.21	5.30	0.052	0.0127	0.59
1	300	4000.00	1760.31	1760.03	9.41	780.00	959.00	179.00	5.31	0.049	0.0127	0.73
1	400	4000.00	1780.95	1780.95	6.79	145.92	879.13	695.60	2.95	0.052	0.0143	0.89
1	400	4000.00	1781.35	1781.12	7.19	601.00	851.00	250.00	3.35	0.049	0.0143	0.85
1	500	3600.00	1801.19		6.72	168.48	669.33	500.84	3.19	0.052	0.0138	0.73
1	500	3600.00	1801.69		7.53	195.00	460.00	265.00	3.69	0.050	0.0138	0.74
1	600	3600.00	1825.22		6.31	230.46	922.54	568.03	3.22	0.053	0.0118	0.74
1	600	3600.00	1825.99		7.66	764.00	919.00	155.00	3.99	0.045	0.0118	0.78
1	700	3600.00	1866.24		8.50	136.79	572.94	436.15	3.24	0.053	0.0134	0.86
1	700	3600.00	1867.14		9.63	157.00	269.32	112.32	4.14	0.048	0.0134	0.85
1	800	3600.00	1896.06	1895.55	6.63	162.42	564.14	401.72	3.06	0.055	0.0122	0.69
1	800	3600.00	1896.79	1896.08	7.56	193.00	372.42	179.42	3.79	0.051	0.0122	0.70
1	900	3600.00	1917.84	1917.84	9.52	515.84	874.44	358.60	4.84	0.050	0.0103	0.79
1	900	3600.00	1918.74	1918.07	10.88	796.00	857.00	61.00	5.74	0.045	0.0103	0.82
1	1000	2800.00	1945.36	1945.31	10.60	185.00	352.77	167.77	4.36	0.052	0.0127	0.90
1	1000	2800.00	1946.35	1945.50	10.29	223.47	290.44	66.97	5.35	0.049	0.0127	0.79
1	1100	2800.00	1973.41	1972.35	9.98	134.95	228.16	93.21	6.41	0.050	0.0099	0.70
1	1100	2800.00	1973.11		10.64	136.48	226.18	89.70	6.10	0.050	0.0099	0.77
1	1200	2800.00	1989.81	1989.31	9.82	112.19	225.91	113.71	4.81	0.050	0.0103	0.79
1	1200	2800.00	1990.04	1989.31	9.24	111.91	228.26	116.35	5.04	0.050	0.0103	0.73
1	1300	2300.00	2029.37	2029.18	10.30	111.26	240.60	129.34	4.37	0.053	0.0126	0.88
1	1300	2300.00	2029.18	2029.18	11.02	111.64	237.45	125.81	4.18	0.053	0.0126	0.96
1	1400	2300.00	2065.27	2064.76	9.58	102.91	181.64	78.73	5.27	0.046	0.0121	0.78
1	1400	2300.00	2065.47	2064.76	9.13	102.13	182.81	80.68	5.47	0.047	0.0121	0.73

HEC-RAS Plan: Plan 01 River: T5R4S21 Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	2300.00	2117.81	2117.81	10.87	145.87	245.35	99.48	3.81	0.050	0.0148	0.98
1	1500	2300.00	2117.81	2117.81	10.87	145.87	245.35	99.48	3.81	0.050	0.0148	0.98
1	1600	2300.00	2178.07	2178.07	11.10	129.42	217.00	87.58	5.07	0.048	0.0162	0.88
1	1600	2300.00	2178.07	2178.07	11.10	129.42	217.00	87.58	5.07	0.048	0.0162	0.88

HEC-RAS Plan: t5r5s8 River: t5r5s8 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	400.00	1793.39	1792.55	3.58	166.38	324.15	157.77	2.39	0.045		0.61
1	100	400.00	1793.43	1792.55	3.54	221.00	329.73	108.73	2.43	0.045		0.61
1	200	400.00	1806.98	1806.54	3.87	127.80	209.94	82.14	1.98	0.045	0.0109	0.61
1	200	400.00	1806.99	1806.54	3.87	127.78	210.00	82.23	1.99	0.045	0.0109	0.61
1	300	400.00	1822.71	1822.45	4.02	94.16	214.81	120.64	1.71	0.046	0.0123	0.70
1	300	400.00	1822.74	1822.44	4.05	92.36	189.00	96.64	1.74	0.045	0.0123	0.71
1	400	400.00	1835.47	1834.94	5.29	133.02	188.56	55.54	2.47	0.045	0.0111	0.65
1	400	400.00	1835.51	1834.95	5.25	140.00	176.00	36.00	2.51	0.045	0.0111	0.64
1	500	400.00	1850.47	1850.36	3.94	97.06	321.67	224.61	1.47	0.049	0.0120	0.66
1	500	400.00	1850.68	1850.39	4.48	157.00	225.00	68.00	1.68	0.045	0.0120	0.69
1	600	400.00	1872.24	1871.86	3.99	125.10	222.56	83.44	1.74	0.045	0.0118	0.64
1	600	400.00	1872.27		3.88	124.83	222.67	84.43	1.77	0.045	0.0118	0.62
1	700	400.00	1887.14	1886.86	3.65	206.84	314.48	107.64	1.14	0.045	0.0122	0.64
1	700	400.00	1887.12	1886.86	3.74	207.22	314.34	107.12	1.12	0.045	0.0122	0.66
1	750	700.00	1910.23	1910.04	3.46	30.69	429.75	292.84	1.23	0.045	0.0147	0.72
1	750	700.00	1910.25	1910.04	3.40	30.13	430.15	297.01	1.25	0.045	0.0147	0.70
1	800	700.00	1917.79	1917.44	3.51	110.37	543.41	433.04	1.79	0.048	0.0088	0.49
1	800	700.00	1917.78	1917.44	3.54	113.30	542.52	429.22	1.78	0.048	0.0088	0.50
1	900	700.00	1938.23	1938.23	3.69	71.56	555.18	483.62	1.23	0.045	0.0131	1.00
1	900	700.00	1938.23	1938.23	3.71	75.00	524.00	449.00	1.23	0.045	0.0131	1.01
1	1000	700.00	1955.85	1955.26	3.27	105.73	339.86	161.18	1.75	0.045	0.0132	0.50
1	1000	700.00	1955.85	1955.26	3.27	105.72	339.88	161.27	1.75	0.045	0.0132	0.50
1	1100	700.00	1973.79	1973.79	6.22	101.84	196.45	94.61	1.29	0.045	0.0135	1.01
1	1100	700.00	1973.79	1973.79	6.22	101.84	196.45	94.61	1.29	0.045	0.0135	1.01

HEC-RAS Plan: t5r5s10a River: t5r5s10a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2100.00	1850.86	1850.41	4.93	22.20	274.00	251.80	2.86	0.059		0.63
1	100	2100.00	1851.03	1850.48	5.17	39.00	236.00	197.00	3.03	0.060		0.63
1	200	2100.00	1870.19	1869.34	4.34	14.65	328.96	314.31	5.19	0.059	0.0107	0.48
1	200	2100.00	1870.34	1869.30	4.45	71.00	248.00	177.00	5.33	0.060	0.0107	0.48
1	300	2100.00	1882.02	1881.46	5.49	143.44	495.21	197.30	4.02	0.040	0.0098	0.69
1	300	2100.00	1882.05	1881.46	5.40	142.35	495.61	203.68	4.05	0.040	0.0098	0.68
1	400	2100.00	1901.06	1900.92	5.59	65.38	647.11	334.20	3.06	0.040	0.0129	0.90
1	400	2100.00	1901.06	1900.90	5.66	89.00	647.13	310.69	3.06	0.040	0.0129	0.91
1	500	2100.00	1918.07	1917.29	6.16	154.33	325.93	134.30	4.07	0.040	0.0105	0.67
1	500	2100.00	1918.09	1917.29	6.11	157.00	324.00	130.64	4.09	0.040	0.0105	0.66
1	600	2100.00	1929.13	1929.13	9.04	204.69	489.02	284.33	6.13	0.044	0.0090	0.69
1	600	2100.00	1928.61	1928.61	12.48	367.00	402.00	35.00	5.61	0.040	0.0090	1.00
1	700	2100.00	1949.85	1949.85	8.85	76.86	468.00	391.14	2.85	0.052	0.0135	0.96
1	700	2100.00	1950.93	1950.25	7.65	164.00	296.42	132.42	3.93	0.051	0.0135	0.70
1	800	2100.00	1968.21	1968.21	6.73	17.34	642.18	624.84	5.21	0.045	0.0106	0.61
1	800	2100.00	1967.66	1967.66	10.20	489.00	553.00	64.00	4.66	0.040	0.0106	1.00
1	900	2100.00	1985.53	1985.53	8.10	61.62	446.52	384.90	4.53	0.046	0.0133	0.70
1	900	2100.00	1986.10		10.13	221.00	265.00	44.00	5.10	0.040	0.0133	0.82

HEC-RAS Plan: t5r5s13a River: t5r5s13a Reach: t5r5s13a

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t5r5s13a	100	300	1777.47	1777.09	3.49	224.53	346.95	122.42	1.46	0.052		0.51
t5r5s13a	100	300	1777.47	1777.09	3.49	224.53	346.95	122.42	1.46	0.052		0.51

HEC-RAS Plan: t5r5s13b River: T5R5S13B Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vol Chan	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(acre-ft)	(ft)	(ft)	(ft)	(ft)			
1	100	300.00	1783.61	1782.78		37.93	137.43	99.51	2.91	0.055		0.47
1	100	300.00	1783.61	1782.78		37.93	137.43	99.51	2.91	0.055		0.47
1	200	300.00	1788.75	1788.14	2.08	279.40	396.08	116.69	1.75	0.040	0.0069	0.42
1	200	300.00	1788.75	1788.14	2.08	279.40	396.08	116.69	1.75	0.040	0.0069	0.42
1	300	300.00	1798.72		4.57	57.24	103.32	46.08	1.72	0.055	0.0082	0.82
1	300	300.00	1798.72		4.57	57.24	103.32	46.08	1.72	0.055	0.0082	0.82
1	400	300.00	1818.61	1817.74	7.31	71.33	143.93	72.60	2.60	0.055	0.0113	0.42
1	400	300.00	1818.61	1817.74	7.31	71.33	143.93	72.60	2.60	0.055	0.0113	0.42
1	500	300.00	1835.70	1835.41	10.36	204.06	277.41	73.36	1.70	0.055	0.0111	0.68
1	500	300.00	1835.70	1835.41	10.36	204.06	277.41	73.36	1.70	0.055	0.0111	0.68
1	600	300.00	1867.58	1867.33	17.41	250.00	625.11	375.11	0.58	0.055	0.0140	0.41
1	600	300.00	1867.58	1867.33	17.41	250.00	625.11	375.11	0.58	0.055	0.0140	0.41

HEC-RAS Plan: t5r5s14 River: t5r5s14 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1200.00	1810.72	1810.42	7.49	94.57	287.05	192.49	3.72	0.053		0.72
1	100	1200.00	1811.72	1810.93	8.92	165.66	209.06	43.40	4.72	0.052		0.76
1	200	1200.00	1828.15	1827.52	4.27	38.46	372.65	334.19	3.15	0.052	0.0107	0.53
1	200	1200.00	1829.12	1828.13	5.37	281.00	356.00	75.00	4.12	0.050	0.0107	0.55
1	300	1200.00	1849.18	1849.18	6.65	174.91	436.39	261.48	3.18	0.051	0.0116	0.75
1	300	1200.00	1849.53	1849.15	7.59	256.00	313.00	57.00	3.53	0.050	0.0116	0.80

HEC-RAS Plan: t5r5s16 River: t5r5s16 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	500.00	1792.84	1792.44	5.60	61.68	132.89	71.20	2.84	0.046		0.73
1	100	500.00	1792.84	1792.44	5.60	61.68	132.89	71.21	2.84	0.046		0.73
1	200	500.00	1805.11	1804.47	5.31	87.10	137.87	50.76	2.61	0.045	0.0117	0.65
1	200	500.00	1805.11	1804.47	5.31	87.11	137.87	50.76	2.61	0.045	0.0117	0.65
1	300	500.00	1817.98	1817.55	5.69	177.11	222.93	45.83	2.48	0.045	0.0115	0.73
1	300	500.00	1817.98	1817.55	5.69	177.11	222.93	45.82	2.48	0.045	0.0115	0.72
1	400	500.00	1831.16	1830.65	4.26	149.43	254.64	87.55	3.16	0.045	0.0115	0.64
1	400	500.00	1831.16	1830.65	4.26	149.44	254.64	87.53	3.16	0.045	0.0115	0.64
1	500	500.00	1846.06	1845.93	5.30	133.63	260.58	126.96	3.06	0.048	0.0129	0.76
1	500	500.00	1846.21		5.63	207.00	260.58	53.58	3.21	0.045	0.0129	0.77
1	600	500.00	1857.09		6.32	125.84	181.07	55.22	3.09	0.046	0.0120	0.68
1	600	500.00	1857.13	1856.62	6.20	125.30	181.57	56.27	3.13	0.046	0.0120	0.66

HEC-RAS Plan: t5r5s17 River: t5r5s17 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	600.00	1825.42	1825.26	5.44	63.78	234.54	170.76	2.42	0.045		0.69
1	100	600.00	1826.41	1825.78	6.79	165.91	199.00	33.09	3.41	0.041		0.70
1	200	600.00	1837.64	1837.57	6.42	33.80	97.74	63.94	1.64	0.040	0.0129	0.94
1	200	600.00	1837.76	1837.57	5.92	33.19	98.17	64.98	1.76	0.040	0.0129	0.84
1	300	600.00	1849.03	1848.77	4.76	9.04	195.39	186.34	2.03	0.046	0.0114	0.63
1	300	600.00	1849.80	1849.45	7.00	29.00	71.36	42.36	2.80	0.042	0.0114	0.77
1	400	600.00	1859.25	1859.12	3.95	63.98	438.60	248.43	1.25	0.040	0.0106	0.74
1	400	600.00	1859.42	1859.12	3.21	49.55	440.05	276.53	1.42	0.041	0.0106	0.55

HEC-RAS Plan: t5r5s18 River: t5r5s18 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2000.00	1813.74	1813.50	3.50	33.13	769.92	736.79	3.73	0.050		0.65
1	100	2000.00	1813.76	1813.50	3.55	125.00	737.00	612.00	3.75	0.050		0.65
1	200	2000.00	1829.31	1828.92	4.25	0.00	510.00	510.00	2.31	0.055	0.0133	0.56
1	200	2000.00	1830.22	1829.50	5.83	189.00	317.00	128.00	3.22	0.050	0.0133	0.63
1	300	2000.00	1845.37	1844.91	4.22	31.49	409.33	377.84	3.37	0.055	0.0102	0.58
1	300	2000.00	1845.61		4.01	95.00	360.00	265.00	3.61	0.055	0.0102	0.52
1	400	2000.00	1864.82	1864.59	6.73	8.32	239.35	231.03	2.82	0.052	0.0142	0.76
1	400	2000.00	1864.84	1864.64	7.87	55.00	158.00	103.00	2.84	0.050	0.0142	0.88
1	500	2000.00	1883.34	1882.78	4.46	0.00	276.00	276.00	2.34	0.051	0.0124	0.56
1	500	2000.00	1883.49	1882.78	4.11	0.00	276.00	276.00	2.49	0.051	0.0124	0.50
1	600	2000.00	1899.78	1899.73	8.17	38.82	270.19	231.37	2.78	0.052	0.0119	0.90
1	600	2000.00	1900.60	1900.60	10.69	149.05	206.00	56.95	3.60	0.046	0.0119	1.02
1	700	2000.00	1917.43	1916.88	3.26	20.98	527.76	506.78	2.43	0.052	0.0125	0.51
1	700	2000.00	1917.58	1916.88	2.97	15.73	538.33	522.61	2.57	0.052	0.0125	0.44
1	800	2000.00	1931.93	1931.73	9.41	70.20	217.46	147.26	3.92	0.051	0.0102	0.92
1	800	2000.00	1932.57	1932.57	11.91	146.92	200.00	53.08	4.57	0.049	0.0102	1.06
1	900	2000.00	1949.44	1948.95	8.52	28.17	148.65	120.48	5.43	0.052	0.0121	0.70
1	900	2000.00	1949.89	1948.95	7.41	20.04	154.53	134.48	5.89	0.052	0.0121	0.58
1	1000	2000.00	1962.84	1961.86	5.99	63.19	173.05	109.86	3.84	0.045	0.0103	0.61
1	1000	2000.00	1962.49	1961.86	6.76	65.75	171.86	106.11	3.49	0.045	0.0103	0.71
1	1100	2000.00	1990.51	1990.51	9.02	12.64	161.68	149.03	3.51	0.048	0.0174	0.92
1	1100	2000.00	1990.51	1990.51	9.02	12.64	161.68	149.03	3.51	0.048	0.0174	0.92
1	1200	2000.00	2014.88	2014.88	9.08	4.01	135.54	131.53	4.88	0.046	0.0167	0.87
1	1200	2000.00	2014.90	2014.76	9.90	66.00	125.00	59.00	4.90	0.045	0.0167	0.94
1	1300	2000.00	2041.12	2040.88	5.84	72.01	331.91	259.90	3.12	0.051	0.0178	0.77
1	1300	2000.00	2041.41	2040.94	5.66	115.00	284.00	169.00	3.41	0.050	0.0178	0.69
1	1400	2000.00	2065.67	2065.40	4.42	0.00	566.75	471.15	5.67	0.051	0.0154	0.70
1	1400	2000.00	2065.85	2065.54	5.08	155.00	524.00	306.24	5.85	0.050	0.0154	0.79

HEC-RAS Plan: t5r5s18 River: t5r5s18 Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	500.00	2083.63	2083.61	4.72	38.95	352.80	313.85	1.63	0.048	0.0189	0.68
1	1500	500.00	2084.46	2083.63	4.54	122.00	169.00	47.00	2.46	0.045	0.0189	0.52
1	1600	500.00	2103.38	2103.33	4.73	85.24	309.57	224.33	1.38	0.049	0.0140	0.77
1	1600	500.00	2103.40	2103.40	6.28	127.00	193.00	66.00	1.40	0.045	0.0140	1.01
1	1700	500.00	2127.48	2127.30	3.08	137.16	392.08	239.96	2.48	0.050	0.0166	0.66
1	1700	500.00	2127.59	2127.30	2.65	136.07	392.69	244.80	2.59	0.050	0.0166	0.53
1	1800	500.00	2151.45	2151.37	3.96	80.81	394.50	250.04	1.45	0.051	0.0200	0.73
1	1800	500.00	2151.40	2151.40	5.36	222.00	394.28	104.70	1.40	0.050	0.0200	1.00
1	1900	500.00	2177.80	2177.61	3.58	103.18	341.18	213.60	1.79	0.050	0.0194	0.70
1	1900	500.00	2178.02	2177.62	3.04	162.00	342.08	180.08	2.02	0.050	0.0194	0.56
1	2000	500.00	2209.91	2209.74	3.99	2.12	578.49	168.67	1.91	0.055	0.0213	0.73
1	2000	500.00	2209.74	2209.74	4.98	5.95	577.58	153.58	1.74	0.055	0.0213	0.97
1	2100	2200.00	2250.36	2250.21	5.04	38.32	821.96	410.75	2.36	0.055	0.0284	0.84
1	2100	2200.00	2250.41	2250.22	4.82	35.36	822.78	420.00	2.41	0.055	0.0284	0.79

HEC-RAS Plan: t5r5s21a River: t5r5s21a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	600.00	1758.25	1757.84	3.23	152.54	319.08	166.54	1.25	0.055		0.53
1	100	600.00	1758.25	1757.84	3.22	152.53	316.00	163.47	1.25	0.055		0.53
1	200	600.00	1774.55	1774.13	3.33	59.57	278.25	218.68	1.55	0.055	0.0113	0.52
1	200	600.00	1774.59	1774.12	3.38	132.00	267.00	135.00	1.59	0.055	0.0113	0.52
1	300	600.00	1794.84	1794.58	3.55	54.11	381.93	327.82	1.84	0.055	0.0106	0.52
1	300	600.00	1795.13	1794.54	3.97	230.00	318.00	88.00	2.13	0.055	0.0106	0.53

HEC-RAS Plan: t5r5s21b River: T5R5S21b Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	900.00	1746.27	1745.63	3.04	33.44	536.77	503.33	3.27	0.051		0.43
1	100	900.00	1746.27	1745.63	3.04	33.44	536.77	503.33	3.27	0.051		0.43
1	200	900.00	1760.27	1760.24	5.19	107.91	768.07	606.80	1.27	0.058	0.0127	0.88
1	200	900.00	1760.27	1760.24	5.19	107.91	768.07	606.80	1.27	0.058	0.0127	0.88
1	300	900.00	1780.29	1779.57	3.45	33.43	605.77	417.09	2.79	0.050	0.0103	0.45
1	300	900.00	1780.29	1779.57	3.45	33.43	605.77	417.09	2.79	0.050	0.0103	0.45
1	400	900.00	1790.56	1790.56	6.13	19.91	338.23	318.32	3.56	0.043	0.0102	0.62
1	400	900.00	1790.56	1790.56	6.13	19.91	338.23	318.32	3.56	0.043	0.0102	0.62
1	500	900.00	1804.88	1804.88	5.95	2.78	603.54	569.06	2.88	0.045	0.0115	0.67
1	500	900.00	1804.88	1804.88	5.95	2.78	603.54	569.06	2.88	0.045	0.0115	0.67
1	600	300.00	1823.39	1823.34	4.79	117.16	190.13	72.97	0.89	0.045	0.0113	0.91
1	600	300.00	1823.39	1823.34	4.79	117.16	190.13	72.97	0.89	0.045	0.0113	0.91
1	700	300.00	1836.83	1836.29	4.11	114.11	229.05	47.66	1.83	0.040	0.0114	0.58
1	700	300.00	1836.83	1836.29	4.11	114.11	229.05	47.66	1.83	0.040	0.0114	0.58
1	800	300.00	1848.22	1848.02	6.78	111.56	134.71	23.15	2.22	0.040	0.0093	0.86
1	800	300.00	1848.22	1848.02	6.78	111.56	134.71	23.15	2.22	0.040	0.0093	0.86
1	900	300.00	1867.38	1867.17	3.90	38.36	196.82	74.80	1.38	0.040	0.0151	0.73
1	900	300.00	1867.38	1867.17	3.90	38.36	196.82	74.80	1.38	0.040	0.0151	0.73
1	1000	300.00	1886.11	1886.00	4.07	122.85	243.01	120.17	1.11	0.040	0.0146	0.80
1	1000	300.00	1886.11	1886.00	4.07	122.85	243.01	120.17	1.11	0.040	0.0146	0.80
1	1100	300.00	1899.24	1899.04	3.46	108.85	340.06	132.67	1.24	0.040	0.0133	0.67
1	1100	300.00	1899.24	1899.04	3.46	108.85	340.06	132.67	1.24	0.040	0.0133	0.67

HEC-RAS Plan: t5r5s23a River: t5r5s23a Reach: t5r5s23a

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t5r5s23a	100	1100.00	1724.10	1723.49	6.26	185.70	267.75	82.04	4.10	0.030		0.71
t5r5s23a	100	1100.00	1724.10	1723.49	6.26	185.70	267.75	82.04	4.10	0.030		0.71
t5r5s23a	200	1100.00	1730.65	1729.78	6.56	199.24	255.34	56.10	4.65	0.030	0.0042	0.67
t5r5s23a	200	1100.00	1730.65		6.56	199.24	255.34	56.11	4.65	0.030	0.0042	0.67
t5r5s23a	300	1100.00	1740.60	1739.97	3.12	382.44	684.11	301.67	2.60	0.045	0.0061	0.46
t5r5s23a	300	1100.00	1740.60	1739.97	3.12	382.45	684.11	301.66	2.60	0.045	0.0061	0.46
t5r5s23a	400	1100.00	1760.44	1760.44	4.72	114.56	537.27	404.57	2.44	0.046	0.0132	0.95
t5r5s23a	400	1100.00	1760.44	1760.44	4.72	114.56	537.27	404.57	2.44	0.046	0.0132	0.95
t5r5s23a	500	1100.00	1777.11	1776.63	4.31	98.22	435.33	337.11	2.11	0.047	0.0124	0.53
t5r5s23a	500	1100.00	1777.11	1776.63	4.31	98.22	435.33	337.11	2.11	0.047	0.0124	0.53
t5r5s23a	600	1100.00	1797.64	1797.64	7.61	65.56	265.57	200.01	2.64	0.053	0.0119	1.02
t5r5s23a	600	1100.00	1797.64	1797.64	7.61	65.56	265.57	200.01	2.64	0.053	0.0119	1.02
t5r5s23a	700	1100.00	1808.37	1807.99	4.29	25.67	535.59	509.93	2.37	0.058	0.0120	0.52
t5r5s23a	700	1100.00	1808.37	1807.99	4.29	25.67	535.59	509.93	2.37	0.058	0.0120	0.52
t5r5s23a	800	1100.00	1827.26	1827.26	7.67	19.35	409.64	390.29	2.26	0.057	0.0122	1.02
t5r5s23a	800	1100.00	1827.26	1827.26	7.67	19.35	409.64	390.29	2.26	0.057	0.0122	1.02
t5r5s23a	900	1100.00	1841.31		2.95	37.24	431.41	394.17	2.31	0.046	0.0118	0.49
t5r5s23a	900	1100.00	1841.31		2.95	37.24	431.41	394.17	2.31	0.046	0.0118	0.49
t5r5s23a	1000	1100.00	1859.01	1859.01	7.44	0.00	247.00	247.00	2.01	0.054	0.0113	0.95
t5r5s23a	1000	1100.00	1859.01	1859.01	7.44	0.00	247.00	247.00	2.01	0.054	0.0113	0.95
t5r5s23a	1100	1100.00	1871.51	1871.07	5.04	117.49	386.93	269.44	3.01	0.050	0.0097	0.54
t5r5s23a	1100	1100.00	1871.51	1871.07	5.04	117.49	386.93	269.44	3.01	0.050	0.0097	0.54

HEC-RAS Plan: t5r5s23b River: t5r5s23b Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	200	4900.00	1748.45	1747.77	4.75	72.63	922.70	694.82	4.45	0.051		0.63
1	200	4900.00	1748.57	1747.81	4.75	176.00	876.00	579.65	4.57	0.050		0.63
1	300	4900.00	1760.65	1759.94	3.52	16.99	1042.82	956.81	5.65	0.051	0.0088	0.50
1	300	4900.00	1760.77	1760.05	3.62	129.00	1018.00	843.45	5.77	0.050	0.0088	0.50
1	400	4900.00	1777.22	1776.84	4.18	139.40	1283.51	1010.55	6.22	0.050	0.0102	0.66
1	400	4900.00	1777.23	1776.84	4.16	139.15	1283.86	1012.43	6.23	0.050	0.0102	0.65
1	500	3700.00	1800.88	1800.09	3.41	72.36	1565.95	719.60	3.88	0.055	0.0119	0.49
1	500	3700.00	1801.77	1800.72	3.38	203.00	1367.00	774.55	4.77	0.050	0.0119	0.50
1	600	3700.00	1811.72	1811.20	4.43	183.69	1543.66	601.74	4.72	0.051	0.0089	0.64
1	600	3700.00	1812.03		4.14	200.00	1448.00	548.84	5.03	0.050	0.0089	0.57
1	675	3700.00	1828.08		3.88	33.27	699.26	666.00	5.08	0.051	0.0105	0.53
1	675	3700.00	1828.05		4.19	109.00	657.00	548.00	5.05	0.050	0.0105	0.58
1	700	3700.00	1831.60	1830.98	4.35	43.90	528.66	484.76	3.60	0.050	0.0125	0.55
1	700	3700.00	1831.71	1830.98	4.21	84.00	519.00	435.00	3.71	0.050	0.0125	0.52
1	800	1600.00	1849.08	1849.08	6.66	0.00	578.75	578.75	3.08	0.055	0.0117	0.70
1	800	1600.00	1849.08	1849.08	6.66	0.00	578.75	578.75	3.08	0.055	0.0117	0.70
1	900	2800.00	1868.75	1868.39	3.24	76.68	1245.09	1113.25	3.75	0.045	0.0115	0.64
1	900	2800.00	1868.78	1868.35	3.30	76.20	1150.00	1024.89	3.78	0.045	0.0115	0.64
1	1000	2800.00	1883.72		5.58	401.11	893.68	168.53	3.72	0.050	0.0101	0.57
1	1000	2800.00	1883.73		5.57	401.08	893.72	168.63	3.73	0.050	0.0101	0.57
1	1100	2800.00	1905.59	1905.09	4.52	326.89	1322.94	414.86	3.59	0.050	0.0106	0.65
1	1100	2800.00	1905.59	1905.09	4.54	326.94	1322.91	414.23	3.59	0.050	0.0106	0.65
1	1200	2800.00	1919.55	1918.87	5.64	180.62	1280.06	240.56	5.55	0.045	0.0104	0.69
1	1200	2800.00	1919.56	1918.87	5.63	180.49	1280.17	241.01	5.56	0.045	0.0104	0.69
1	1300	2800.00	1946.91	1946.62	4.59	128.62	1027.92	611.64	2.91	0.047	0.0139	0.72
1	1300	2800.00	1947.37	1947.03	5.10	410.00	996.00	382.44	3.37	0.045	0.0139	0.75
1	1400	2600.00	1966.29	1966.06	6.70	116.09	499.60	383.51	3.29	0.047	0.0109	0.67
1	1400	2600.00	1967.14		7.64	143.00	244.84	101.84	4.14	0.046	0.0109	0.67

HEC-RAS Plan: t5r5s23b River: t5r5s23b Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	2600.00	1980.52		5.28	150.16	443.16	292.99	3.52	0.045	0.0104	0.71
1	1500	2600.00	1980.63	1980.14	4.95	153.00	447.85	294.85	3.63	0.045	0.0104	0.65
1	1600	4700.00	1994.09	1993.55	4.83	14.76	712.00	656.24	4.09	0.047	0.0127	0.72
1	1600	4700.00	1993.88		5.75	18.23	712.00	525.40	3.88	0.047	0.0127	0.78
1	1700	3000.00	2018.78	2018.71	5.93	110.70	605.37	475.02	2.78	0.042	0.0152	0.88
1	1700	3000.00	2018.94	2018.74	5.80	122.00	472.00	344.74	2.94	0.040	0.0152	0.84
1	1800	1400.00	2033.82		4.77	130.37	416.79	286.41	2.82	0.046	0.0115	0.58
1	1800	1400.00	2034.15		5.79	267.00	367.00	100.00	3.14	0.040	0.0115	0.66
1	1900	1400.00	2058.73	2058.73	7.90	142.79	318.57	175.78	2.73	0.046	0.0119	0.92
1	1900	1400.00	2059.20	2059.20	9.51	153.00	206.00	53.00	3.20	0.040	0.0119	1.01

HEC-RAS Plan: t5r5s25a River: T5R5S25A Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1200.00	1703.08	1701.98	4.19	130.10	281.44	151.34	5.08	0.054		0.49
1	100	1200.00	1703.08	1701.95	4.19	130.10	281.44	151.34	5.08	0.054		0.49
1	200	1200.00	1718.66	1717.38	3.88	35.43	183.79	148.36	4.66	0.055	0.0072	0.44
1	200	1200.00	1718.66	1717.38	3.88	35.43	183.78	148.35	4.66	0.055	0.0072	0.44
1	300	1200.00	1735.79		9.01	189.65	274.94	85.29	4.79	0.047	0.0079	0.76
1	300	1200.00	1735.79		9.01	189.65	274.95	85.30	4.79	0.047	0.0079	0.76
1	400	1200.00	1752.74		3.36	23.21	232.77	209.56	4.74	0.054	0.0048	0.29
1	400	1200.00	1752.74		3.36	23.21	232.76	209.55	4.74	0.054	0.0048	0.29
1	500	1200.00	1768.25	1768.25	9.04	46.67	115.12	68.45	3.25	0.053	0.0088	0.95
1	500	1200.00	1768.25	1768.25	9.04	46.67	115.12	68.45	3.25	0.053	0.0088	0.95
1	600	500.00	1789.00		2.69	160.38	229.20	68.82	4.00	0.055	0.0106	0.29
1	600	500.00	1789.00		2.69	160.38	229.20	68.82	4.00	0.055	0.0106	0.29
1	700	500.00	1809.97	1809.97	6.81	63.22	114.79	51.57	1.97	0.045	0.0140	1.01
1	700	500.00	1809.97	1809.97	6.81	63.22	114.79	51.57	1.97	0.045	0.0140	1.01
1	800	500.00	1828.60	1827.94	2.92	85.00	208.26	123.26	1.60	0.055	0.0136	0.44
1	800	500.00	1828.60	1827.94	2.92	85.00	208.26	123.26	1.60	0.055	0.0136	0.44
1	900	500.00	1849.70		5.22	134.46	207.93	73.47	1.70	0.055	0.0115	0.73
1	900	500.00	1849.72		5.24	134.42	194.00	59.58	1.72	0.055	0.0115	0.73
1	1000	500.00	1868.53	1867.92	2.78	93.49	236.55	143.06	1.53	0.055	0.0123	0.44
1	1000	500.00	1868.53	1867.92	2.77	93.45	236.60	143.15	1.53	0.055	0.0123	0.44
1	1100	800.00	1905.68	1905.38	3.01	256.87	924.06	313.92	1.68	0.054	0.0118	0.59
1	1100	800.00	1905.86	1905.52	3.26	329.00	925.18	266.63	1.86	0.055	0.0118	0.60
1	1200	800.00	1945.04	1944.73	2.61	59.91	458.65	398.73	1.04	0.055	0.0140	0.50
1	1200	800.00	1945.10	1944.76	2.69	125.00	458.00	333.00	1.10	0.055	0.0140	0.50
1	1300	800.00	1962.85	1962.41	5.17	61.92	188.40	126.48	2.85	0.054	0.0110	0.62
1	1300	800.00	1963.06	1962.39	5.42	108.00	170.00	62.00	3.06	0.055	0.0110	0.62
1	1400	800.00	1980.75	1980.00	4.82	40.09	195.02	154.93	2.75	0.052	0.0104	0.51
1	1400	800.00	1981.68		6.03	98.20	137.39	39.19	3.68	0.053	0.0104	0.55

HEC-RAS Plan: t5r5s25a River: T5R5S25A Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	800.00	1994.42	1994.04	5.35	54.53	157.29	102.76	2.42	0.055	0.0119	0.70
1	1500	800.00	1994.59	1994.04	4.93	69.00	151.00	82.00	2.59	0.055	0.0119	0.62

HEC-RAS Plan: t5r5s25b River: T5R5S25B Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2900.00	1680.26	1678.91	4.01	173.99	603.76	429.77	4.26	0.045		0.47
1	100	2900.00	1680.27	1678.91	4.01	213.00	533.00	320.00	4.27	0.045		0.47
1	200	2900.00	1688.43	1687.80	6.68	114.23	446.58	332.36	3.43	0.045	0.0072	0.68
1	200	2900.00	1688.48	1687.80	6.79	253.00	395.00	142.00	3.48	0.045	0.0072	0.69
1	400	2700.00	1715.39	1715.26	6.21	0.00	502.00	502.00	5.39	0.048	0.0082	0.62
1	400	2700.00	1716.16	1715.22	7.30	188.00	287.60	99.60	6.16	0.045	0.0082	0.66
1	450	2700.00	1721.65		8.31	94.31	269.17	174.86	5.65	0.048	0.0075	0.68
1	450	2700.00	1722.39		8.77	159.29	225.01	65.71	6.39	0.046	0.0075	0.67
1	500	2700.00	1732.60	1732.29	6.78	112.97	420.00	307.03	4.60	0.048	0.0084	0.59
1	500	2700.00	1733.48	1732.18	8.03	130.00	199.91	69.91	5.48	0.045	0.0084	0.64
1	600	2700.00	1746.25	1746.00	7.05	160.49	476.01	315.52	4.25	0.048	0.0073	0.64
1	600	2700.00	1747.46		7.90	395.73	467.00	71.27	5.46	0.045	0.0073	0.62
1	700	2700.00	1760.46	1759.68	6.15	164.04	398.37	234.32	3.46	0.045	0.0086	0.64
1	700	2700.00	1760.59	1759.68	5.94	195.00	345.00	150.00	3.59	0.045	0.0086	0.60
1	800	1700.00	1773.84	1773.03	6.39	201.58	297.71	96.13	4.84	0.045	0.0079	0.68
1	800	1700.00	1773.67	1773.03	6.82	203.35	296.26	92.91	4.67	0.045	0.0079	0.73
1	900	1700.00	1792.78	1792.29	6.46	82.36	248.56	166.20	2.78	0.045	0.0114	0.71
1	900	1700.00	1792.89	1792.29	6.15	74.93	254.27	179.34	2.89	0.045	0.0114	0.66
1	1000	1700.00	1811.80	1811.19	5.84	188.47	803.16	230.68	3.80	0.049	0.0109	0.68
1	1000	1700.00	1811.71	1811.19	6.12	189.21	799.45	219.63	3.71	0.049	0.0109	0.73
1	1100	1700.00	1828.04	1827.97	5.79	100.81	466.11	365.31	3.04	0.046	0.0113	0.73
1	1100	1700.00	1828.10	1827.97	5.49	99.41	470.72	371.31	3.10	0.046	0.0113	0.68
1	1200	1700.00	1854.46	1854.46	7.40	44.41	509.98	418.99	3.46	0.048	0.0135	0.73
1	1200	1700.00	1854.46	1854.46	7.40	44.41	509.98	418.99	3.46	0.048	0.0135	0.73
1	1300	2800.00	1900.07	1899.70	5.69	46.64	395.29	348.65	3.07	0.048	0.0116	0.71
1	1300	2800.00	1900.94	1900.51	7.36	47.00	193.05	146.05	3.94	0.046	0.0116	0.76
1	1400	2800.00	1930.54	1930.18	5.99	72.85	535.16	462.31	2.53	0.049	0.0121	0.72
1	1400	2800.00	1931.49	1931.05	7.01	242.60	496.00	253.40	3.49	0.049	0.0121	0.70

HEC-RAS Plan: t5r5s25b River: T5R5S25B Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1425	2800.00	1943.06	1943.06	8.35	57.98	354.48	296.50	3.06	0.047	0.0156	0.92
1	1425	2800.00	1943.43	1943.43	9.84	144.78	260.88	116.11	3.43	0.046	0.0156	1.01
1	1450	3800.00	1968.06		6.44	0.00	408.73	408.73	3.06	0.047	0.0125	0.68
1	1450	3800.00	1969.08		7.49	189.00	322.00	133.00	4.08	0.045	0.0125	0.68
1	1500	3800.00	1979.87	1979.78	5.86	15.45	571.85	556.40	1.87	0.045	0.0148	0.87
1	1500	3800.00	1980.00	1979.77	5.52	123.00	576.00	453.00	2.00	0.045	0.0148	0.79
1	1600	3800.00	2007.69	2007.27	6.06	159.55	1264.32	609.68	2.69	0.048	0.0129	0.66
1	1600	3800.00	2007.60	2007.27	6.41	161.38	1263.01	593.97	2.60	0.048	0.0129	0.71
1	1700	1300.00	2068.00	2068.00	9.78	70.02	161.96	91.94	3.00	0.053	0.0131	1.24
1	1700	1300.00	2068.07	2068.00	9.54	68.87	164.03	95.15	3.07	0.053	0.0131	1.19
1	1800	1300.00	2094.16	2093.60	4.02	181.70	434.15	252.45	2.16	0.043	0.0126	0.56
1	1800	1300.00	2094.14	2093.60	4.08	181.99	434.00	252.01	2.14	0.043	0.0126	0.57
1	1900	1300.00	2139.90	2139.90	6.02	113.35	310.80	197.46	1.90	0.040	0.0150	1.01
1	1900	1300.00	2139.90	2139.90	6.02	113.35	310.80	197.46	1.90	0.040	0.0150	1.01
1	2000	1300.00	2175.41	2175.40	6.84	198.25	457.96	259.71	2.41	0.047	0.0177	0.87
1	2000	1300.00	2175.41	2175.40	6.84	198.25	457.96	259.71	2.41	0.047	0.0177	0.87
1	2100	1300.00	2201.12	2201.12	8.02	117.28	203.55	86.27	3.12	0.040	0.0169	0.99
1	2100	1300.00	2201.12	2201.12	8.02	117.28	203.55	86.27	3.12	0.040	0.0169	0.99

HEC-RAS Plan: t5r5s25c River: T5R5S25C Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1300.00	1679.21	1678.61	4.51	94.65	426.72	332.07	4.21	0.048		0.53
1	100	1300.00	1680.14	1679.02	5.34	235.00	311.00	76.00	5.14	0.040		0.53
1	200	1300.00	1691.25	1690.92	6.83	414.38	521.34	106.96	3.25	0.041	0.0074	0.78
1	200	1300.00	1691.46	1690.89	6.45	413.45	492.00	78.55	3.46	0.040	0.0074	0.71
1	300	1300.00	1702.01	1701.41	6.79	189.27	315.26	125.99	4.01	0.042	0.0075	0.63
1	300	1300.00	1701.90		7.04	200.00	300.00	100.00	3.90	0.042	0.0075	0.67
1	400	1300.00	1709.17	1708.56	4.48	109.85	270.91	161.06	2.17	0.040	0.0085	0.59
1	400	1300.00	1709.23	1708.56	4.35	109.07	271.50	162.43	2.23	0.040	0.0085	0.56
1	500	600.00	1718.27	1718.19	7.11	93.41	152.04	58.63	2.27	0.040	0.0081	0.93
1	500	600.00	1718.17	1718.17	7.52	97.00	143.00	46.00	2.17	0.040	0.0081	1.01
1	600	600.00	1731.89		3.44	236.31	394.74	140.38	2.89	0.053	0.0074	0.42
1	600	600.00	1731.94		3.33	235.41	395.20	142.63	2.94	0.053	0.0074	0.40
1	700	600.00	1743.59	1743.59	7.80	51.41	99.28	47.87	2.59	0.045	0.0088	0.97
1	700	600.00	1743.59	1743.59	7.80	51.41	99.28	47.87	2.59	0.045	0.0088	0.97
1	800	600.00	1762.86	1762.26	2.86	33.38	362.16	201.20	1.86	0.046	0.0102	0.44
1	800	600.00	1763.41	1762.62	3.58	274.00	365.00	91.00	2.41	0.045	0.0102	0.47
1	900	600.00	1787.50	1787.50	5.41	472.29	596.49	124.21	1.50	0.045	0.0120	1.01
1	900	600.00	1787.50	1787.50	5.41	472.28	596.53	124.25	1.50	0.045	0.0120	1.01
1	1000	600.00	1811.24	1810.23	3.27	152.99	275.67	122.68	3.24	0.045	0.0106	0.47
1	1000	600.00	1811.24	1810.23	3.28	153.01	275.66	122.65	3.24	0.045	0.0106	0.47
1	1100	600.00	1839.54	1839.54	6.04	47.09	212.43	165.34	2.54	0.042	0.0130	0.79
1	1100	600.00	1839.41	1839.41	7.43	67.00	115.00	48.00	2.41	0.040	0.0130	1.01
1	1200	600.00	1858.63	1858.52	4.18	36.02	474.65	438.63	1.63	0.048	0.0111	0.65
1	1200	600.00	1859.67		5.15	332.00	382.00	50.00	2.67	0.040	0.0111	0.60
1	1300	1300.00	1878.71	1878.56	5.01	65.73	1476.09	1038.15	1.71	0.052	0.0107	0.75
1	1300	1300.00	1879.59	1879.59	7.03	600.08	906.00	305.92	2.59	0.048	0.0107	0.82
1	1400	1300.00	1897.47	1897.37	4.01	83.60	1032.32	948.72	3.47	0.052	0.0109	0.66
1	1400	1300.00	1898.02	1897.59	4.85	684.00	843.00	159.00	4.02	0.045	0.0109	0.66

HEC-RAS Plan: t5r5s25c River: T5R5S25C Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	2700.00	1947.95	1947.77	7.12	374.31	695.84	321.53	2.95	0.046	0.0125	0.77
1	1500	2700.00	1947.92	1947.77	7.22	378.20	694.17	315.97	2.92	0.046	0.0125	0.78
1	1600	1300.00	1986.47	1986.30	4.50	538.24	1312.87	632.71	1.47	0.055	0.0131	0.68
1	1600	1300.00	1987.17	1986.66	5.70	845.64	972.21	126.57	2.17	0.050	0.0131	0.72
1	1700	1300.00	2010.57	2010.49	4.24	106.23	824.09	717.86	1.57	0.052	0.0155	0.81
1	1700	1300.00	2010.98	2010.84	5.40	582.00	773.00	191.00	1.98	0.045	0.0155	0.85

HEC-RAS Plan: t5r5s29a River: t5r5s29a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	200	700.00	1747.61	1746.78	3.23	17.77	389.27	251.46	2.61	0.050		0.53
1	200	700.00	1747.66	1746.78	3.22	46.00	350.00	191.19	2.66	0.050		0.53
1	300	700.00	1759.45	1758.63	3.59	101.10	521.72	130.94	2.45	0.055	0.0103	0.52
1	300	700.00	1759.46	1758.63	3.58	101.07	521.75	131.36	2.46	0.055	0.0103	0.52
1	400	700.00	1774.94	1774.53	3.45	4.51	274.67	270.16	1.94	0.056	0.0104	0.50
1	400	700.00	1775.10	1774.50	3.69	79.00	195.00	116.00	2.09	0.055	0.0104	0.51
1	500	700.00	1791.11		3.53	0.00	250.00	250.00	2.10	0.056	0.0107	0.55
1	500	700.00	1791.26		3.71	69.00	198.00	129.00	2.26	0.055	0.0107	0.54
1	600	700.00	1804.74	1804.43	2.75	50.83	454.46	403.63	1.74	0.055	0.0104	0.48
1	600	700.00	1805.19	1804.69	3.62	49.00	183.00	134.00	2.19	0.050	0.0104	0.53
1	700	1300.00	1816.77	1816.39	4.65	175.21	514.49	318.45	2.77	0.057	0.0096	0.59
1	700	1300.00	1817.39	1816.61	5.33	333.00	428.00	95.00	3.39	0.055	0.0096	0.59

HEC-RAS Plan: t5r5s29b River: t5r5s29b Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2500.00	1724.27	1723.65	3.18	88.81	681.03	592.22	4.27	0.055		0.46
1	100	2500.00	1724.31	1723.65	3.22	182.00	681.90	499.90	4.31	0.055		0.46
1	200	2500.00	1737.23	1736.96	3.22	53.86	1356.91	1303.05	3.23	0.051	0.0109	0.59
1	200	2500.00	1737.27	1736.97	3.32	574.00	1347.00	773.00	3.27	0.050	0.0109	0.59
1	300	1800.00	1754.29	1752.65	2.76	32.70	569.02	536.32	6.29	0.055	0.0077	0.41
1	300	1800.00	1754.32	1752.65	2.79	92.00	532.00	440.00	6.32	0.055	0.0077	0.41
1	400	1800.00	1770.26	1769.58	3.37	47.62	644.85	597.23	4.26	0.055	0.0107	0.59
1	400	1800.00	1770.30	1769.54	3.48	137.00	630.00	493.00	4.30	0.055	0.0107	0.60
1	500	1800.00	1783.59		4.17	0.00	396.16	396.16	4.59	0.052	0.0096	0.49
1	500	1800.00	1783.87		4.50	170.00	329.00	159.00	4.87	0.050	0.0096	0.50

HEC-RAS Plan: t5r5s31_west River: t5r5s31 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1300.00	2227.33	2227.33	6.74	30.70	400.23	369.53	2.33	0.048		0.82
1	100	1300.00	2228.04	2228.04	9.62	44.00	97.93	53.93	3.04	0.041		1.01
1	250	650.00	2258.21	2258.21	4.02	33.89	531.42	497.53	1.21	0.046	0.0156	0.78
1	250	650.00	2258.50	2258.15	3.48	360.00	527.00	167.00	1.50	0.045	0.0156	0.58
1	300	1300.00	2288.70	2288.38	5.51	53.62	225.69	172.07	1.70	0.047	0.0149	0.75
1	300	1300.00	2288.53		6.14	55.61	223.85	168.24	1.53	0.047	0.0149	0.88
1	400	1300.00	2308.41	2308.39	6.03	75.48	269.10	193.62	1.41	0.045	0.0188	0.97
1	400	1300.00	2308.55		5.36	72.40	271.67	199.27	1.55	0.045	0.0188	0.81
1	500	1300.00	2354.55	2354.39	6.29	42.31	208.79	166.49	2.55	0.046	0.0181	0.77
1	500	1300.00	2354.38	2354.38	7.04	44.62	206.15	161.53	2.38	0.046	0.0181	0.90

HEC-RAS Plan: t5r5s31_east River: t5r5s31_east Reach: t5r5s31_east

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t5r5s31_east	200	650	2247.96	2247.66	4.12	68.36	240.48	143.67	1.96	0.05		0.69
t5r5s31_east	200	650	2247.96	2247.66	4.12	68.36	240.48	143.69	1.96	0.05		0.69

HEC-RAS Plan: t5r5s33 River: t5r5s33 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	5400.00	1631.22	1630.71	4.02	213.00	3082.46	1165.50	2.72	0.040		0.64
1	100	5400.00	1631.22	1630.71	4.02	213.00	3082.46	1165.50	2.72	0.040		0.64
1	300	5400.00	1654.94	1654.88	10.41	7.54	867.00	859.46	4.94	0.057	0.0088	0.86
1	300	5400.00	1654.94	1654.88	10.41	7.54	867.00	859.46	4.94	0.057	0.0088	0.86
1	400	5400.00	1665.34	1664.68	4.61	98.36	1133.00	1034.64	5.34	0.043	0.0071	0.53
1	400	5400.00	1665.53		4.94	317.00	752.00	435.00	5.53	0.040	0.0071	0.55
1	500	5400.00	1676.86	1676.86	6.86	247.25	871.76	624.50	3.86	0.040	0.0102	0.97
1	500	5400.00	1676.87	1676.82	6.85	365.00	871.76	506.76	3.87	0.040	0.0102	0.97
1	600	5400.00	1692.25		5.97	25.20	559.66	534.47	4.25	0.043	0.0085	0.56
1	600	5400.00	1692.49		6.28	101.00	330.00	229.00	4.49	0.040	0.0085	0.57
1	700	5400.00	1704.88	1704.88	6.41	188.21	1120.79	932.58	4.88	0.043	0.0087	0.98
1	700	5400.00	1704.96	1704.95	6.72	335.00	900.00	565.00	4.96	0.040	0.0087	0.99
1	800	3500.00	1719.65		7.79	9.53	388.42	378.89	5.65	0.050	0.0097	0.60
1	800	3500.00	1720.62	1719.29	8.69	110.00	210.83	100.83	6.62	0.046	0.0097	0.61
1	900	3500.00	1731.93	1731.93	9.04	122.99	467.94	344.95	4.93	0.042	0.0080	0.80
1	900	3500.00	1731.96	1731.93	8.89	121.06	468.71	347.65	4.96	0.042	0.0080	0.79
1	1000	3500.00	1746.27	1746.22	9.68	13.34	482.54	469.20	3.27	0.056	0.0134	0.97
1	1000	3500.00	1746.24	1746.22	9.89	15.38	481.32	465.94	3.24	0.056	0.0134	0.99
1	1100	3500.00	1761.45	1760.86	6.05	54.23	430.13	375.90	4.45	0.042	0.0092	0.65
1	1100	3500.00	1761.62	1760.87	6.18	155.00	351.00	196.00	4.62	0.040	0.0092	0.64
1	1200	3500.00	1773.60	1773.60	9.82	33.89	211.62	177.73	4.59	0.040	0.0093	0.94
1	1200	3500.00	1773.55	1773.47	10.02	66.00	170.00	104.00	4.55	0.040	0.0093	0.96
1	1300	3500.00	1788.61	1788.23	7.73	26.40	440.10	413.69	3.61	0.052	0.0119	0.73
1	1300	3500.00	1789.52		9.29	157.00	267.75	110.75	4.52	0.045	0.0119	0.78
1	1400	3100.00	1798.80		7.38	23.38	300.01	276.63	3.80	0.051	0.0107	0.86
1	1400	3100.00	1799.63		7.65	7.31	179.00	171.69	4.62	0.046	0.0107	0.76
1	1500	3100.00	1815.30		8.27	10.87	486.03	475.16	4.30	0.056	0.0107	0.73
1	1500	3100.00	1816.09		9.87	180.24	324.00	143.76	5.09	0.052	0.0107	0.79

HEC-RAS Plan: t5r5s33 River: t5r5s33 Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1600	3100.00	1831.05	1831.05	8.86	41.13	527.83	486.70	4.05	0.056	0.0119	0.82
1	1600	3100.00	1831.39	1831.35	8.87	26.34	388.00	361.66	4.39	0.055	0.0119	0.78
1	1700	3100.00	1844.79	1844.18	5.00	112.18	637.46	387.43	3.29	0.040	0.0116	0.68
1	1700	3100.00	1844.80	1844.18	4.96	111.94	637.80	389.81	3.30	0.040	0.0116	0.67
1	1800	3100.00	1860.30	1860.16	4.87	68.49	904.59	836.11	2.30	0.044	0.0123	0.82
1	1800	3100.00	1860.29	1860.17	4.89	69.40	882.18	812.78	2.29	0.044	0.0123	0.83
1	1900	3100.00	1878.90	1878.60	3.69	98.76	1092.63	978.13	3.40	0.047	0.0122	0.62
1	1900	3100.00	1878.99	1878.63	3.82	169.00	868.00	697.50	3.49	0.045	0.0122	0.62
1	2000	3100.00	1899.47		4.44	119.11	1059.23	678.45	3.47	0.045	0.0120	0.69
1	2000	3100.00	1899.47		4.42	118.89	1060.35	682.05	3.47	0.045	0.0120	0.69
1	2100	3100.00	1916.30	1915.85	5.75	211.36	1078.61	278.72	2.30	0.046	0.0129	0.70
1	2100	3100.00	1916.34	1915.87	5.83	211.15	1047.00	247.61	2.34	0.045	0.0129	0.70
1	2200	3100.00	1936.34		4.94	76.14	849.43	600.03	2.34	0.050	0.0157	0.81
1	2200	3100.00	1936.35		4.89	74.92	849.87	603.11	2.35	0.050	0.0157	0.80
1	2300	3100.00	1955.80	1955.44	6.22	101.76	554.98	453.22	3.80	0.055	0.0117	0.58
1	2300	3100.00	1956.55	1955.98	7.20	284.03	481.00	196.97	4.55	0.053	0.0117	0.61
1	2400	3100.00	1971.27	1971.27	9.18	13.51	265.84	252.33	3.27	0.050	0.0133	0.92
1	2400	3100.00	1972.12	1972.12	11.22	167.00	237.00	70.00	4.12	0.045	0.0133	1.00
1	2500	3800.00	1990.46		4.10	272.44	1088.04	617.34	3.46	0.050	0.0136	0.58
1	2500	3800.00	1990.61	1989.85	3.74	270.72	1089.82	635.44	3.61	0.050	0.0136	0.52
1	2600	3800.00	2009.07	2009.05	7.30	257.12	599.83	342.71	3.07	0.040	0.0139	0.98
1	2600	3800.00	2009.05	2009.05	7.38	258.79	599.69	340.89	3.05	0.040	0.0139	0.99
1	2700	3100.00	2027.51	2026.74	5.26	131.98	562.51	430.53	2.51	0.057	0.0130	0.60
1	2700	3100.00	2027.53	2026.74	5.21	131.58	562.89	431.32	2.53	0.057	0.0130	0.59
1	2800	3100.00	2048.97	2048.97	9.32	94.45	329.66	235.21	3.97	0.046	0.0135	0.89
1	2800	3100.00	2048.97	2048.97	9.32	94.45	329.66	235.21	3.97	0.046	0.0135	0.89
1	2900	2900.00	2066.82	2066.23	5.98	25.36	228.87	203.50	2.82	0.050	0.0134	0.67
1	2900	2900.00	2066.82	2066.23	5.98	25.36	228.87	203.50	2.82	0.050	0.0134	0.67

HEC-RAS Plan: t5r5s33 River: t5r5s33 Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	3000	2900.00	2086.28	2085.83	7.20	204.44	443.39	238.96	4.28	0.049	0.0153	0.90
1	3000	2900.00	2086.28	2085.83	7.20	204.44	443.39	238.96	4.28	0.049	0.0153	0.90
1	3100	2400.00	2105.00	2104.80	8.22	35.02	154.72	119.70	3.00	0.045	0.0169	0.88
1	3100	2400.00	2105.00	2104.80	8.22	35.02	154.72	119.70	3.00	0.045	0.0169	0.88
1	3200	2400.00	2124.12	2123.88	9.64	63.45	143.64	80.19	4.12	0.045	0.0145	0.88
1	3200	2400.00	2124.12	2123.88	9.64	63.45	143.64	80.19	4.12	0.045	0.0145	0.88
1	3300	2400.00	2146.47	2146.19	6.79	76.34	244.31	167.97	2.47	0.045	0.0166	0.81
1	3300	2400.00	2146.47	2146.19	6.79	76.34	244.31	167.97	2.47	0.045	0.0166	0.81
1	3400	2400.00	2176.00	2176.00	12.63	59.74	114.71	54.97	6.00	0.037	0.0179	0.95
1	3400	2400.00	2176.00	2176.00	12.63	59.74	114.71	54.97	6.00	0.037	0.0179	0.95
1	3500	2400.00	2204.94	2204.94	9.11	70.70	182.43	111.73	2.94	0.035	0.0218	0.99
1	3500	2400.00	2204.94	2204.94	9.11	70.70	182.43	111.73	2.94	0.035	0.0218	0.99
1	3600	2400.00	2230.65	2230.65	10.97	64.53	142.03	77.50	4.65	0.036	0.0203	0.95
1	3600	2400.00	2230.65	2230.65	10.97	64.53	142.03	77.50	4.65	0.036	0.0203	0.95
1	3700	2400.00	2255.87	2255.87	9.76	80.26	172.42	92.16	3.87	0.040	0.0189	0.99
1	3700	2400.00	2255.87	2255.87	9.76	80.26	172.42	92.16	3.87	0.040	0.0189	0.99
1	3800	2400.00	2289.20	2289.20	9.38	57.68	168.18	110.51	3.20	0.045	0.0223	0.96
1	3800	2400.00	2289.20	2289.20	9.38	57.68	168.18	110.51	3.20	0.045	0.0223	0.96
1	3900	2400.00	2316.06	2315.90	6.72	158.68	356.35	197.67	2.06	0.045	0.0201	0.88
1	3900	2400.00	2316.06	2315.90	6.72	158.68	356.35	197.67	2.06	0.045	0.0201	0.88
1	4000	2400.00	2341.10	2341.10	8.66	80.12	212.04	131.91	3.10	0.035	0.0171	0.99
1	4000	2400.00	2341.10	2341.10	8.66	80.12	212.04	131.91	3.10	0.035	0.0171	0.99

HEC-RAS Plan: t5r5s34a River: t5r5s34a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2600.00	1630.21	1629.24	3.54	51.08	753.98	537.08	4.21	0.050		0.42
1	100	2600.00	1630.21	1629.24	3.54	51.08	753.98	537.08	4.21	0.050		0.42
1	200	2600.00	1637.92	1637.86	5.44	48.80	838.41	571.20	2.42	0.034	0.0092	0.98
1	200	2600.00	1637.92	1637.86	5.44	48.80	838.39	571.16	2.42	0.034	0.0092	0.98
1	400	2600.00	1662.20	1661.63	5.42	29.53	615.82	550.05	5.20	0.054	0.0074	0.50
1	400	2600.00	1662.20	1661.63	5.42	29.53	615.83	550.07	5.20	0.054	0.0074	0.50
1	500	2600.00	1677.31	1676.91	5.79	197.53	430.52	232.99	2.31	0.050	0.0107	0.73
1	500	2600.00	1677.31	1676.91	5.79	197.53	430.52	232.99	2.31	0.050	0.0107	0.73
1	600	2600.00	1688.99	1688.06	3.83	70.08	533.23	462.41	3.49	0.051	0.0085	0.46
1	600	2600.00	1688.99	1688.06	3.83	70.07	533.24	462.43	3.49	0.051	0.0085	0.46
1	700	2600.00	1701.93	1701.72	3.91	32.08	939.99	870.50	2.43	0.051	0.0108	0.72
1	700	2600.00	1701.93	1701.72	3.91	32.09	939.97	870.41	2.43	0.051	0.0108	0.72
1	800	2600.00	1713.77	1713.14	4.21	38.81	882.66	843.84	4.77	0.056	0.0072	0.44
1	800	2600.00	1713.77	1713.14	4.21	38.79	882.68	843.88	4.77	0.056	0.0072	0.44
1	900	2600.00	1725.20	1725.20	8.35	199.19	415.05	215.86	4.19	0.045	0.0084	0.84
1	900	2600.00	1725.20	1725.20	8.35	199.19	415.05	215.86	4.19	0.045	0.0084	0.84
1	950	1400.00	1743.77	1743.10	4.19	84.85	296.27	211.42	2.77	0.045	0.0119	0.53
1	950	1400.00	1743.77	1743.10	4.19	84.85	296.27	211.42	2.77	0.045	0.0119	0.53
1	1000	1400.00	1754.83	1754.79	8.83	132.48	333.40	194.51	3.33	0.048	0.0095	0.92
1	1000	1400.00	1754.83	1754.79	8.83	132.48	333.40	194.51	3.33	0.048	0.0095	0.92
1	1100	900.00	1772.92	1772.50	3.98	32.49	292.15	259.66	1.92	0.046	0.0136	0.55
1	1100	900.00	1772.92	1772.50	3.98	32.49	292.15	259.66	1.92	0.046	0.0136	0.55
1	1200	900.00	1784.67	1784.67	6.90	50.62	261.28	210.67	3.67	0.046	0.0102	0.67
1	1200	900.00	1784.62	1784.62	7.23	96.45	223.36	126.91	3.62	0.046	0.0102	0.70
1	1300	400.00	1797.32	1796.86	5.88	268.04	313.50	45.46	2.82	0.045	0.0099	0.65
1	1300	400.00	1797.47	1796.86	5.46	267.58	315.41	47.83	2.97	0.045	0.0099	0.59
1	1400	400.00	1810.33	1809.85	3.32	82.49	247.20	116.78	2.33	0.049	0.0121	0.66
1	1400	400.00	1810.19	1809.85	3.83	84.94	241.76	98.15	2.19	0.049	0.0121	0.76

HEC-RAS Plan: t5r5s34a River: t5r5s34a Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	400.00	1830.71	1830.57	3.70	34.82	256.82	222.01	1.70	0.046	0.0143	0.68
1	1500	400.00	1830.92	1830.61	3.76	75.00	168.00	93.00	1.92	0.045	0.0143	0.62
1	1600	400.00	1844.96	1844.41	5.89	168.90	208.79	39.88	2.96	0.045	0.0102	0.65
1	1600	400.00	1844.85	1844.41	6.20	169.94	208.24	38.30	2.85	0.045	0.0102	0.70
1	1700	400.00	1858.37	1858.23	4.65	258.00	401.35	143.35	2.37	0.046	0.0129	0.75
1	1700	400.00	1858.56	1858.23	4.72	340.00	400.99	60.99	2.56	0.045	0.0129	0.71
1	1800	1500.00	1877.83	1877.60	3.03	73.23	1201.27	895.67	3.83	0.046	0.0129	0.63
1	1800	1500.00	1877.83	1877.60	3.06	73.70	1200.47	890.92	3.83	0.046	0.0129	0.64
1	1900	1500.00	1896.72	1896.63	7.06	68.18	403.89	335.72	2.72	0.048	0.0139	0.78
1	1900	1500.00	1896.91	1896.78	7.46	237.67	403.86	166.19	2.91	0.048	0.0139	0.79

HEC-RAS Plan: t5r5s34b River: t5r5s34b Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	3200.00	1633.90	1632.85	3.63	49.64	1201.52	1114.57	3.90	0.054		0.42
1	100	3200.00	1634.27	1632.92	4.00	900.00	1201.52	301.52	4.27	0.055		0.43
1	200	3200.00	1642.76	1641.96	6.18	82.69	315.16	232.47	3.76	0.054	0.0075	0.58
1	200	3200.00	1642.85	1641.95	6.02	118.00	315.16	197.16	3.85	0.054	0.0075	0.56
1	300	3200.00	1652.92	1652.19	3.01	5.57	841.43	835.86	2.92	0.055	0.0086	0.41
1	300	3200.00	1652.95	1652.18	3.12	73.00	665.00	592.00	2.94	0.055	0.0086	0.42
1	400	3200.00	1663.78	1663.26	4.63	26.42	588.36	521.87	5.78	0.051	0.0063	0.65
1	400	3200.00	1664.01	1663.37	4.63	70.00	489.00	419.00	6.01	0.050	0.0063	0.64
1	500	3200.00	1676.74		7.92	15.78	538.76	485.34	5.74	0.052	0.0106	0.63
1	500	3200.00	1676.74	1676.58	7.92	15.88	538.71	484.97	5.74	0.052	0.0106	0.63
1	600	3200.00	1688.67	1687.84	4.28	37.90	448.20	410.30	4.67	0.051	0.0094	0.52
1	600	3200.00	1688.82	1687.91	4.45	126.00	457.28	331.28	4.82	0.050	0.0094	0.53
1	700	3200.00	1702.09	1701.65	4.91	53.12	625.27	572.15	4.09	0.051	0.0091	0.59
1	700	3200.00	1702.44	1701.71	5.40	144.00	380.00	236.00	4.44	0.050	0.0091	0.60
1	800	3200.00	1711.65	1710.62	6.08	63.98	550.66	280.81	5.15	0.053	0.0079	0.58
1	800	3200.00	1711.73		5.91	61.76	551.25	286.68	5.23	0.053	0.0079	0.56
1	900	3200.00	1724.13	1723.56	8.25	88.47	316.76	228.29	5.13	0.050	0.0096	0.72
1	900	3200.00	1724.03	1723.56	8.50	98.50	289.50	191.00	5.03	0.050	0.0096	0.76
1	1000	3200.00	1738.52	1738.08	3.69	17.93	732.83	714.90	2.52	0.046	0.0123	0.55
1	1000	3200.00	1738.62	1738.12	3.76	154.00	722.00	568.00	2.62	0.045	0.0123	0.54
1	1100	2600.00	1754.62	1754.56	6.87	15.72	250.59	234.86	2.62	0.030	0.0086	0.95
1	1100	2600.00	1754.59	1754.56	6.99	15.96	250.33	234.37	2.59	0.030	0.0086	0.98
1	1200	2600.00	1769.77		4.23	124.56	752.41	550.67	3.27	0.050	0.0114	0.63
1	1200	2600.00	1769.84		4.13	117.61	600.00	452.08	3.34	0.050	0.0114	0.62
1	1300	2600.00	1780.84	1780.61	5.38	9.85	595.48	578.46	4.34	0.053	0.0109	0.63
1	1300	2600.00	1781.63	1781.05	7.33	123.00	244.55	121.55	5.13	0.050	0.0109	0.74
1	1400	1700.00	1794.21	1793.14	3.99	110.30	609.40	420.55	3.21	0.053	0.0099	0.49
1	1400	1700.00	1795.17	1793.73	4.37	203.50	440.00	236.50	4.17	0.052	0.0099	0.44

HEC-RAS Plan: t5r5s34b River: t5r5s34b Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1450	2000.00	1801.14	1800.79	3.72	54.84	691.83	370.26	2.14	0.057	0.0126	0.69
1	1450	2000.00	1801.64	1801.46	5.37	192.74	691.12	280.32	2.64	0.053	0.0126	0.87
1	1500	2000.00	1810.95	1810.42	5.23	73.33	537.03	463.71	3.44	0.051	0.0101	0.56
1	1500	2000.00	1811.40	1810.23	5.08	139.00	263.00	124.00	3.90	0.050	0.0101	0.50
1	1600	1000.00	1826.70	1826.64	5.77	123.32	386.23	262.91	1.70	0.052	0.0118	0.81
1	1600	1000.00	1826.90	1826.90	6.98	270.00	383.24	113.24	1.90	0.050	0.0118	0.92
1	1700	1000.00	1840.51	1840.01	2.48	252.93	662.79	409.86	1.51	0.051	0.0107	0.42
1	1700	1000.00	1840.66	1840.06	2.49	339.00	663.73	324.73	1.66	0.050	0.0107	0.39
1	1800	1000.00	1855.22	1855.08	4.01	85.84	552.04	349.58	1.21	0.051	0.0111	0.78
1	1800	1000.00	1855.20	1855.14	4.66	149.00	534.00	266.54	1.20	0.050	0.0111	0.92
1	1900	1000.00	1869.70	1869.29	3.27	16.24	373.32	357.08	2.70	0.051	0.0127	0.52
1	1900	1000.00	1869.98	1869.40	3.45	107.00	298.00	191.00	2.98	0.050	0.0127	0.49
1	2000	1000.00	1884.50	1884.20	7.69	212.99	263.58	50.59	3.00	0.050	0.0122	0.85
1	2000	1000.00	1884.36	1884.20	8.15	213.29	263.16	49.88	2.86	0.050	0.0122	0.92
1	2100	1000.00	1902.34		4.69	112.74	218.36	105.62	3.34	0.050	0.0137	0.58
1	2100	1000.00	1902.42		4.51	111.17	218.83	107.66	3.42	0.050	0.0137	0.55

HEC-RAS Plan: t5r5s34c River: t5r5s34c Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	6600.00	1623.28	1622.59	7.29	1279.71	2684.10	1404.40	5.28	0.057		0.57
1	100	6600.00	1623.28	1622.51	7.29	1279.67	2684.12	1404.46	5.28	0.057		0.57
1	200	6600.00	1638.21	1636.57	6.33	959.11	1826.09	540.01	8.21	0.046	0.0052	0.57
1	200	6600.00	1638.21	1636.57	6.33	959.11	1826.09	539.95	8.21	0.046	0.0052	0.57
1	300	6600.00	1648.98	1648.34	5.14	7.56	1142.67	1127.58	6.97	0.047	0.0083	0.62
1	300	6600.00	1648.98	1648.34	5.14	7.52	1142.68	1127.67	6.98	0.047	0.0083	0.62
1	400	6600.00	1661.83		5.92	140.89	1364.49	528.78	7.83	0.046	0.0075	0.60
1	400	6600.00	1661.83		5.92	140.89	1364.48	528.76	7.83	0.046	0.0075	0.60
1	500	6600.00	1672.86	1672.86	9.09	84.56	989.86	370.54	3.86	0.027	0.0112	1.00
1	500	6600.00	1672.86	1672.86	9.09	84.56	989.86	370.54	3.86	0.027	0.0112	1.00
1	600	6600.00	1690.60	1690.60	7.98	334.40	1180.30	650.79	4.60	0.029	0.0087	0.97
1	600	6600.00	1690.60	1690.60	7.98	334.40	1180.30	650.79	4.60	0.029	0.0087	0.97
1	800	6800.00	1730.42	1730.10	4.95	113.95	1548.75	1332.25	4.42	0.052	0.0104	0.73
1	800	6800.00	1730.61		5.27	300.00	1198.00	828.54	4.61	0.050	0.0104	0.74
1	900	1900.00	1745.96		2.28	60.71	660.94	595.91	4.96	0.053	0.0097	0.31
1	900	1900.00	1746.45		2.66	284.00	610.00	326.00	5.45	0.050	0.0097	0.32
1	1000	1900.00	1769.85	1769.85	5.98	112.88	732.98	295.98	2.84	0.050	0.0167	1.02
1	1000	1900.00	1769.85	1769.85	5.98	112.88	732.98	295.98	2.84	0.050	0.0167	1.02
1	1100	1900.00	1777.42	1777.42	4.86	196.27	1054.16	546.80	3.42	0.050	0.0040	1.01
1	1100	1900.00	1777.42	1777.42	4.86	196.27	1054.16	546.80	3.42	0.050	0.0040	1.01
1	1200	1900.00	1798.12	1797.45	2.25	139.04	1077.63	938.59	2.12	0.050	0.0119	0.38
1	1200	1900.00	1798.12	1797.45	2.25	139.04	1077.63	938.59	2.12	0.050	0.0119	0.38
1	1300	1900.00	1819.00	1818.51	2.98	222.63	1013.33	790.70	3.00	0.056	0.0099	0.83
1	1300	1900.00	1819.00	1818.51	2.98	222.63	1013.33	790.70	3.00	0.056	0.0099	0.83
1	1400	1900.00	1837.11	1836.34	2.13	101.85	1034.03	832.11	4.11	0.055	0.0127	0.43
1	1400	1900.00	1837.93	1837.30	3.19	470.00	923.00	445.40	4.93	0.045	0.0127	0.49
1	1500	1900.00	1855.65	1855.65	7.19	199.10	416.80	172.23	3.64	0.045	0.0111	0.99
1	1500	1900.00	1855.62	1855.62	7.33	212.00	416.58	155.89	3.62	0.045	0.0111	1.00

HEC-RAS Plan: t5r5s34c River: t5r5s34c Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1600	3000.00	1875.73		4.99	18.13	695.97	646.81	3.73	0.050	0.0116	0.59
1	1600	3000.00	1876.30	1875.51	5.86	351.00	534.00	183.00	4.30	0.045	0.0116	0.62
1	1700	3000.00	1892.37	1891.95	8.53	127.34	509.77	382.43	3.37	0.053	0.0111	0.90
1	1700	3000.00	1893.36	1893.20	10.42	316.94	412.00	95.06	4.36	0.048	0.0111	0.94
1	1800	3000.00	1909.66	1908.63	5.25	149.91	549.70	297.53	4.66	0.045	0.0095	0.56
1	1800	3000.00	1909.92		4.92	147.73	362.61	214.88	4.91	0.045	0.0095	0.51
1	1900	3000.00	1929.03	1928.94	6.45	492.46	804.20	311.75	3.03	0.045	0.0121	0.93
1	1900	3000.00	1928.94	1928.94	6.88	492.60	792.96	300.36	2.94	0.045	0.0121	1.01
1	2000	3000.00	1958.57	1957.71	6.02	488.61	1239.28	344.56	5.57	0.046	0.0149	0.73
1	2000	3000.00	1958.71	1957.71	5.56	478.20	1240.79	387.15	5.71	0.046	0.0149	0.68
1	2100	3000.00	1986.44	1986.42	5.70	504.54	1300.06	694.70	3.44	0.048	0.0182	0.93
1	2100	3000.00	1986.53	1986.53	6.34	701.00	1177.00	383.46	3.53	0.045	0.0182	1.01

HEC-RAS Plan: 1 River: T5R5S35 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	3000.00	1616.32	1615.57	5.03	353.27	1529.79	964.31	3.32	0.061		0.49
1	100	3000.00	1617.36	1616.82	5.80	746.40	1351.00	448.06	4.36	0.059		0.49
1	200	3000.00	1626.11	1625.45	3.58	269.44	1282.20	717.41	3.11	0.056	0.0083	0.50
1	200	3000.00	1626.31	1625.42	3.39	267.79	897.00	512.10	3.31	0.055	0.0083	0.45
1	300	3000.00	1641.27	1640.36	3.52	285.85	1691.29	995.13	5.27	0.047	0.0057	0.45
1	300	3000.00	1641.62	1640.18	3.70	358.00	1118.00	458.80	5.62	0.045	0.0057	0.49
1	400	3000.00	1658.12	1657.76	3.23	0.00	1644.00	1215.40	2.12	0.047	0.0085	0.61
1	400	3000.00	1658.29	1657.77	3.02	253.00	1644.00	998.71	2.29	0.045	0.0085	0.53
1	500	3000.00	1665.70		2.66	455.29	1236.98	781.69	2.70	0.055	0.0074	0.39
1	500	3000.00	1665.62		2.84	460.53	1225.00	764.47	2.61	0.055	0.0074	0.43
1	600	3000.00	1681.56	1681.00	4.74	43.35	563.90	494.96	3.55	0.059	0.0083	0.64
1	600	3000.00	1682.35	1681.67	5.62	261.00	474.00	213.00	4.35	0.055	0.0083	0.63
1	700	3000.00	1709.28	1708.79	4.07	0.00	918.00	918.00	3.27	0.061	0.0093	0.44
1	700	3000.00	1710.06	1709.17	5.01	270.00	567.51	297.51	4.06	0.059	0.0093	0.47
1	800	3000.00	1726.08	1725.28	5.32	216.09	475.45	259.35	3.08	0.055	0.0083	0.60
1	800	3000.00	1726.26	1725.28	4.97	236.00	466.00	230.00	3.26	0.055	0.0083	0.54
1	900	3000.00	1740.24	1739.49	5.65	0.00	812.40	503.35	4.24	0.057	0.0094	0.55
1	900	3000.00	1740.39	1739.34	6.53	103.00	235.00	132.00	4.39	0.055	0.0094	0.62
1	1000	3000.00	1752.46	1751.53	2.92	48.87	1157.11	731.90	3.46	0.057	0.0086	0.43
1	1000	3000.00	1752.87	1751.80	2.92	346.33	1065.00	602.52	3.87	0.055	0.0086	0.39
1	1050	3000.00	1777.91	1777.74	6.11	225.70	2035.32	324.41	3.91	0.048	0.0102	0.87
1	1050	3000.00	1777.73	1777.73	6.90	227.13	2033.93	302.23	3.73	0.048	0.0102	1.01
1	1075	3000.00	1802.66	1801.70	4.21	216.41	1204.77	330.52	4.66	0.057	0.0111	0.48
1	1075	3000.00	1802.80	1801.69	3.96	214.73	1206.08	337.47	4.80	0.057	0.0111	0.44
1	1200	3000.00	1841.45	1841.21	4.56	84.07	1335.10	762.04	2.45	0.058	0.0132	0.73
1	1200	3000.00	1841.56	1841.42	5.62	303.00	1006.36	417.78	2.56	0.055	0.0132	0.88
1	1400	1000.00	1870.16	1869.66	2.87	0.00	912.59	912.59	2.16	0.059	0.0123	0.36
1	1400	1000.00	1871.03		2.86	491.24	636.00	144.76	3.03	0.056	0.0123	0.30

HEC-RAS Plan: 1 River: T5R5S35 Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1500	1000.00	1887.69	1887.69	9.40	249.62	354.24	104.63	2.69	0.061	0.0098	1.01
1	1500	1000.00	1888.35	1888.35	11.63	290.83	322.78	31.96	3.35	0.059	0.0098	1.12
1	1600	1000.00	1907.77		3.28	85.80	225.56	139.75	3.77	0.055	0.0105	0.39
1	1600	1000.00	1907.90		3.09	82.13	226.04	143.90	3.90	0.055	0.0105	0.36
1	1700	1000.00	1942.42	1942.42	2.22	138.21	520.48	160.73	2.42	0.065	0.0139	0.86
1	1700	1000.00	1943.40	1943.40	6.04	116.00	440.38	184.57	3.40	0.062	0.0139	1.13

HEC-RAS Plan: t5r6s12a River: t5r6s12a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	700.00	1900.72	1900.70	5.38	68.09	323.06	254.97	1.72	0.043		0.79
1	100	700.00	1900.86	1900.62	5.62	244.00	324.38	80.38	1.86	0.040		0.80
1	200	700.00	1922.45	1922.23	4.31	53.11	250.55	197.44	1.45	0.050	0.0150	0.70
1	200	700.00	1922.48	1922.21	4.31	96.00	230.00	134.00	1.48	0.050	0.0150	0.69
1	300	700.00	1952.29	1952.04	3.64	65.82	299.39	233.56	1.28	0.045	0.0147	0.65
1	300	700.00	1952.28	1952.05	3.67	92.00	289.00	197.00	1.28	0.045	0.0147	0.66
1	400	700.00	1978.77	1978.77	5.38	27.98	302.40	274.43	1.77	0.047	0.0153	0.80
1	400	700.00	1978.77	1978.72	5.83	99.34	222.76	123.42	1.77	0.046	0.0153	0.86

HEC-RAS Plan: t5r6s12b River: t5r6s12b Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1400.00	1884.53	1884.24	5.05	90.00	416.92	303.78	2.53	0.047		0.67
1	100	1400.00	1884.86	1884.34	5.44	122.66	251.00	128.34	2.86	0.045		0.68
1	200	1400.00	1912.15	1912.15	8.74	21.19	156.09	134.89	3.15	0.044	0.0136	0.92
1	200	1400.00	1912.15	1912.15	8.74	21.19	156.09	134.90	3.15	0.044	0.0136	0.92
1	300	1400.00	1932.87	1932.67	4.64	70.32	519.75	449.43	1.87	0.048	0.0135	0.65
1	300	1400.00	1933.26	1932.83	5.48	150.00	281.00	131.00	2.26	0.045	0.0135	0.69
1	400	1400.00	1953.13	1952.92	5.45	53.23	390.97	337.74	2.13	0.052	0.0130	0.74
1	400	1400.00	1953.39		5.55	217.00	347.00	130.00	2.39	0.050	0.0130	0.70

HEC-RAS Plan: t5r6s13 River: t5r6s13 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	3000.00	1832.07	1831.65	3.81	0.00	641.00	641.00	3.07	0.051		0.55
1	100	3000.00	1832.34	1831.76	4.14	58.00	475.00	417.00	3.34	0.050		0.55
1	200	3000.00	1847.64	1847.25	4.43	18.06	525.32	507.26	3.64	0.056	0.0114	0.65
1	200	3000.00	1847.73	1847.33	4.52	50.00	477.00	427.00	3.73	0.055	0.0114	0.64
1	300	3000.00	1866.76	1866.21	3.43	10.38	699.79	689.42	2.76	0.056	0.0128	0.49
1	300	3000.00	1866.89	1866.29	3.67	43.00	546.00	503.00	2.89	0.055	0.0128	0.51

HEC-RAS Plan: t5r6s18 River: t5r6s18 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1800.00	1804.93	1804.70	4.83	2.75	450.64	414.63	1.93	0.052		0.77
1	100	1800.00	1805.55	1805.30	6.25	141.00	297.00	156.00	2.55	0.050		0.81
1	200	1800.00	1818.66	1818.20	4.02	5.15	439.66	434.51	2.66	0.052	0.0113	0.51
1	200	1800.00	1819.52	1818.57	5.07	105.00	233.00	128.00	3.52	0.050	0.0113	0.54
1	300	1800.00	1835.36	1835.29	4.63	0.00	575.66	575.66	2.36	0.051	0.0121	0.77
1	300	1800.00	1835.54	1835.28	4.70	121.00	414.00	293.00	2.54	0.050	0.0121	0.72
1	400	1800.00	1851.09	1850.82	5.23	0.00	503.00	503.00	3.09	0.051	0.0109	0.58
1	400	1800.00	1851.94	1851.32	6.82	157.00	272.18	115.18	3.94	0.048	0.0109	0.65
1	500	1800.00	1864.75	1864.54	3.65	80.64	722.50	641.85	2.75	0.050	0.0106	0.66
1	500	1800.00	1864.92	1864.54	3.26	136.00	626.00	490.00	2.92	0.050	0.0106	0.54
1	600	1800.00	1880.99	1880.66	3.23	2.01	792.97	790.96	2.99	0.051	0.0123	0.53
1	600	1800.00	1880.98		3.96	158.00	557.00	399.00	2.98	0.050	0.0123	0.65
1	700	1800.00	1898.74	1898.55	3.71	9.96	805.56	763.35	1.74	0.047	0.0127	0.69
1	700	1800.00	1898.99	1898.61	3.43	38.00	525.00	485.48	1.99	0.045	0.0127	0.58
1	800	1800.00	1921.62	1921.24	2.65	29.70	775.04	745.33	2.62	0.055	0.0119	0.48
1	800	1800.00	1921.52	1921.25	2.98	31.90	772.63	740.73	2.52	0.055	0.0119	0.57

HEC-RAS Plan: t5r6s25a River: t5r6s25a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	4100.00	1768.82	1768.34	3.16	22.11	1365.24	1276.25	2.82	0.057		0.53
1	100	4100.00	1768.98	1768.46	3.33	168.00	1204.00	1028.00	2.98	0.055		0.54
1	200	4100.00	1786.00	1785.12	4.21	56.32	822.00	765.68	5.00	0.055	0.0102	0.56
1	200	4100.00	1786.51	1785.82	5.08	170.00	525.00	355.00	5.51	0.055	0.0102	0.59
1	300	4100.00	1799.28	1798.58	3.48	50.22	1037.26	987.04	5.28	0.058	0.0091	0.46
1	300	4100.00	1799.71		3.86	199.00	677.00	478.00	5.71	0.055	0.0091	0.46
1	400	4100.00	1813.81	1813.38	3.19	97.69	1431.71	1311.78	5.81	0.057	0.0095	0.55
1	400	4100.00	1813.94	1813.52	3.48	196.00	1208.00	1005.57	5.94	0.055	0.0095	0.57
1	500	2000.00	1827.93		9.77	52.71	256.85	204.14	5.93	0.054	0.0107	0.75
1	500	2000.00	1828.58		11.11	129.00	193.69	64.68	6.58	0.049	0.0107	0.80
1	600	2000.00	1839.63	1839.53	8.37	28.60	163.69	135.09	3.63	0.041	0.0122	0.88
1	600	2000.00	1840.03	1839.49	7.68	58.00	140.00	82.00	4.03	0.040	0.0122	0.76
1	700	2000.00	1853.10		4.78	18.85	283.64	264.79	4.10	0.051	0.0099	0.53
1	700	2000.00	1853.26		5.56	77.00	210.00	133.00	4.26	0.050	0.0099	0.60
1	800	2000.00	1871.21	1871.21	9.66	5.23	197.44	192.21	5.21	0.049	0.0131	0.79
1	800	2000.00	1871.49	1871.49	12.63	82.87	117.00	34.13	5.48	0.040	0.0131	1.01
1	900	2000.00	1889.89	1889.89	8.19	5.02	274.43	269.41	3.89	0.046	0.0130	0.82
1	900	2000.00	1890.74	1889.93	8.10	89.00	151.00	62.00	4.74	0.040	0.0130	0.72
1	1000	2000.00	1909.84	1909.84	6.73	57.27	640.51	450.53	3.84	0.056	0.0139	0.69
1	1000	2000.00	1910.07	1909.80	9.01	493.00	562.00	69.00	4.07	0.055	0.0139	0.88
1	1100	2000.00	1924.86	1924.78	7.48	12.52	281.48	268.95	3.86	0.042	0.0127	0.82
1	1100	2000.00	1925.35		6.62	106.00	204.00	98.00	4.35	0.040	0.0127	0.67
1	1200	2000.00	1944.10	1943.73	4.26	35.85	526.70	490.85	3.10	0.051	0.0148	0.70
1	1200	2000.00	1943.75	1943.71	6.12	95.00	466.00	261.72	2.75	0.050	0.0148	0.96
1	1275	3400.00	1958.33	1957.89	4.27	2.51	594.99	592.48	4.33	0.052	0.0135	0.65
1	1275	3400.00	1958.87	1958.32	4.76	191.00	568.00	377.00	4.87	0.050	0.0135	0.61
1	1300	3400.00	1966.93	1966.93	6.49	5.26	551.97	546.71	4.93	0.041	0.0162	0.95
1	1300	3400.00	1966.90	1966.90	6.81	74.00	425.00	351.00	4.90	0.040	0.0162	1.01

HEC-RAS Plan: t5r6s25a River: t5r6s25a Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1400	4100.00	1987.23	1986.80	3.71	15.71	1026.00	1010.30	4.23	0.050	0.0150	0.58
1	1400	4100.00	1987.33	1986.81	3.74	88.00	899.00	811.00	4.33	0.050	0.0150	0.57
1	1450	4100.00	1999.27	1998.87	4.91	79.25	1003.55	756.92	3.27	0.050	0.0160	0.77
1	1450	4100.00	1999.20	1998.87	5.19	86.26	998.70	698.56	3.20	0.050	0.0160	0.80
1	1500	4100.00	2011.12	2010.17	2.11	30.67	1640.98	1610.32	3.12	0.055	0.0148	0.46
1	1500	4100.00	2011.14		2.09	30.10	1641.68	1611.59	3.14	0.055	0.0148	0.45
1	1600	4100.00	2036.61	2036.55	5.49	35.58	1056.35	743.93	2.61	0.050	0.0172	0.92
1	1600	4100.00	2036.58	2036.54	5.68	91.00	1040.00	665.80	2.58	0.050	0.0172	0.96
1	1700	4100.00	2081.60	2081.60	6.16	294.12	1450.07	811.19	2.60	0.056	0.0316	0.91
1	1700	4100.00	2081.64	2081.60	5.98	269.73	1458.77	847.41	2.64	0.056	0.0316	0.88
1	1800	4100.00	2087.72		3.36	7.48	487.96	480.48	4.72	0.047	0.0028	0.29
1	1800	4100.00	2087.90		3.53	178.00	438.00	260.00	4.90	0.045	0.0028	0.29
1	1900	4100.00	2111.60	2111.60	8.02	73.05	384.06	311.01	3.60	0.046	0.0160	0.97
1	1900	4100.00	2111.58	2111.58	8.31	104.00	337.00	233.00	3.58	0.045	0.0160	1.01
1	2025	4100.00	2137.86	2137.76	7.12	73.15	686.39	437.41	3.86	0.045	0.0173	0.87
1	2025	4100.00	2137.97	2137.68	6.98	225.00	670.00	273.70	3.97	0.045	0.0173	0.84
1	2050	4100.00	2146.50	2146.50	10.77	125.36	370.91	245.54	3.50	0.052	0.0180	1.07
1	2050	4100.00	2147.56	2147.56	12.34	281.90	374.51	92.61	4.56	0.045	0.0180	1.08
1	2100	4100.00	2160.36	2160.36	9.53	95.76	327.90	232.14	4.36	0.043	0.0144	0.88
1	2100	4100.00	2160.77		9.77	223.00	327.00	104.00	4.77	0.040	0.0144	0.86
1	2200	4100.00	2183.83	2183.78	8.07	32.39	269.93	237.54	3.83	0.050	0.0178	0.97
1	2200	4100.00	2183.83	2183.78	8.08	32.42	269.89	237.47	3.83	0.050	0.0178	0.97
1	2300	4100.00	2207.69	2207.68	12.70	6.78	86.06	79.28	5.69	0.041	0.0157	0.97
1	2300	4100.00	2207.69	2207.68	12.69	6.77	86.07	79.30	5.69	0.041	0.0157	0.97
1	2400	4100.00	2226.86	2226.26	8.39	17.99	154.29	136.29	3.86	0.050	0.0158	0.77
1	2400	4100.00	2226.86	2226.26	8.40	18.00	154.28	136.28	3.86	0.050	0.0158	0.77
1	2500	4100.00	2251.21	2251.21	11.91	18.94	120.02	101.08	5.21	0.036	0.0168	0.96
1	2500	4100.00	2251.21	2251.21	11.91	18.94	120.02	101.08	5.21	0.036	0.0168	0.96

HEC-RAS Plan: t5r6s25a River: t5r6s25a Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	2600	4100.00	2270.37	2270.37	11.58	5.44	99.93	94.49	4.37	0.035	0.0147	0.99
1	2600	4100.00	2270.37	2270.37	11.58	5.44	99.93	94.49	4.37	0.035	0.0147	0.99
1	2700	4100.00	2295.01	2295.01	11.92	5.93	103.53	97.60	5.01	0.036	0.0190	0.97
1	2700	4100.00	2295.01	2295.01	11.92	5.93	103.53	97.60	5.01	0.036	0.0190	0.97
1	2800	4100.00	2319.19	2319.19	12.13	2.03	89.78	87.75	5.19	0.036	0.0181	0.98
1	2800	4100.00	2319.19	2319.19	12.13	2.03	89.78	87.75	5.19	0.036	0.0181	0.98
1	2900	4100.00	2345.54	2345.54	11.95	3.68	112.58	108.90	5.54	0.037	0.0186	0.95
1	2900	4100.00	2345.54	2345.54	11.95	3.68	112.58	108.90	5.54	0.037	0.0186	0.95
1	3000	2400.00	2384.25	2384.25	10.33	7.88	86.96	79.09	4.25	0.040	0.0291	0.99
1	3000	2400.00	2384.25	2384.25	10.33	7.88	86.96	79.09	4.25	0.040	0.0291	0.99
1	3100	2400.00	2412.06	2412.06	10.55	13.62	125.27	111.66	5.05	0.043	0.0202	0.87
1	3100	2400.00	2412.06	2412.06	10.55	13.62	125.27	111.66	5.05	0.043	0.0202	0.87
1	3200	2400.00	2445.23	2445.23	11.27	44.99	134.85	89.86	5.23	0.039	0.0232	0.91
1	3200	2400.00	2445.23	2445.23	11.27	44.99	134.85	89.86	5.23	0.039	0.0232	0.91
1	3300	2400.00	2466.33	2466.33	8.02	18.37	210.61	192.24	2.33	0.047	0.0210	0.96
1	3300	2400.00	2466.33	2466.33	8.02	18.37	210.61	192.24	2.33	0.047	0.0210	0.96
1	3400	2400.00	2488.78	2488.66	7.73	16.72	184.50	167.77	2.78	0.046	0.0190	0.89
1	3400	2400.00	2488.78	2488.66	7.73	16.72	184.50	167.77	2.78	0.046	0.0190	0.89
1	3500	2400.00	2516.33	2516.33	9.13	33.91	162.14	128.23	3.33	0.047	0.0209	0.96
1	3500	2400.00	2516.33	2516.33	9.13	33.91	162.14	128.23	3.33	0.047	0.0209	0.96
1	3600	2400.00	2539.23	2538.99	6.68	33.90	243.49	209.60	2.23	0.045	0.0182	0.81
1	3600	2400.00	2539.23	2538.99	6.68	33.90	243.49	209.60	2.23	0.045	0.0182	0.81
1	3700	2400.00	2561.83	2561.52	5.38	51.84	326.66	274.82	2.83	0.050	0.0158	0.74
1	3700	2400.00	2561.83	2561.52	5.38	51.84	326.66	274.82	2.83	0.050	0.0158	0.74
1	3800	1400.00	2587.09	2587.09	7.88	19.66	155.73	136.07	3.08	0.043	0.0168	0.93
1	3800	1400.00	2587.09	2587.09	7.88	19.66	155.73	136.07	3.08	0.043	0.0168	0.93
1	3900	1200.00	2606.70	2606.27	5.70	36.73	147.51	110.78	2.70	0.050	0.0154	0.70
1	3900	1200.00	2606.70	2606.27	5.70	36.73	147.51	110.78	2.70	0.050	0.0154	0.70

HEC-RAS Plan: t5r6s25b River: t5r6s25b Reach: t5r6s25b

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t5r6s25b	200	5700.00	1741.80	1741.21	3.80	75.47	1668.89	1593.42	3.80	0.054		0.49
t5r6s25b	200	5700.00	1741.80	1741.21	3.80	75.47	1668.89	1593.42	3.80	0.054		0.49
t5r6s25b	300	5700.00	1752.64	1751.83	4.14	29.16	1569.57	979.14	3.64	0.060	0.0092	0.53
t5r6s25b	300	5700.00	1752.64	1751.83	4.14	29.17	1569.54	978.97	3.64	0.060	0.0092	0.53
t5r6s25b	400	1600.00	1768.77	1768.49	5.69	27.43	523.96	496.53	4.77	0.053	0.0096	0.50
t5r6s25b	400	1600.00	1768.77	1768.49	5.69	27.35	524.01	496.65	4.77	0.053	0.0096	0.50

HEC-RAS Plan: t5r6s30 River: t5r6s30 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	2100.00	1832.94	1832.39	6.53	80.42	348.01	267.58	3.94	0.049		0.60
1	100	2100.00	1833.83	1832.62	7.16	137.00	218.51	81.51	4.83	0.048		0.59
1	200	2100.00	1843.70	1842.86	7.20	60.66	220.38	159.71	4.70	0.050	0.0060	0.60
1	200	2100.00	1844.70		7.70	120.55	176.00	55.45	5.70	0.046	0.0060	0.58
1	300	2100.00	1851.21	1850.73	6.86	30.13	223.24	193.10	4.21	0.048	0.0076	0.64
1	300	2100.00	1852.04		7.17	113.00	180.00	67.00	5.04	0.045	0.0076	0.60
1	400	2100.00	1863.13		6.55	181.05	431.27	250.23	4.13	0.049	0.0073	0.59
1	400	2100.00	1864.12		7.34	275.00	335.00	60.00	5.12	0.045	0.0073	0.59

HEC-RAS Plan: t5r6s33a River: t5r6s33a Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	200	4000.00	1759.88	1758.94	6.06	200.46	546.50	346.04	4.88	0.047		0.56
1	200	4000.00	1760.37	1759.01	6.38	340.00	492.00	152.00	5.37	0.045		0.55
1	300	4000.00	1771.51	1771.13	9.00	78.14	360.02	281.88	5.51	0.050	0.0066	0.70
1	300	4000.00	1772.28		9.90	190.98	278.00	87.02	6.28	0.047	0.0066	0.72
1	400	4000.00	1781.20	1780.77	7.40	6.83	560.95	554.12	5.20	0.053	0.0083	0.63
1	400	4000.00	1782.17		7.65	382.12	534.00	151.88	6.17	0.051	0.0083	0.59
1	500	4000.00	1797.62	1797.04	6.65	7.12	1010.74	699.01	3.61	0.057	0.0080	0.64
1	500	4000.00	1798.55	1797.89	8.26	143.27	754.73	611.46	4.55	0.055	0.0080	0.70
1	600	4000.00	1813.28	1813.10	5.70	22.30	799.69	777.39	3.28	0.047	0.0103	0.76
1	600	4000.00	1813.61	1813.14	5.64	102.00	443.00	341.00	3.61	0.045	0.0103	0.69
1	700	4000.00	1825.23	1824.86	7.02	0.00	715.72	715.72	4.23	0.051	0.0092	0.63
1	700	4000.00	1825.75	1825.03	8.75	122.11	277.09	154.98	4.75	0.049	0.0092	0.74
1	800	4000.00	1840.34	1840.11	7.18	66.43	669.02	602.59	3.34	0.051	0.0091	0.71
1	800	4000.00	1841.34	1840.51	7.45	321.12	501.00	179.88	4.34	0.048	0.0091	0.64

HEC-RAS Plan: t5r6s33b River: t5r6s33b Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	200	3400.00	1752.91	1751.50	9.91	33.27	218.91	185.63	7.91	0.053		0.63
1	200	3400.00	1753.91	1751.54	10.76	96.09	151.80	55.71	8.91	0.051		0.64
1	300	3400.00	1762.51	1761.31	7.33	29.72	183.41	153.69	6.51	0.047	0.0073	0.61
1	300	3400.00	1763.26		7.18	40.00	130.00	90.00	7.26	0.045	0.0073	0.55
1	400	3400.00	1773.41	1772.57	8.09	66.33	270.64	204.31	5.41	0.050	0.0076	0.64
1	400	3400.00	1774.14	1772.93	9.55	114.00	182.74	68.74	6.14	0.046	0.0076	0.71
1	500	3400.00	1782.49	1781.39	9.06	4.76	241.55	236.78	7.49	0.055	0.0049	0.59
1	500	3400.00	1783.48		8.70	47.73	140.00	92.27	8.48	0.055	0.0049	0.53
1	600	3400.00	1791.24	1790.70	7.73	70.75	347.87	277.12	5.24	0.051	0.0079	0.64
1	600	3400.00	1791.77	1790.95	9.69	166.30	252.40	86.09	5.77	0.047	0.0079	0.76
1	700	3400.00	1800.11		6.16	96.41	537.00	440.59	5.11	0.055	0.0051	0.49
1	700	3400.00	1801.05		5.44	134.00	390.70	256.70	6.05	0.054	0.0051	0.40
1	800	3400.00	1808.25	1808.07	8.71	34.00	437.34	403.34	4.25	0.055	0.0064	0.76
1	800	3400.00	1808.63	1808.63	11.82	244.80	372.00	127.20	4.63	0.053	0.0064	0.99
1	900	3400.00	1818.44		6.40	109.21	522.78	413.57	4.44	0.051	0.0077	0.57
1	900	3400.00	1819.44		6.00	219.64	410.28	190.64	5.44	0.050	0.0077	0.48
1	1000	4000.00	1832.60		7.10	24.39	412.00	387.61	4.60	0.051	0.0060	0.60
1	1000	4000.00	1833.02	1832.18	9.30	163.60	291.17	127.57	5.02	0.049	0.0060	0.75
1	1100	4000.00	1849.81	1849.81	9.86	120.22	495.51	375.28	5.80	0.050	0.0165	0.80
1	1100	4000.00	1850.09	1850.09	11.88	319.37	431.00	111.63	6.09	0.048	0.0165	0.93
1	1200	4000.00	1853.41		3.05	36.46	677.83	641.37	8.41	0.050	0.0006	0.20
1	1200	4000.00	1854.37		2.88	347.23	618.00	270.77	9.37	0.050	0.0006	0.17
1	1300	4000.00	1862.23	1862.23	8.55	140.14	499.91	359.77	3.23	0.047	0.0079	0.89
1	1300	4000.00	1862.55	1862.55	10.13	279.00	404.00	125.00	3.55	0.045	0.0079	1.00
1	1400	4000.00	1879.66	1878.95	5.27	0.00	705.00	705.00	3.65	0.050	0.0079	0.49
1	1400	4000.00	1880.52		5.67	268.70	486.42	217.73	4.52	0.048	0.0079	0.47
1	1500	4000.00	1890.32	1890.32	7.10	45.71	860.06	814.34	4.32	0.050	0.0078	0.76
1	1500	4000.00	1890.62	1890.62	9.96	578.00	710.00	132.00	4.62	0.045	0.0078	1.01

HEC-RAS Plan: t5r6s33b River: t5r6s33b Reach: 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	1600	4000.00	1906.45	1906.00	5.29	88.30	1116.64	1014.00	3.45	0.054	0.0100	0.59
1	1600	4000.00	1907.42	1906.33	5.24	581.31	911.00	329.69	4.42	0.051	0.0100	0.49
1	1700	4000.00	1921.79	1921.66	5.73	230.54	994.97	751.62	2.79	0.049	0.0108	0.81
1	1700	4000.00	1921.87	1921.87	7.22	625.00	978.00	344.94	2.87	0.045	0.0108	1.00
1	1800	4000.00	1942.29	1941.99	6.90	50.49	569.51	519.01	3.29	0.050	0.0122	0.69
1	1800	4000.00	1943.27	1942.21	7.36	370.25	509.00	138.75	4.27	0.045	0.0122	0.64

HEC-RAS Plan: t5r7s14 River: t5r7s14 Reach: reach 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
reach 1	100	3500.00	1968.12	1967.93	6.91	89.92	676.76	586.84	5.12	0.044		0.74
reach 1	100	3500.00	1968.43	1967.93	7.34	472.50	632.00	159.50	5.43	0.040		0.75
reach 1	200	3500.00	1987.28	1987.26	6.89	198.18	835.17	636.98	3.28	0.047	0.0097	0.77
reach 1	200	3500.00	1987.82	1987.38	7.85	195.16	345.00	149.84	3.82	0.040	0.0097	0.80
reach 1	300	3500.00	2004.15	2004.15	7.17	108.95	683.78	574.83	3.15	0.043	0.0111	0.76
reach 1	300	3500.00	2004.27	2003.87	7.82	108.91	263.00	154.09	3.27	0.040	0.0111	0.81
reach 1	400	3500.00	2020.30	2020.30	8.30	109.98	658.32	398.07	4.30	0.043	0.0099	0.76
reach 1	400	3500.00	2020.36	2019.91	9.15	332.80	435.00	102.20	4.35	0.040	0.0099	0.83
reach 1	500	3500.00	2034.54	2034.34	7.28	85.78	546.79	407.14	3.04	0.043	0.0103	0.77
reach 1	500	3500.00	2034.91	2034.25	7.15	390.41	548.24	157.83	3.41	0.040	0.0103	0.72
reach 1	600	3500.00	2046.16		5.38	285.48	540.82	255.33	3.16	0.040	0.0078	0.59
reach 1	600	3500.00	2046.11	2045.38	5.50	285.56	540.54	254.98	3.11	0.040	0.0078	0.61
reach 1	700	3500.00	2066.88	2066.88	9.54	473.47	604.52	131.05	3.38	0.040	0.0103	1.01
reach 1	700	3500.00	2066.88	2066.88	9.54	473.45	604.54	131.09	3.38	0.040	0.0103	1.00
reach 1	800	3500.00	2078.01	2077.60	8.16	134.73	601.76	330.33	4.51	0.047	0.0100	0.71
reach 1	800	3500.00	2078.76	2077.90	9.36	339.00	416.00	77.00	5.26	0.040	0.0100	0.75
reach 1	900	3500.00	2092.89	2092.89	9.87	253.37	425.18	171.82	3.39	0.043	0.0107	0.96
reach 1	900	3500.00	2093.52	2093.06	9.28	325.00	422.00	97.00	4.02	0.040	0.0107	0.83
reach 1	1000	2000.00	2126.72	2126.02	6.64	252.99	374.26	121.27	4.72	0.040	0.0122	0.74
reach 1	1000	2000.00	2126.31	2126.02	7.86	268.49	373.54	105.05	4.31	0.040	0.0122	0.89
reach 1	1100	2000.00	2147.45	2147.22	8.14	202.40	297.20	94.80	3.45	0.040	0.0120	0.89
reach 1	1100	2000.00	2147.77	2147.22	7.22	198.94	298.06	99.12	3.77	0.040	0.0120	0.76
reach 1	1200	2000.00	2164.15	2163.57	7.00	326.73	427.01	100.27	3.15	0.040	0.0113	0.73
reach 1	1200	2000.00	2163.89	2163.57	7.70	327.75	426.43	98.68	2.89	0.040	0.0113	0.84
reach 1	1300	2000.00	2182.53	2182.53	10.14	309.74	387.51	77.77	3.53	0.041	0.0121	0.97
reach 1	1300	2000.00	2182.81	2182.56	9.82	325.60	381.00	55.40	3.81	0.040	0.0121	0.90
reach 1	1400	2000.00	2204.03	2203.82	9.00	118.16	192.12	73.96	4.03	0.040	0.0140	0.91
reach 1	1400	2000.00	2204.01	2203.82	9.05	118.26	191.90	73.64	4.01	0.040	0.0140	0.92

HEC-RAS Plan: t5r7s14 River: t5r7s14 Reach: reach 1 (Continued)

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
reach 1	1500	2000.00	2232.51	2232.51	10.67	58.72	133.56	74.83	5.51	0.041	0.0179	0.94
reach 1	1500	2000.00	2232.49	2232.49	11.41	64.00	108.00	44.00	5.49	0.040	0.0179	1.01
reach 1	1600	2000.00	2252.79	2252.79	10.13	139.17	225.38	86.21	3.79	0.043	0.0147	0.94
reach 1	1600	2000.00	2253.52	2252.91	9.42	150.90	200.00	49.10	4.52	0.040	0.0147	0.80
reach 1	1700	2000.00	2270.43	2270.03	7.43	118.38	220.68	102.30	3.43	0.040	0.0126	0.79
reach 1	1700	2000.00	2270.34	2270.03	7.69	120.90	219.00	98.10	3.34	0.040	0.0126	0.83
reach 1	1800	1300.00	2296.24	2296.24	10.28	168.76	207.65	38.89	4.24	0.040	0.0120	1.01
reach 1	1800	1300.00	2296.46	2296.25	9.62	168.54	208.37	39.84	4.46	0.040	0.0120	0.92
reach 1	1900	1300.00	2322.31	2322.31	8.26	291.98	370.30	78.32	3.31	0.040	0.0270	0.99
reach 1	1900	1300.00	2322.28	2322.28	8.35	293.86	367.12	73.26	3.28	0.040	0.0270	1.01
reach 1	2000	1300.00	2347.76	2347.62	7.82	179.73	256.04	76.31	3.76	0.040	0.0167	0.93
reach 1	2000	1300.00	2347.79	2347.62	7.69	179.63	256.69	77.07	3.79	0.040	0.0167	0.92
reach 1	2100	1000.00	2370.97	2370.97	8.44	158.97	227.68	68.71	2.97	0.040	0.0172	0.95
reach 1	2100	1000.00	2370.91	2370.91	8.80	173.00	221.00	48.00	2.91	0.040	0.0172	1.01

HEC-RAS Plan: Plan 01 River: t6r4s27 Reach: t6r4s27

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t6r4s27	100	2200.00	1777.57	1777.32	9.80	128.03	234.70	106.67	4.57	0.051		0.84
t6r4s27	100	2200.00	1778.83	1778.08	10.74	152.00	190.10	38.10	5.83	0.045		0.81
t6r4s27	200	2200.00	1829.73	1829.73	7.82	171.30	419.69	248.39	2.73	0.048	0.0176	0.90
t6r4s27	200	2200.00	1829.89	1829.83	8.71	236.00	336.00	100.00	2.89	0.045	0.0176	0.97
t6r4s27	300	1200.00	1947.95	1947.95	8.54	136.35	221.49	85.15	2.95	0.047	0.0195	0.93
t6r4s27	300	1200.00	1948.30	1947.99	8.30	151.00	200.00	49.00	3.30	0.045	0.0195	0.85

HEC-RAS Plan: t6r4s33 River: T6R4S33 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1000.00	1768.80	1768.74	5.47	28.20	230.80	202.60	1.80	0.048		0.90
1	100	1000.00	1768.91	1768.83	5.80	28.09	165.00	136.91	1.91	0.045		0.91
1	200	1000.00	1795.70	1795.52	4.43	187.65	423.48	235.84	1.70	0.045	0.0197	0.76
1	200	1000.00	1795.71	1795.52	4.43	187.51	399.00	211.49	1.71	0.045	0.0197	0.75
1	300	1000.00	1886.67	1886.67	13.14	12.00	34.33	22.33	5.66	0.047	0.0202	0.97
1	300	1000.00	1887.77	1886.99	12.30	18.00	30.00	12.00	6.77	0.045	0.0202	0.83

HEC-RAS Plan: t6r5s21 River: t6r5s21 Reach: t6r5s21

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t6r5s21	100	5200.00	2200.57	2200.40	2.59	0.00	460.00	460.00	3.57	0.046		0.50
t6r5s21	100	5200.00	2200.57	2200.40	2.59	0.00	460.00	460.00	3.57	0.046		0.50
t6r5s21	200	4400.00	2234.89	2234.88	7.59	84.61	642.78	352.20	2.39	0.050	0.0170	1.09
t6r5s21	200	4400.00	2234.89	2234.88	7.59	84.61	642.78	352.20	2.39	0.050	0.0170	1.09
t6r5s21	300	4400.00	2267.54	2267.48	10.57	200.41	380.42	180.01	4.54	0.047	0.0184	0.89
t6r5s21	300	4400.00	2267.54	2267.48	10.57	200.41	380.42	180.01	4.54	0.047	0.0184	0.89
t6r5s21	400	4400.00	2300.09	2300.09	9.65	29.55	281.28	251.73	6.09	0.046	0.0171	0.75
t6r5s21	400	4400.00	2300.09	2300.09	9.65	29.55	281.28	251.73	6.09	0.046	0.0171	0.75
t6r5s21	500	4400.00	2322.34	2322.34	11.22	13.69	129.70	116.01	5.34	0.045	0.0150	0.96
t6r5s21	500	4400.00	2322.34	2322.34	11.22	13.69	129.70	116.01	5.34	0.045	0.0150	0.96
t6r5s21	600	4400.00	2354.17	2354.17	11.01	43.41	170.49	127.09	5.17	0.045	0.0199	0.95
t6r5s21	600	4400.00	2354.17	2354.17	11.01	43.41	170.49	127.09	5.17	0.045	0.0199	0.95
t6r5s21	700	4400.00	2381.46	2381.46	11.96	26.70	135.03	108.33	5.46	0.046	0.0160	0.93
t6r5s21	700	4400.00	2381.46	2381.46	11.96	26.70	135.03	108.33	5.46	0.046	0.0160	0.93
t6r5s21	800	3700.00	2408.99	2408.80	8.97	15.03	156.62	141.58	3.99	0.045	0.0171	0.90
t6r5s21	800	3700.00	2408.99	2408.80	8.97	15.03	156.62	141.58	3.99	0.045	0.0171	0.90
t6r5s21	900	3200.00	2440.72	2440.72	11.33	16.41	106.13	89.72	4.72	0.046	0.0170	0.93
t6r5s21	900	3200.00	2440.72	2440.72	11.33	16.41	106.13	89.72	4.72	0.046	0.0170	0.93
t6r5s21	1000	3200.00	2479.04	2479.04	11.94	14.25	86.27	72.02	5.04	0.045	0.0235	0.96
t6r5s21	1000	3200.00	2479.04	2479.04	11.94	14.25	86.27	72.02	5.04	0.045	0.0235	0.96
t6r5s21	1100	3200.00	2519.32	2519.32	10.31	94.78	280.76	185.98	3.32	0.044	0.0214	1.05
t6r5s21	1100	3200.00	2519.32	2519.32	10.31	94.78	280.76	185.98	3.32	0.044	0.0214	1.05
t6r5s21	1200	2000.00	2541.97	2541.94	7.64	71.32	289.89	218.56	2.97	0.047	0.0154	0.88
t6r5s21	1200	2000.00	2541.97	2541.94	7.64	71.32	289.89	218.56	2.97	0.047	0.0154	0.88
t6r5s21	1300	1400.00	2572.24	2572.24	7.65	105.50	213.51	108.02	2.24	0.040	0.0186	1.00
t6r5s21	1300	1400.00	2572.24	2572.24	7.65	105.50	213.51	108.02	2.24	0.040	0.0186	1.00

HEC-RAS Plan: 1 River: t6r5s36 Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1400.00	2070.44	2070.16	3.84	8.93	548.87	539.93	2.44	0.051		0.56
1	100	1400.00	2070.70	2070.16	4.24	320.00	510.00	190.00	2.70	0.045		0.57
1	200	1400.00	2098.26	2098.26	5.60	78.41	639.86	561.45	2.26	0.047	0.0153	0.76
1	200	1400.00	2098.23	2098.23	7.33	90.00	205.00	115.00	2.23	0.040	0.0153	1.00
1	300	1400.00	2122.41	2122.41	7.77	243.44	357.76	114.32	2.41	0.041	0.0161	0.97
1	300	1400.00	2122.63	2122.41	7.23	265.00	353.00	88.00	2.63	0.040	0.0161	0.86
1	400	1400.00	2150.08	2150.08	9.16	107.60	207.72	100.12	4.08	0.043	0.0143	0.85
1	400	1400.00	2150.08	2150.08	9.16	107.60	207.72	100.12	4.08	0.043	0.0143	0.85
1	500	1400.00	2178.45	2178.45	10.52	141.73	196.34	54.61	4.45	0.041	0.0163	0.95
1	500	1400.00	2178.45	2178.45	10.52	141.73	196.34	54.61	4.45	0.041	0.0163	0.95
1	600	1400.00	2200.19	2200.19	9.18	102.72	182.23	79.51	3.19	0.042	0.0197	0.95
1	600	1400.00	2200.19	2200.19	9.18	102.72	182.23	79.51	3.19	0.042	0.0197	0.95
1	700	1400.00	2234.85	2234.85	7.27	142.80	271.20	128.41	1.85	0.040	0.0207	0.99
1	700	1400.00	2234.85	2234.85	7.27	142.80	271.20	128.41	1.85	0.040	0.0207	0.99

HEC-RAS Plan: 1 River: T6R5S36B Reach: 1

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
1	100	1400	1990.66	1990.49	6.14	35.48	459	423.52	2.66	0.059		0.69
1	100	1400	1991.71	1991.11	7.1	230	313.15	83.15	3.71	0.058		0.67

HEC-RAS Plan: t6r6s22 River: t6r6s22 Reach: t6r6s22

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t6r6s22	100	2400.00	2358.85	2358.85	12.05	9.45	66.56	57.11	5.85	0.046		0.92
t6r6s22	100	2400.00	2358.85	2358.85	12.05	9.45	66.56	57.11	5.85	0.046		0.92
t6r6s22	200	2000.00	2392.15	2392.15	10.78	35.37	115.97	80.60	4.15	0.048	0.0222	0.98
t6r6s22	200	2000.00	2392.15	2392.15	10.78	35.37	115.97	80.60	4.15	0.048	0.0222	0.98
t6r6s22	300	1300.00	2430.44	2430.41	5.73	36.23	247.47	211.24	2.44	0.045	0.0229	0.97
t6r6s22	300	1300.00	2430.44	2430.41	5.73	36.23	247.47	211.24	2.44	0.045	0.0229	0.97
t6r6s22	400	1100.00	2454.93	2454.63	3.77	44.79	311.35	266.56	1.93	0.045	0.0181	0.63
t6r6s22	400	1100.00	2454.93	2454.63	3.77	44.79	311.35	266.56	1.93	0.045	0.0181	0.63
t6r6s22	500	1100.00	2491.42	2491.42	7.75	89.40	199.23	109.84	2.42	0.042	0.0181	0.93
t6r6s22	500	1100.00	2491.42	2491.42	7.75	89.40	199.23	109.84	2.42	0.042	0.0181	0.93

HEC-RAS Plan: t6r6s25 River: t6r6s25 Reach: t6r6s25

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t6r6s25	100	2200.00	2167.20	2166.98	9.37	23.39	94.90	71.51	5.20	0.045		0.91
t6r6s25	100	2200.00	2167.20	2166.98	9.37	23.39	94.90	71.51	5.20	0.045		0.91
t6r6s25	200	1400.00	2200.04	2200.04	10.64	0.00	38.00	38.00	5.04	0.045	0.0205	1.01
t6r6s25	200	1400.00	2200.04	2200.04	10.64	0.00	38.00	38.00	5.04	0.045	0.0205	1.01
t6r6s25	300	1200.00	2236.96	2236.44	7.66	21.54	74.53	52.99	3.96	0.050	0.0197	0.79
t6r6s25	300	1200.00	2236.96	2236.44	7.66	21.54	74.53	52.99	3.96	0.050	0.0197	0.79
t6r6s25	400	1000.00	2256.74	2256.74	8.34	21.20	82.82	61.62	2.74	0.050	0.0241	0.98
t6r6s25	400	1000.00	2256.74	2256.74	8.34	21.20	82.82	61.62	2.74	0.050	0.0241	0.98
t6r6s25	500	1000.00	2290.02	2289.60	4.72	44.91	205.12	160.21	2.02	0.055	0.0202	0.63
t6r6s25	500	1000.00	2290.02	2289.60	4.72	44.91	205.12	160.21	2.02	0.055	0.0202	0.63

HEC-RAS Plan: t6r7s34 River: t6r7s34 Reach: t6r7s34

Reach	River Sta	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Sta W.S. Lft	Sta W.S. Rgt	Top Width	Max Chl Dpth	Mann Wtd Total	Invert Slope	Froude # Chl
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)			
t6r7s34	100	1400.00	2118.28	2117.66	4.27	76.14	260.14	184.00	3.28	0.055		0.55
t6r7s34	100	1400.00	2118.28	2117.66	4.27	76.14	260.14	184.00	3.28	0.055		0.55
t6r7s34	200	1400.00	2136.67	2136.50	7.08	36.84	144.66	107.82	2.67	0.045	0.0140	0.87
t6r7s34	200	1400.00	2136.67	2136.50	7.08	36.84	144.66	107.82	2.67	0.045	0.0140	0.87
t6r7s34	300	1400.00	2158.21	2157.89	8.02	16.65	106.78	90.13	3.21	0.050	0.0149	0.81
t6r7s34	300	1400.00	2158.21	2157.89	8.02	16.65	106.78	90.13	3.21	0.050	0.0149	0.81
t6r7s34	400	1400.00	2172.97	2172.13	4.69	25.77	160.84	135.07	2.97	0.050	0.0103	0.53
t6r7s34	400	1400.00	2172.97	2172.13	4.69	25.77	160.84	135.07	2.97	0.050	0.0103	0.53
t6r7s34	450	1400.00	2195.91	2195.91	9.59	10.14	72.16	62.02	3.91	0.046	0.0140	0.95
t6r7s34	450	1400.00	2195.91	2195.91	9.59	10.14	72.16	62.02	3.91	0.046	0.0140	0.95
t6r7s34	500	1400.00	2212.11		7.89	29.45	124.27	94.82	4.11	0.041	0.0133	0.77
t6r7s34	500	1400.00	2212.11		7.89	29.45	124.27	94.82	4.11	0.041	0.0133	0.77
t6r7s34	600	1400.00	2229.22	2229.12	8.67	34.74	99.65	64.91	3.22	0.040	0.0123	0.94
t6r7s34	600	1400.00	2229.22	2229.12	8.67	34.74	99.65	64.91	3.22	0.040	0.0123	0.94
t6r7s34	700	1000.00	2261.06	2261.06	6.37	10.36	248.88	172.64	2.06	0.046	0.0197	0.98
t6r7s34	700	1000.00	2261.06	2261.06	6.37	10.36	248.88	172.64	2.06	0.046	0.0197	0.98
t6r7s34	800	800.00	2283.93	2283.68	4.97	34.26	177.51	143.25	1.93	0.046	0.0194	0.73
t6r7s34	800	800.00	2283.93	2283.68	4.97	34.26	177.51	143.25	1.93	0.046	0.0194	0.73
t6r7s34	900	800.00	2317.11	2317.09	6.31	84.92	413.83	104.66	2.11	0.050	0.0202	0.99
t6r7s34	900	800.00	2317.11	2317.09	6.31	84.92	413.83	104.66	2.11	0.050	0.0202	0.99
t6r7s34	1100	300.00	2406.95	2406.95	6.90	15.18	44.80	29.62	1.95	0.045	0.0360	1.00
t6r7s34	1100	300.00	2406.95	2406.95	6.90	15.18	44.80	29.62	1.95	0.045	0.0360	1.00
t6r7s34	1200	300.00	2446.88	2446.88	7.19	39.85	66.15	26.29	1.88	0.045	0.0377	1.01
t6r7s34	1200	300.00	2446.88	2446.88	7.19	39.85	66.15	26.29	1.88	0.045	0.0377	1.01

5.3 Parameter Estimation

Manning's equation was used to determine the flow width and depth for each cross section. The variables of the equation are as follows:

$$Q=A\ ^{1.49}/_{n}\ R^{2/3}\ S^{1/2}$$

Where:

Q = 100-year discharge in cubic feet per second (cfs)
A = The cross-sectional area of the cross section at the corresponding depth in square feet
n = Manning's roughness coefficient
R = Hydraulic radius in feet
S = Friction slope

5.3.1 Roughness Coefficients

Manning's roughness coefficient (n value) describes the friction attributable to the channel, banks and overbank areas. The n value generally varies with depth of flow, so it is determined assuming a flow depth associated with the 100-year discharge.

Manning's "n" values were determined using the methodology outlined in the USGS report titled, "Estimating Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" by B.W. Thomsen and H.W. Hjalmarson, (April, 1991)[3].

Field reconnaissance was undertaken to photograph typical reaches in the study area and to document channel and overbank conditions. The findings of these field investigations were summarized in a separate Manning's n value report produced by JEF in association with Wood, Patel & Associates and Argus Consulting for this study for the FCDMC (see Appendix E.1).

The field reconnaissance was performed by personnel from the three firms noted above. In order to assure consistency in n-value estimates, the members of the project team participated in a one-day joint reconnaissance meeting which included stops at a variety of reach types. A technical memorandum, written to describe the results from the meeting, is included in Appendix E.1.

5.4 Cross-section descriptions

Cross section data were collected from the base map using various software tools available in AutoCAD Land Development Desktop Version 2. The base map used included that described in Section 5.2 (above).

Cross sections are labeled numerically in intervals of 100 increasing in the upstream direction. Cross sections are typically spaced at approximately 1,500 to 2,000-foot intervals. Cross section stationing is from left to right if viewed in the downstream direction.

Low-flow channel geometry was estimated using the aerial base as a guide, from observations of surficial geology from the aerial photos and during reconnaissance, and the survey data described in Section 3.1 of this Technical Data Notebook.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and drop analysis

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

5.5.2 Bridge or Culverts

Numerous culverts are located on the Toyota Proving Grounds property. For the purposes of this approximate-level study, it was assumed that no flow passes through any culvert during the 100-year peak discharge, and that the elevation of the road passing over the culvert controls the ponding depth.

5.5.3 Levees and Dikes

There are numerous earthen diversion berms associated with stock tanks located throughout the study area. None of those visited during field reconnaissance appeared to be maintained, and displayed evidence of erosion, breeching and overtopping. The largest of these structures do, however cause significant diversions. In these cases, the effects of the diversions were considered, but it was also assumed that the structures would eventually fail due to lack of maintenance.

5.5.4 Islands and Flow Splits

In general, small islands were not delineated on the workmaps. Numerous flow splits were identified in the study area, and since the topography at splits tends to be relatively subtle, cross sections were surveyed at these locations to more accurately determine the flow distribution. See section 4.1 for a more detailed description of how flow splits were analyzed.

5.5.5 Ineffective Flow Areas

The effect of ineffective flow areas was simulated by increasing the Manning's n value in those areas of the cross section thought to be ineffective and by utilizing the ineffective flow options available in HEC-RAS 3.1.

5.5.6 Supercritical Flow

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

5.6 Floodway modeling

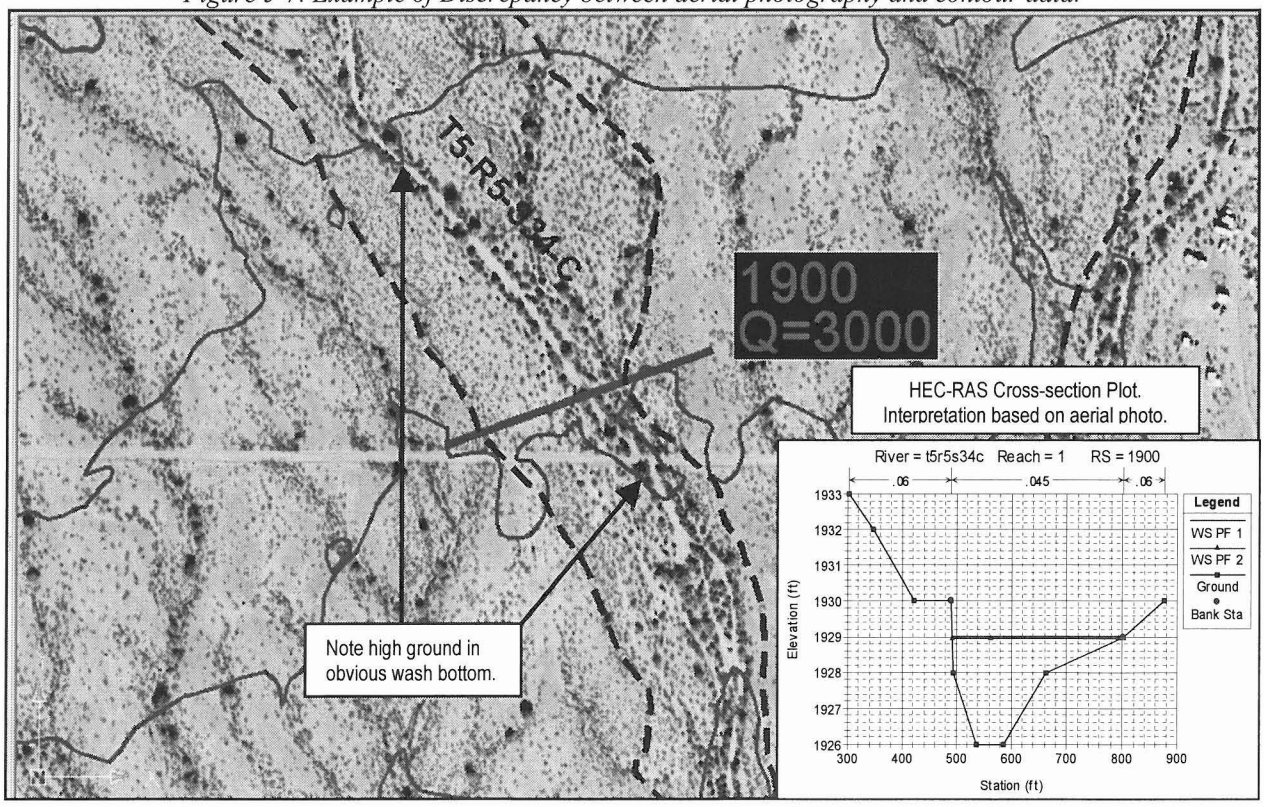
Using HEC-RAS, a method 4 profile (equal conveyance encroachment) was run with a one-foot surcharge target to define the administrative floodway. Floodway surcharge targets for individual cross sections were adjusted to eliminate surcharges less than zero and greater than one foot and to avoid exclusion of active channels from the administrative floodway zones. As with the floodplain delineation, the administrative floodway delineation was further refined by observation of geomorphic features identified from the aerial base mapping and during field visits. Once targets were adjusted and the results approved by the Flood Control District of Maricopa County, all encroachment profiles were converted to method 1.

Since this is an approximate Zone A delineation, administrative floodway tables are not included in this TDN.

5.7 Special problems encountered during the study

In a few limited cases, discrepancies exist between the aerial photo and the 10 ft contour mapping. The discrepancies generally consist of the contour data showing high ground or no change in relief where an obvious drainage path exists on the aerial photo. The mapping at cross-section 1900 of reach T5-R5-S34C, Figure 5-7, shows an example of this type of discrepancy.

Figure 5-7. Example of Discrepancy between aerial photography and contour data.



Cross sections located in reaches which display this discrepancy were adjusted to reflect the actual conditions of the channel based on observations of the aerial photography and field verification (see above example)

5.8 Calibration

No hydraulic calibration was performed during this study.

5.9 Final Results

5.9.1 Hydraulic analysis results

A summary of the hydraulic analysis results are provided in the following HEC-RAS Summary tables below. Appendix E.2 (Volume 2) presents cross section plots along with the detailed geometry input data.

5.10 References

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

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

3. U.S. Army Corps of Engineers, HEC-RAS River Analysis System Users Manual, Version 3.0, January, 2001.

4. U.S. Army Corps of Engineers, HEC-RAS River Analysis System Hydraulic Reference Manual, Version 3.0, January, 2001

5. U.S. Army Corps of Engineers, HEC-RAS River Analysis System, Version 3.0, January, 2001.

SECTION 6: EROSION AND SEDIMENT TRANSPORT

No erosion or sediment transport analyses were conducted as part of this study. However, a geomorphic assessment was made to define the boundaries of the study area that could not be mapped using the hydrologic and hydraulic floodplain modeling techniques described in sections 4 and 5 to this TDN. This assessment was performed by JE Fuller/Hydrology & Geomorphology, Inc. as part of this study and was published as a technical memorandum to Mr. Michael Duncan, P.E., of the Flood Control District of Maricopa County. The technical memorandum was dated October 8, 2002 and is included in this section.

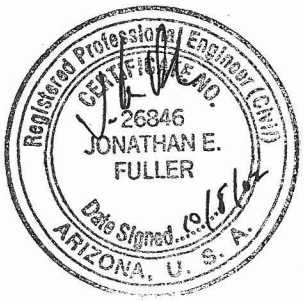
Memorandum **JE Fuller/ Hydrology & Geomorphology, Inc.**

DATE: October 8, 2002

TO: Michael Duncan, P.E./FCDMC

FROM: Jon Fuller, P.E., P.H., C.F.M.

RE: **Watershed OO - Jackrabbit Wash**
Approximate Zone A Floodplain Delineation Study
Task 6.4: Special Piedmont Area Boundary Definition



CC: Brian R. Iserman, P.E.

Introduction

JE Fuller/Hydrology & Geomorphology, Inc., (JEF) has completed a piedmont boundary delineation for the Jackrabbit Wash Approximate Method Floodplain Delineation Study, as required by Task 6.4 of the study scope of services, which states the following:

> *Task 6.4 - The delineation of 52 miles of the study (inside the piedmont areas shown in Exhibit A[1]) shall be based on the final results of the hydrologic study as directed by the District and geomorphic analyses of the piedmont surface. The purpose of this delineation will be to identify the overall boundary of the piedmont areas using low-level geomorphic approaches in order to provide a limit of the approximate Zone A delineations. This will include interpretation of aerial photographs, USGS topographic maps, stereo photos developed under the USGS Aerial Photography Program (NAPP, 1997), and observations in the field.*

This memorandum describes the processes used to identify the parts of the study area that could not be mapped using the hydraulic and hydrologic floodplain modeling techniques used for the remainder of the Jackrabbit Wash study area, and recommends methods for future floodplain delineations in these areas.

Methodology

The Jackrabbit Wash study area (Figure 1) consists of mountains, foothills, and a wide piedmont area known as the Hassayampa Plain, which is located between Jackrabbit Wash and the Hassayampa River. Floodplains in the mountain and foothill areas consist of riverine systems with well-defined stream terraces that confine flood flows within the tributary drainage network. In most of the piedmont area, floodplains are also located along riverine systems characterized by tributary drainage networks, readily defined watersheds, and continuous channel systems. Riverine floodplains in the study area were mapped using convention hydraulic and hydrologic modeling techniques, such as Manning's ratings at specific cross sections, supplemented by interpretation of fluvial landforms.

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[1] Piedmont zone from Exhibit A is shown as the hatched area on Figure 1.

The portions of the study area that could not be readily mapped using hydraulic and hydrologic floodplain modeling techniques are referred to as "non-riverine piedmont flood hazard areas." Non-riverine piedmont flood hazard areas identified within the study limits included active alluvial fans, distributary flow areas, pediments and sheet flow (shallow flooding) floodplains. Methods for identifying alluvial fan and distributary flow area flood hazards are discussed in detail in the Districts' *Piedmont Flood Hazard Assessment Manual – Draft* (PFHAM - FCDMC, 1998). Methods for identifying sheet flooding hazards are described in Arizona State Standard 4-95 *Identification of and Development Within Sheet Flow Areas* (SS4-95 - ADWR, 1995).

As discussed in the PFHAM and SS4-95, non-riverine piedmont flood hazard areas have some or all of the following characteristics:

- Absence of continuous identifiable flow corridors
- Absence of identifiable well-defined hydrologic concentration points
- Absence of well-defined or linear stream terraces
- Channels and floodplains that lack capacity to contain flood flows
- Distributary channel networks that branch in the downstream direction
- Evidence of unstable flow paths or historical channel avulsions
- Uniform floodplain vegetative, topographic, and soil attributes
- Evidence of unconfined overland flooding between channels
- Alluvial fan landform topography

To define the limits of the non-riverine piedmont flood hazard areas, JEF relied on observations made from aerial photographs and 10-foot contour interval topographic mapping provided by the District, LANDSAT images developed and processed for flood hazard mapping of the study area (JEF, 2002), detailed soils mapping published by the USDA Soil Conservation Service (SCS - Camp, 1986), surficial geomorphic mapping and geologic mapping published by the Arizona Geological Survey (AZGS - Dempsey, 1988, Reynolds and Grubensky, 1993), reconnaissance-level field work, and engineering judgment. Landform characteristics observed in the field and on aerial photographs included relative channel size, drainage pattern, drainage density, frequency and spacing of channel splits, surface color, vegetative associations, and surface color. Landform indicators observed on topographic mapping included degree of contour crenulation, degree of channel incision, presence of radial or linear contour pattern, and contour spacing.

To a limited degree, some of the piedmont characteristics listed above also exist on the riverine stream segments in the Jackrabbit Wash study area. However, the areas identified as non-riverine piedmont surfaces for this task exhibit these characteristics to the degree that the use of conventional approximate floodplain mapping techniques would be likely to generate unrealistic or incomplete floodplain delineations. Also, note that while the results of this task show the non-riverine piedmont flood hazard area boundaries as distinct lines, in practice the limits between piedmont and riverine flood processes are usually transitional, occurring over a broad zone that may fluctuate with time. Therefore,

the boundaries should be considered approximate given the level of effort dictated by the scope of services.

Non-Riverine Piedmont Flood Hazard Areas

The following types of non-riverine piedmont flood hazard areas were identified in the Jackrabbit Wash study area (Figure 2):

- Pediments
- Active alluvial fans
- Distributary flow areas
- Sheet flow areas

Pediments. A pediment is a broad, concave up, gently sloping erosional surface underlain by shallow or exposed bedrock. Pediments have low lateral relief and are frequently located at the base of a mountain front or other topographic rise. A pediment was identified in the northern portion of the study area (Figure 1), based on geologic and soils mapping of the study area. A Late Cretaceous granodiorite bedrock unit (Kgd) crops out at the surface (Reynolds & Grubensky, 1993) or is buried by thin Middle Pleistocene alluvium (Dempsey, 1988) that is also mapped as the Gran-Wickenberg Complex soils unit (Camp, 1986). The LANDSAT 3-5-6 image developed by JEF (2002) further indicates the presence of surrounding and underlying shallow bedrock. The AZGS geologic map and SCS soils map of the area are shown in Figures 3 and 4, respectively. The LANDSAT image is shown in Figure 5. Descriptions of SCS soils units are provided in Table 1.

Aerial photography of the pediment area (Figure 6) indicates a lack of channel development and drainage network integration, as well as uniform surficial characteristics. The few poorly defined channels that occur in the pediment area are typically less than 15 feet wide and 2 feet deep. These channels are too small to contain significant flow events, resulting in frequent inundation of the unconfined floodplains. Topographic mapping shows smooth, non-crenulated, parallel contours that indicate low lateral relief and lack of channel incision. Shallow bedrock prevents scour and formation well-defined channels or development of the lateral relief required to confine flood flows. Therefore, because of the lack of an integrated channel network and low lateral relief, flood runoff on the piedmont probably occurs as unconfined sheet flow. Bedrock crops out as inselbergs or small hills throughout the pediment area. In general, these bedrock areas are topographically elevated and are probably not subject to significant flood and erosion hazards.

Floodplain delineation of the sheet flow floodplains on the pediment surface could be accomplished using several techniques. First, if expected flow depths are less than three feet, approximate methods may be used. Approximate methods range from geomorphic mapping and landform interpretation techniques to Manning's ratings. The techniques could be used to delineate unnumbered A zones or numbered AO zones. Second, if flow

Table 1. SCS Soils Map Units in the Jackrabbit Wash Study Area.

SCS #	SCS Soils Map Units	Component Soil Series	Position / Landform	Important Characteristics	Subgroup, Order
Defined Channels and Floodplains					
3 4	Antho-Carrizo-Maripo Complex	Antho - 35%	Floodplains, alluvial fans, and drainageways	- 55% with non-calcareous surface layer & calcareous below, 25% calcareous throughout; main limitation to development is hazard of flooding	- Typic Torrifluvents, Entisols
		Carrizo - 30%	Floodplains, drainageways, alluvial fans, and stream terraces	- Subject to occasional flooding; hazard due to water erosion is severe; channeling, deposition, and stream bank erosion occur during flooding	- Typic Torriorthents, Entisols
		Maripo - 20%	Floodplains and low stream terraces	- Subject to rare periods of flooding * Main limitation for urban development of entire units is that they are subject to flooding.	- Typic Torrifluvents, Entisols
Pediment Soils					
62	Gran-Wickenberg Complex	Gran - 45%	Pediments and mountain slopes	- Reddish yellow very gravelly sandy loam, B horizon with many clay films, depth to weathered bedrock mainly from 10 to 20 inches	- Typic Haplargids, Aridisols
		Wickenberg - 35%	Pediments and mountain slopes	- Reddish brown gravelly sandy loam, B horizon slightly effervescent, depth to weathered, fractured bedrock 10 to 20 inches, but as little as 3 inches in some areas	- Typic Camborthids
64	Gran-Wickenberg-Rock Complex	Gran - 30%	Pediments and mountain slopes	-See above	- Typic Haplargids, Aridisols
		Wickenberg - 25% Rock - 25%	Pediments and mountain slopes	- See above	- Typic Camborthids
Relict Alluvial Fans (Fan Terraces)					
21	Cipriano Very Gravelly Loam	Cipriano -	Fan terraces	- High lime content and restricted available water capacity contribute to very low productivity on these soils, shallow, underlain by indurated duripan	- Typic Durorthids
29 30	Denure-Momoli-Carrizo Complex	Denure - 40%	Stream and fan terraces	- Calcareous below about 8 inches; B horizon development; buried calcic or argillic horizon present in some pedons	- Typic Camborthids, Aridisols
		Momoli - 30%	Stream and fan terraces	- B horizon development; strongly effervescent at depth	- Typic Camborthids, Aridisols
		Carrizo - 20%	Floodplains, drainageways, alluvial fans and terraces	- See above	- Typic Torriorthents, Entisols
47	Ebon-Gunsight-Cipriano Association	Ebon - 35%	Fan and stream terraces	- Yellowish red color, common thin clay films, strongly effervescent B horizon	- Typic Haplargids, Aridisols
		Gunsight - 20%	Fan terraces	- C horizon is strongly to violently effervescent and weakly cemented in some pedons	- Typic Calciorthids, Aridisols

Table 1. SCS Soils Map Units in the Jackrabbit Wash Study Area.

SCS #	SCS Soils Map Units	Component Soil Series	Position / Landform	Important Characteristics	Subgroup, Order
				** These are old surfaces generally free from floods.	
		Cipriano - 20%	Fan terraces	- See above	- Typic Durorthids, Aridisols
49	Ebon-Pinamt Complex	Ebon - 45%	Fan and stream terraces	- Yellowish red color, high clay content, calcareous at depth	- Typic Haplargids, Aridisols
		Pinamt - 35%	Fan terraces	- Yellowish red B horizons which are strongly to violently effervescent	- Typic Haplargids, Aridisols
66	Greyeagle-Suncity Complex	Greyeagle – 55%	Fan terraces	- Pink and light brown very gravelly loam, absence of B horizon, depth to duripan (caliche) 4 to 20 in.	- Typic Durorthids
		Suncity - 30%	Fan terraces	- Indurated duripan below 5 inches; B horizon development; moderately thick clay films	- Typic Durargids
68	Gunsight-Cipriano Complex	Gunsight - 45%	Fan terraces	- See above	- Typic Calciorthids, Aridisols
		Cipriano - 40%	Fan terraces	- See above	- Typic Durorthids
70	Gunsight-Rillito Complex	Gunsight - 40%	Fan terraces	- See above	- Typic Calciorthids, Aridisols
71		Rillito - 40%	Fan terraces	- Weak calcic horizon at 4 to 36 inches	- Typic Calciorthids, Aridisols
74	Luke-Cipriano Association	Luke - 45%	Fan terraces	- Moderately deep, well drained soils, yellowish red color, noneffervescent B horizon, depth to duripan ranges from 20 to 40 inches	- Typic Durargids
		Cipriano - 35%	Fan terraces	- See above	- Typic Durorthids
78	Mohall Clay Loam	Mohall - varies	Fan terraces	- Well drained, light brown; calcic horizon ranges from 6 to 40 inches	- Typic Haplargids, Aridisols
81	Mohall-Tremant Complex	Mohall - 45%	Fan terraces	- See above	- Typic Haplargids, Aridisols
		Tremant - 25%	Fan and stream terraces	- Light reddish brown B horizons, calcic horizon at 5 to 24 inches, strongly to violently effervescent at depth, clay at depth	- Typic Haplargids, Aridisols
91	Momoli-Carrizo Complex	Momoli - 45%	Stream and fan terraces	- Weakly developed, light brown	- Typic Camborthids, Aridisols
92		Carrizo - 35%	Floodplains, drainageways, alluvial fans, and terraces	- Poorly developed, pinkish gray, brown moist	- Typic Torriorthents, Entisols
94	Nickel-Cave Complex	Nickel - 50%	Fan terraces	- Pinkish gray gravelly sandy loam, absence of B horizon, depth to calcic horizon ranges from 3 to 20 inches	- Typic Calciorthids
		Cave - 35%	Fan terraces	- Shallow gravelly loam, absence of B horizon, depth to petrocalcic horizon ranges from 8 to 19 inches	- Typic Paleorthids
97	Pinaleno-Tres Hermanos Complex	Pinaleno - 45%	Fan terraces	- Yellowish red A and B horizons, 40% to 90% of surface covered with gravels and cobbles	- Typic Haplargids, Aridisols
		Tres Hermanos -40%	Fan and stream terraces	- Reddish yellow A and B horizons which are strongly to violently effervescent	- Typic Haplargids, Aridisols

Table 1. SCS Soils Map Units in the Jackrabbit Wash Study Area.

SCS #	SCS Soils Map Units	Component Soil Series	Position / Landform	Important Characteristics	Subgroup, Order
98 99	Pinamt-Tremant Complex	Pinamt - 45% Tremant - 35%	Fan terraces Fan and stream terraces	- Yellowish red B horizons which are strongly to violently effervescent - Light reddish brown B horizons, calcic horizon at 5 to 24 inches, strongly to violently effervescent at depth, clay accumulation at depth	- Typic Haplargids, Aridisols - Typic Haplargids, Aridisols
102	Rillito Gravelly Loam	Rillito - varies	Fan terraces	- Weakly cemented calcic horizon at 4 to 36 inches	- Typic Calciorthids, Aridisols
110	Suncity-Cipriano Complex	Suncity - 55% Cipriano - 30%	Fan terraces Fan terraces	- Indurated duripan below 5 inches; B horizon development; moderately thick clay films - High lime content and restricted available water capacity contribute to very low productivity on these soils, shallow, underlain by indurated duripan (caliche), poorly developed, brown, calcareous	- Typic Durargids - Typic Durorthids
114	Tremant Gravelly Loam	Tremant - varies	Fan and stream terraces	- See above	- Typic Haplargids, Aridisols
112	Tremant Grvl Sand Loam	Tremant - varies	Fan and stream terraces	- See above	- Typic Haplargids, Aridisols
116 117	Tremant-Gunsight-Rillito	Tremant - 30% Gunsight - 20% Rillito - 20%	Fan and stream terraces Fan terraces Fan terraces	- See above - See above - See above	- Typic Haplargids, Aridisols - Typic Calciorthids, Aridisols - Typic Calciorthids, Aridisols
121	Tres Hermanos-Anthony Complex	Tres Hermanos -50% Anthony - 35%	Fan and stream terraces Floodplains and alluvial fans	- Reddish yellow A and B horizons which are strongly to violently effervescent - Light brown, well drained soil, buried argillic horizon is below 40 inches	- Typic Haplargids, Aridisols - Typic Torrifluvents
Active Alluvial Fans					
50	Estrella Loams	Estrella - varies	Alluvial fans	- Depth to buried subsoil ranges from 20 to 40 inches, brown, well-drained	- Typic Torrifluvents
Other Landforms					
73	Lehmans Rock Outcrop Complex	Lehmans - 45% Rock - 30%	Mountain slopes	- Shallow to very shallow, well drained, reddish brown, depth to unweathered bedrock 6 to 20 inches	- Lithic Haplargids
103	Rock Outcrop Gachado	Gachado - 25% Rock - 65%	Mountain slopes	- Brown gravelly, sandy loam, depth to unweathered bedrock 20cm	- Lithic Haplargids
123	Vaiva Very Gravelly Loam	Vaiva - varies	Mountain slopes	- Yellowish red, depth to unweathered bedrock less than 20 inches	- Lithic Haplargids, Aridisols

From Soil Survey, Aguila-Carefree Area, Parts Of Maricopa And Pinal Counties, Arizona (Camp, 1986)

depths greater than three feet are expected or if more detailed mapping is required, a two-dimensional model is recommended to account for broad unconfined overland flow as well as the flow diversions created by the transverse felsic dikes that crop out on the surface of the pediment. Preliminary evaluation suggests that expected flow depths will average less than three feet. Therefore, approximate methods are recommended for future floodplain delineation.

Active Alluvial Fans. An alluvial fan is a sedimentary deposit located at a mountain front or other topographic break that is composed of alluvium and has an extended fan shape. An active alluvial fan is one on which the processes of sediment deposition and erosion result in net aggradation, avulsive channel movement, and uncertain flow paths across the surface of the fan.

Five potential active alluvial fans were identified within the Jackrabbit Wash study area (Figures 2; Figures 7 to 11) primarily on the basis of surficial characteristics, topographic expression, and channel pattern. Active alluvial fans typically have very smooth (non-crenulated) contours that bow in the downstream direction. Active alluvial fan features visible on the aerial photographs include uniform vegetative cover and surficial characteristics, a distributary channel pattern, discontinuous flow paths, and lack of an integrated drainage network. Dempsey (1988) and Reynolds and Grubensky (1993) identified three of the active alluvial fans as Qy (Holocene alluvium) surfaces, but failed to identify alluvial fans #1 and #2 (Figure 2). The SCS did not map any of the soil units underlying the five alluvial fan areas identified as non-riverine flood hazard areas as alluvial fans.

Floodplain delineation of the five active alluvial fans should be accomplished using the procedures outlined in the PFHAM. The apparent discrepancy between topographic and surficial evidence used in this study to identify the alluvial fans and the AZGS and SCS mapping should be investigated as part the future floodplain delineation studies.

Distributary Flow Areas. Distributary flow is defined as a branching channel pattern in which the number of channels increases in the downstream direction. Channels in distributary flow areas may split and rejoin numerous times as they traverse a landform. Distributary flow differs from sheet flow in that distributary flows are typically deeper than sheet flow and confined to channels that are generally hydraulic separated from one another with un-flooded interfluves (islands) between adjacent flow paths. Sheet flows generally inundate broad, connected portions of a landform. Distributary flow differs from active alluvial fan flooding in that the distributary flow paths are typically more stable than alluvial fan channels. Unlike active alluvial fans, distributary flow areas may not be aggrading.

Distributary flow occurs throughout the piedmont areas of the Jackrabbit Wash study area. However, the channel pattern in the distributary flow area identified on Figures 2 and 12 is so complex as to defy floodplain delineation using the approximate method riverine modeling techniques used for the remainder of the study area due to the

uncertainty in discharge. The distributary flow area shown in Figure 12 was identified primarily on the basis of the channel pattern and apparent surficial age, as indicated by surface color, relief, and topography crenulation.

Future floodplain delineation of the distributary flow area outlined in Figure 12 may be accomplished using geomorphic mapping techniques. If detailed delineations are required, a two-dimensional model should be used to better account for flow attenuation and bifurcating flow patterns through the distributary channel network. Alternatively, more detailed geomorphic mapping of the distributary flow areas could be used to develop more refined floodplain delineations.

Sheet Flooding. Sheet flooding is a type of surface water runoff that occurs on broad, unconfined floodplains of low relief. Sheet flooding probably occurs over most of the lower piedmont in the Jackrabbit Wash study area, including the areas located between the mapped riverine floodplains. Sheet flood areas were identified based primarily on surficial characteristics such as uniform vegetation, surface color, channel pattern, and drainage density, as well as by colors shown on the processed LANDSAT image (Figure 13). Soil units underlying sheet-flooding areas are typically mapped as alluvial plains or floodplains by the SCS (Camp, 1986), or are shown as Qy surfaces on AZGS surficial mapping (Dempsey, 1988). The sheet flooding areas appear as white or mottled surfaces in the processed LANDSAT imagery of Robinson (2002).

Preliminary analysis indicates that sheet-flooding areas located between the mapped riverine floodplains probably have 100-year flow depths that average less than one foot. As such, it may be prudent to map the sheet flooding areas between the mapped riverine floodplains as shaded Zone X. The shaded Zone X designation will help to prevent construction of at-grade buildings within areas of shallow flooding.

Conclusions

Non-riverine piedmont flood hazard areas were identified on a pediment surface, five active alluvial fans, a large distributary flow area, and sheet flow areas in the Jackrabbit Wash study area. Floodplain delineation in these areas may be accomplished using geomorphic mapping techniques or two-dimensional hydraulic and hydrologic modeling, depending on the level of detail desired. Until such mapping is completed the non-riverine piedmont flood hazard areas should be shown as unnumbered A zones.

Due to the types of flood hazards that occur in non-riverine areas, JEF recommends the following development guidelines and floodplain management policies:

1. Floodway corridors should be identified through the unnumbered A Zone floodplains to assure that water and sediment conveyance is maintained.
2. More detailed mapping using PFHAM, geomorphic, or two-dimensional modeling should be completed as soon as possible.

3. Single lot development should be discouraged in favor of master-planned communities so that flood conveyance through the entire system can be addressed.
4. Future development should include significant open space between developed areas to prevent flow concentration and degradation.

References Cited

Arizona Department of Water Resources, 1995, *State Standard for Identification of and Development Within Sheet Flow Areas*. State Standard 4-95.

Camp, P.D, 1986, *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona*. Washington, D.C.

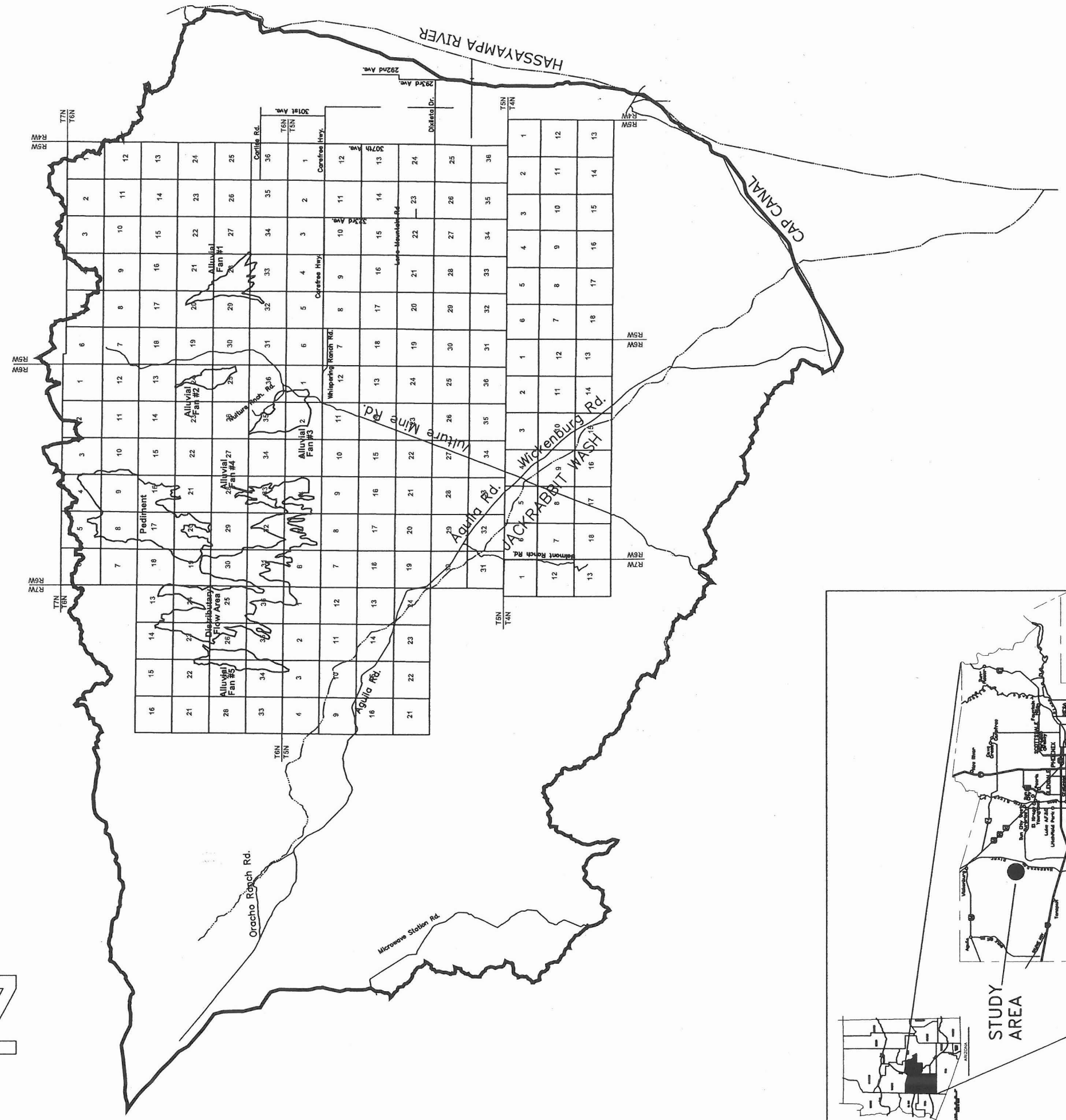
Dempsey, K.A., 1988, *Geologic Map of Quaternary and Upper Tertiary Alluvium in the Phoenix North 30'x60' Quadrangle, Arizona*. Arizona Geological Survey Open File Report 88-17.

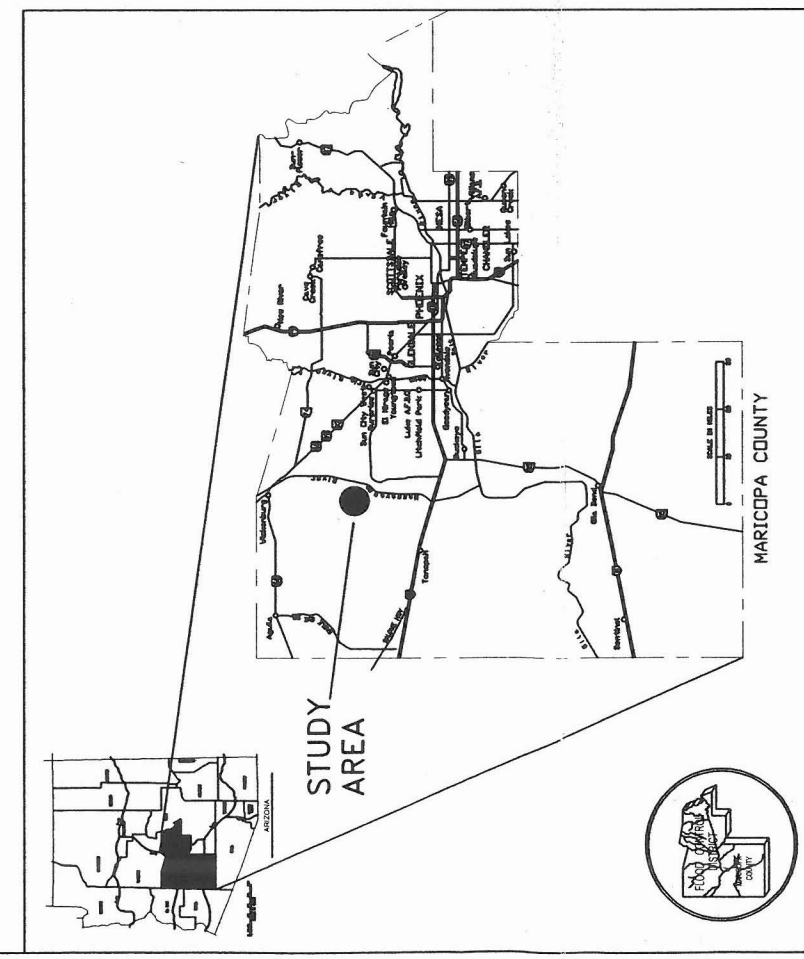
Federal Emergency Management Agency, 1995, *FEMA 37 Guidelines and Specifications for Study Contractors*. Washington, D.C.

FCDMC, 1998, *Piedmont Flood Hazard Assessment for Floodplain Management for Maricopa County User's Manual – Draft.*

JE Fuller/Hydrology & Geomorphology, Inc., 2002, *The Use of Multi-Spectral Remote Sensing Imagery For Geomorphic Mapping and Determination of Flood Prone Areas on Piedmonts in Maricopa County, AZ - An Example From a Portion of the Jackrabbit Wash Watershed*. Report to the Flood Control District of Maricopa County.

Reynolds, S.J., and Grubensky, M.J., 1993, *Geologic Map of the Phoenix North 30'x60' Quadrangle, Central Arizona*. Arizona Geological Survey Open File Report 93-17.





SCALE

7500' 0' 7500' 15000'

1 INCH = 7500 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WATERSHED "OO"

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY, FCD 2000C019

TASK 6.4:
SPECIAL PIEDMONT AREA BOUNDARY DEFINITION

OCTOBER, 2002

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.
TEMPE, ARIZONA - 480-752-2124

Figure 1: Study Area

APPROX. ZONE A FLOODPLAIN DELINEATION STUDY OF WATERSHED "00"

NON-RIVERINE FLOOD
HAZARD ZONES
FCD 2000c019 Task 6.4

OCTOBER, 2002

LEGEND

Zone Boundary

Scale
0 2500 5000 7500
1 Inch = 5000 Feet

VICINITY

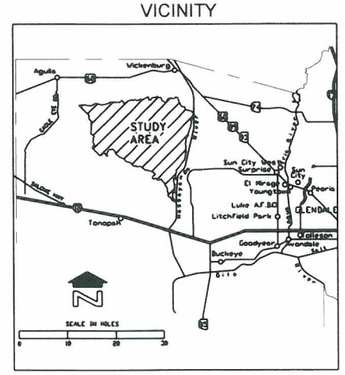


Figure 2. Study Area Overview

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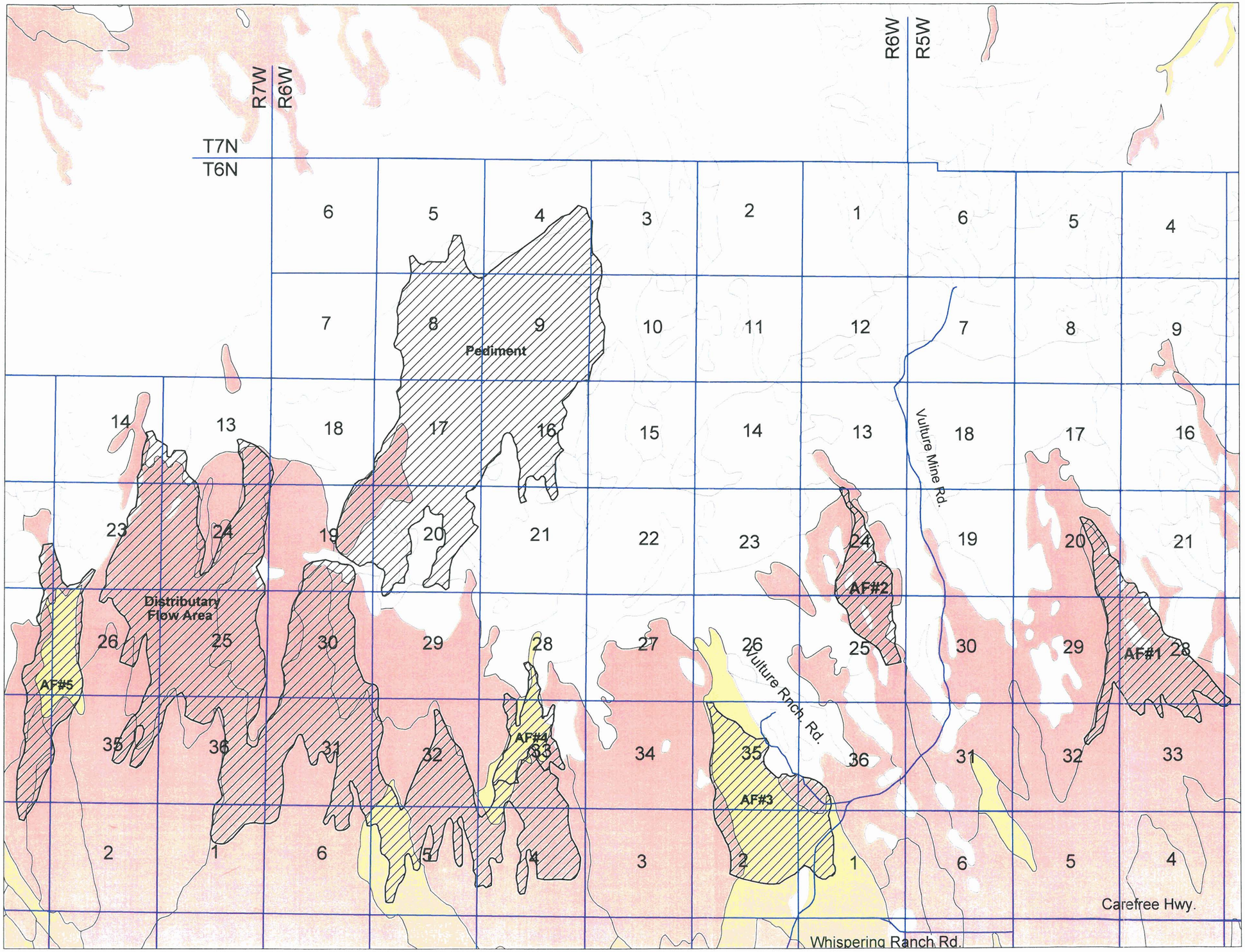
480-752-2124

R7W R6W R6W R5W
T7N
T6N
Pediment
Alluvial Fan #5
Distributary Flow Area
Alluvial Fan #4
Alluvial Fan #2
Alluvial Fan #3
Alluvial Fan #1
Vulture Dam Rd
Vulture Ranch Rd.
Vulture Mine Rd
Whispering Ranch Rd.
Carefree Hwy.



N

Figure 3. Geologic Map of Non-Riverine flood hazard zones (Task 6.4)

Explanation

Non-Riverine flood hazard zones

UNIT

Holocene alluvium (0 -- ~10,000 yrs)

Pleistocene alluvium (~10,000 -- 2 million yrs)

Bedrock

0 0.5 1 2 Miles

Scale

Data simplified from the Geologic Map of the Phoenix North 30' x 60' Quadrangle (Arizona Geologic Survey)

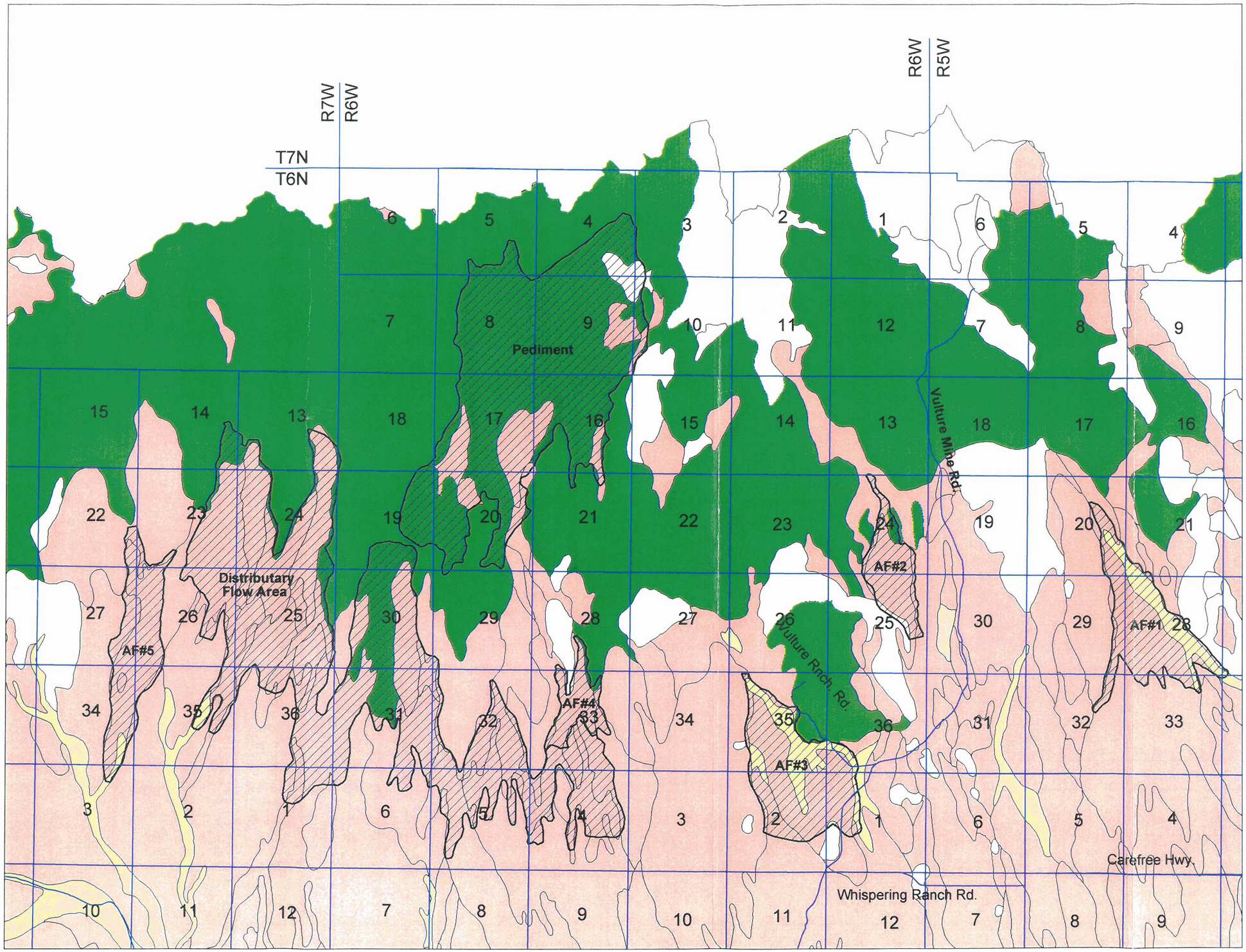


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Figure 4. Soils Map of Non-Riverine flood hazard zones (Task 6.4)

Explanation

Non-Riverine flood hazard zone

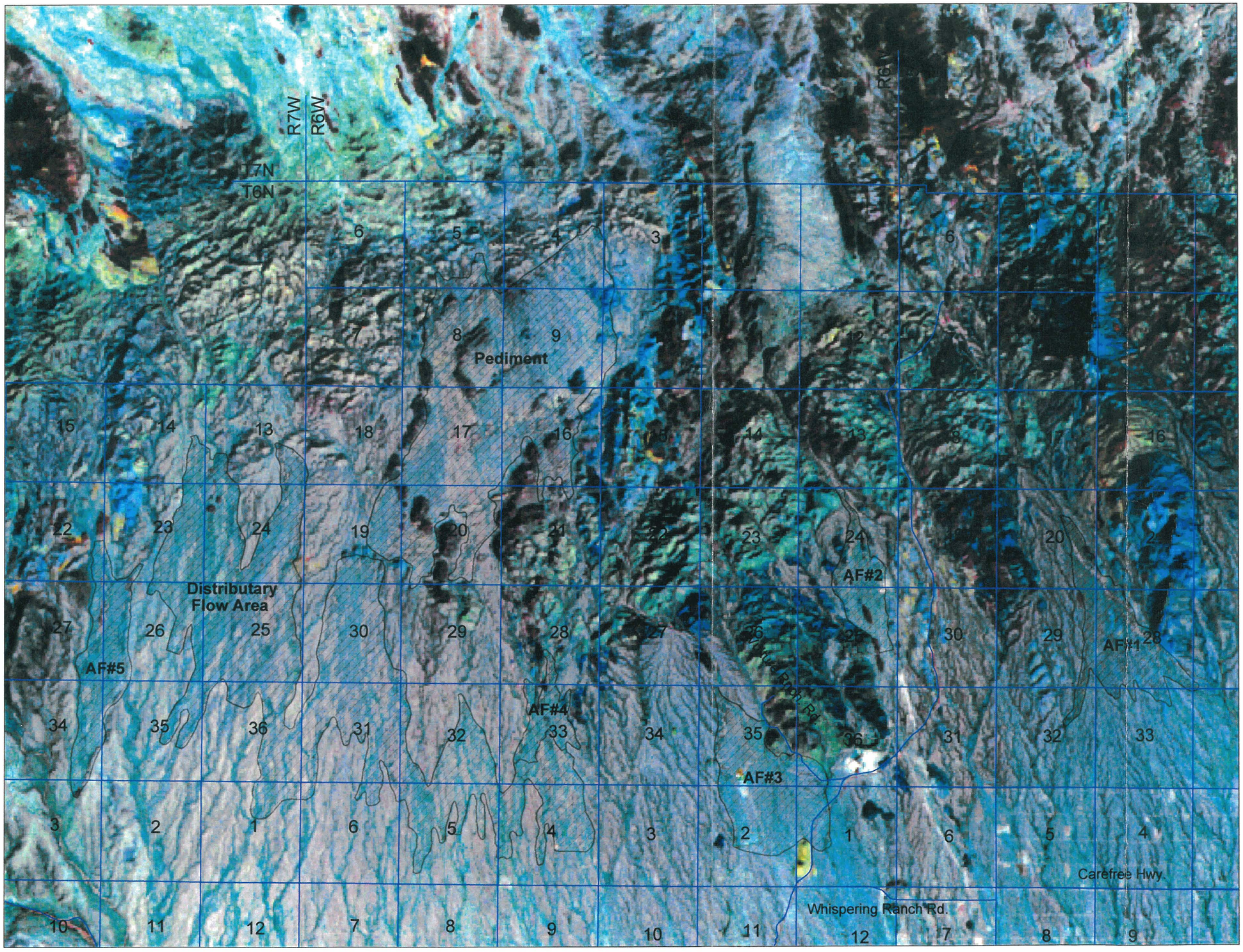
UNIT

- Floodplain, active fan, and channel
- Fan terrace
- Pediment
- Other

0 0.5 1 2 Miles

Scale

Data simplified from Aguila-Carefree Soils Map (Camp, 1986)



N

Figure 5. Landsat 7 ETM+ Image of Non-Riverine flood hazard zones (Task 6.4)

Explanation

Non-Riverine flood hazard zones

COLOR	*GEOMORPHIC UNIT*
Orange	Fan terrace
White	Floodplain deposit
Blue/green	Bedrock

0 0.45 0.9 1.8 Miles

Scale

Landsat image from Robinson (2002)

Figure 6. Pediment Area

Zone Boundary

Scale

0 800 1600 2400

1 Inch = 1600 Feet

N

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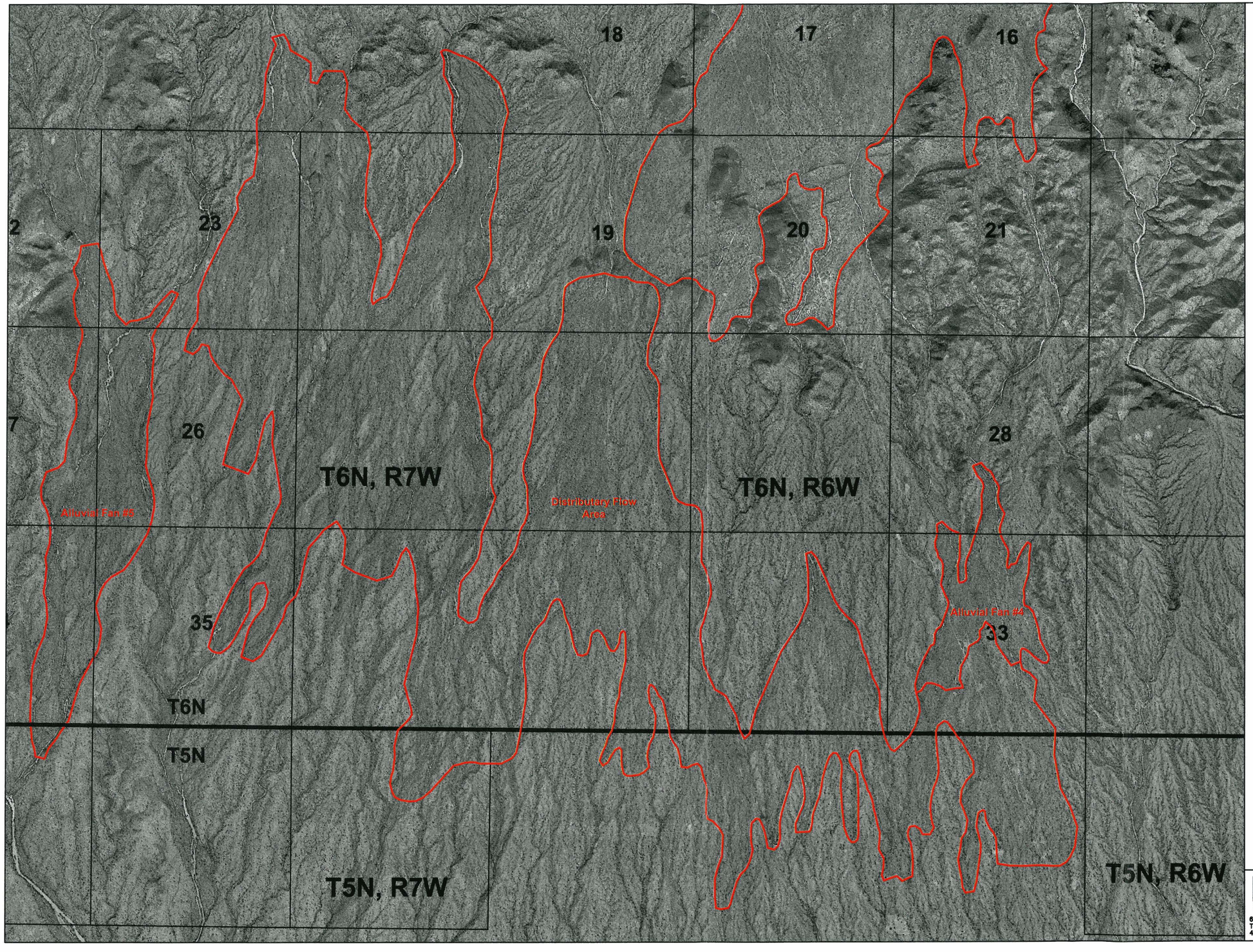

Figure 12. Distributary Zone

Zone Boundary

Scale

0 1300 2600 3900

1 Inch = 2600 Feet

N

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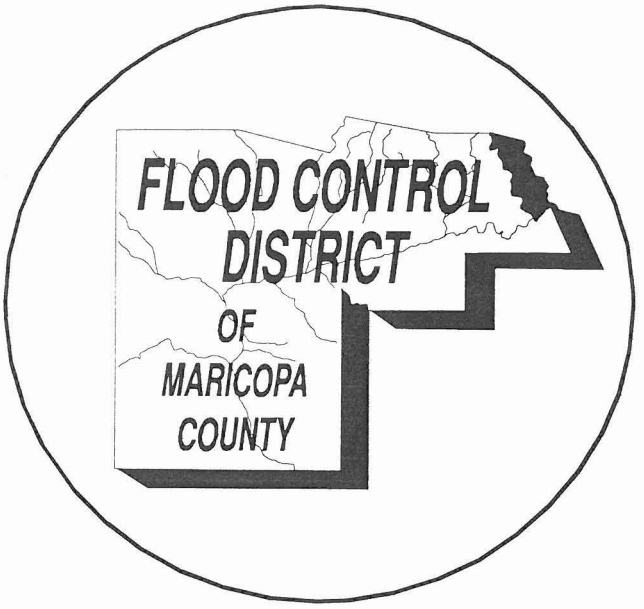
480-752-2124

B.5 Contract Documents



CONTRACT FCD 2000C019

JACKRABBIT WASH WATERSHED ZONE A FLOODPLAIN DELINEATION STUDY

C-69-01-025-5-00

Pursuant to the provisions of the Arizona Revised Statutes § 48-3603, the Board of Directors of the Flood Control District of Maricopa County has the authority to enter into contracts.

The **Flood Control District of Maricopa County**, Arizona, hereinafter called "District", is desirous of having certain professional services performed in connection with **Contract FCD 2000C019, Jackrabbit Wash Watershed Zone A Floodplain Delineation Studies, (also referred to as Watershed OO)**, hereinafter called the "Project" and as more fully described in Exhibit A, Scope of Work, and in accordance with Exhibit B, Fee Proposal attached; and **JE Fuller/Hydrology & Geomorphology, Inc.** hereinafter called "Consultant", with its principal offices located at **5235 S. Kyrene Road, Suite 205, Tempe Arizona, 85283**, is desirous of performing said services;

THEREFORE, the parties hereto mutually agree as follows:

SECTION I—SERVICES OF THE CONSULTANT

The Consultant, under the general supervision of the District Engineering Division Manager, shall prepare studies, reports, surveys, plans, drawings, specifications, and cost estimates as are necessary for the Project according to the directions and designated standards of the District, and in accordance with Exhibit A, Scope of Work. It is understood and agreed that the District's authorized representative shall be the Engineering Division Manager or his duly authorized representative, hereinafter called the "Agent". For purposes of this contract, the Agent's duly authorized representative shall be the Project Manager and he/she shall be the sole contact for administering this contract.

The Consultant shall meet periodically with the Agent so as to keep the District informed of the progress of the work in accordance with the schedule defined in Exhibit A, Scope of Work.

The Consultant shall promptly advise the Agent of any factors which may develop during the Project that would likely result in construction or design costs in excess of budgetary constraints.

SECTION II—PERIOD OF SERVICE

The Consultant shall complete all work per the schedule provided in Exhibit A, Scope of Work **within 570 calendar days**, which includes 90 days for District reviews and 270 days for FEMA reviews, after receipt of the Notice to Proceed. Should extension of this contract period be necessary, and any such extension(s) continue the date of contract performance for a time period of more than one (1) year from the original date of contract expiration, adjustment(s) of the Consultant's fee(s) may, upon agreement by both the District and the Consultant, be made in accordance with the Consumer Price Index for Urban Consumers, Western Division, published by the U.S. Department of Labor, Bureau of Labor Statistics, using the published edition coinciding with the initial contract expiration date. Any such fee adjustment shall only apply to the extended contract time period.

SECTION III—PAYMENTS TO THE CONSULTANT

The Consultant shall be paid for work under this contract a **lump sum fee of six hundred thirty-nine thousand five hundred sixty dollars and fifty-seven cents ($639,560.57)** plus a fee not-to-exceed **one hundred fifty-eight thousand five hundred sixteen dollars and fifty-six cents ($158,516.56)** for optional tasks as identified below and in accordance with the Scope of Work. A written authorization from the Agent is required prior to initiating any optional task.

Task 4.3	Survey 30 additional cross sections		$ 10,674.94
Task 6.5	Piedmont floodway corridor		14,186.63
Task 6.6	Approximate Method Floodway		59,800.74
Task 6.14	Additional 35 miles of Zone A		62,049.37
Task 6.15	GIS-based floodplain approximation		11,804.88
		Total	$158,516.56

The total contract amount is not to exceed **seven hundred ninety-eight thousand seventy-seven dollars and thirteen cents ($798,077.13)** plus any adjustments that have been approved in writing in accordance with the Maricopa County Procurement Code.

The District shall pay the Consultant upon completion of the work as accepted by the District, except that progress payments may be made as billed by the Consultant based on approved monthly progress reports subject to the limitations set forth in Exhibit A, Scope of Work. Ten percent (10%) of all contract payments made on an interim basis shall be retained by the District as insurance of proper performance of the contract or, at the option of the Consultant, a substitute security may be provided by the Consultant in an authorized form pursuant to procedures established by the District. The Consultant is entitled to all interest from any such substitute security.

When the contract is fifty percent (50%) complete, retention shall be reduced to five percent (5%) of the amount of any subsequent progress payments, and one-half (1/2) of the amount retained will be paid to the Consultant provided the Consultant is making satisfactory progress and there is no specific cause or claim requiring a greater amount to be retained. If at any time the District determines satisfactory progress is not being made, ten percent (10%) retention shall be reinstated for all progress payments made under the contract subsequent to the determination.

If the Consultant desires a partial payment in accordance with the provisions above, and a Minority/Women-Owned Business Enterprises (M/WBE) goal has been established this contract, the Consultant will complete and forward the enclosed M/WBE Participation Report (Attachment 1) indicating payment distribution to M/WBE firms with each request for payment. A M/WBE participation goal of five percent (5%) has been established for this contract.

Following approval and acceptance by the District of all work described in Exhibit A, Scope of Work, but prior to submittal by the District to FEMA, the Consultant shall submit a final invoice and a "Certificate of Substantial Performance" form (Attachment 2). This final invoice will be for payment of all monies due under this contract except for five percent (5%) retention unless a substitute security was provided by the Consultant in the authorized form pursuant to procedures established by the District.

Any retained monies shall be paid or substitute security released to the Consultant upon the following:

A. FEMA acceptance/approval of the project and completion of all final work required by the District to receive FEMA acceptance,

B. receipt of a completed "Certificate of Performance" form (Attachment 3),

C. the District's receipt of a Final M/WBE Participation Report for the assignment, stating the total payments received by the prime, as well as total payments the prime has made to M/WBE subconsultants, vendors, and suppliers, and if applicable,

D. an invoice for the release of the five percent (5%) retention.

SECTION IV—THE DISTRICT'S RESPONSIBILITIES

The District shall furnish the Consultant, at no cost to the Consultant, the following information or services for this Project:

A. One copy of on-hand maps, records, survey ties, benchmarks, or other data pertinent to the Project. This does not, however, relieve the Consultant of the responsibility of searching records for additional information, for requesting specific information, or for verification of that information provided. The District does not warrant the accuracy or comprehensiveness of any such information.

B. All available information and data relative to policies, standards, criteria, and studies, etc. impacting the Project as identified by the Consultant.

C. Availability of staff for consultation with the Consultant during the performance of studies and plan development in order to identify the problems, needs, and other functional aspects of the Project.

D. Prompt examination of documents submitted by the Consultant and rendering of decisions pertaining thereto in order to avoid unreasonable delay in the progress of the work by the Consultant. The District will keep the Consultant advised concerning the progress of the District's review of work.

SECTION V—AMENDMENTS

Any alteration in the Scope of Work that will result in a substantial change in the nature of the Project so as to materially increase or decrease the contract fee will require negotiation of an amendment to the contract to be executed by the District and the Consultant. No work shall commence on the change until the contract amendment has been approved by the District and the Agent has notified the Consultant to proceed. It is distinctly understood and agreed that no claim for extra work performed or materials furnished by the Consultant will be allowed by the District except as provided herein, nor shall the Consultant do any work or furnish any materials not covered by this agreement unless such work is first authorized in writing by the District in accordance with the Maricopa County Procurement Code. Any such work or materials furnished by the Consultant without such written authorization first being given shall be at Consultant's own risk, cost, and expense. The Consultant hereby agrees to make no claim for such work or materials furnished without such written authorization.

SECTION VI—RECORDS

Records of the Consultant's payroll expense pertaining to this contract and records of accounts between the District and the Consultant shall be kept on a generally recognized accounting basis and shall be available upon request to the District or its authorized representative for audit during normal business hours.

All Consultant and District procurement records shall be retained for a period of one (1) year and disposed of in accordance with the records retention guidelines and schedules approved by the State of Arizona Department of Library, Archives, and Public Records unless applicable Federal regulations require a longer period of retention.

SECTION VII—PROJECT COMPLETION

If, during the course of this contract, situations arise which prevent completion within the allotted time, the Agent may grant an extension.

SECTION VIII—TERMINATION

The District may terminate this contract at any time upon reimbursement to the Consultant of expenses that include reasonable charges for time and material for the percentage of work satisfactorily completed and provided to the District.

The District reserves the right to postpone, terminate, or abandon this contract for the Consultant's failure to complete the Project on time or failure to comply with the provisions of the contract. The District also reserves the right to terminate any or all parts of this contract for its own convenience as the District may determine at it's sole discretion.

The District hereby gives notice that pursuant to A.R.S. § 38-511 "A" this contract may be canceled without penalty or further obligation within three (3) years after execution if any person significantly involved in initiating, negotiating, securing, drafting, or creating a contract on behalf of the District is, at any time while the contract or any extension of the contract is in effect, an employee or agent of any other party to the contract in any capacity or a consultant to any other party of the contract with respect to the subject matter of the contract. Cancellation under this section shall be effective when written notice from the District Chief Engineer and General Manager is received by all of the parties to the contract. In addition, the District may recoup any fee or commission paid or due to any person significantly involved in initiating, negotiating, securing, drafting, or creating the contract on behalf of the District from any other party to the contract arising as a result of the contract.

The Consultant may terminate this contract in the event of nonpayment of fees as specified in SECTION III, PAYMENTS TO THE CONSULTANT.

SECTION IX—OWNERSHIP OF DOCUMENTS

All original documents including, but not limited to studies, reports, tracings, drawings, physical and computer models, estimates, field notes, investigations, design analysis, calculations, computer software, and specifications, prepared in the performance of this contract are to be and remain the property of the District and are to be delivered to the Agent before final payment is made to the Consultant. The District will not reuse, alter, or modify these documents without noting such modifications, alterations, or intent of their reuse, and will hold the Consultant harmless from any claims arising from such reuse, modifications, or alterations of the documents. The Consultant may retain reproducible copies of all such documents delivered to the District. The District reserves the right to reuse the documents as the District sees fit.

SECTION X—COMPLIANCE WITH LAWS

The Consultant is required to comply with all Federal, State, and local laws, local ordinances and regulations. The Consultant's signature on this contract certifies compliance with the provisions of the I-9 requirements of the Immigration Reform and Control Act of 1986 for all personnel that the Consultant and any subconsultants employ to complete the Project. It is understood that the District shall conduct itself in accordance with the provisions of the Maricopa County Procurement Code.

SECTION XI—GENERAL CONSIDERATIONS

A. The Consultant shall furnish to the District for approval, the names of its key employees, and of its subconsultants and their key employees, to be used on this Project prior to beginning the work under this contract. Any subsequent changes are subject to the written approval of the District.

   The Consultant in replacing a M/WBE subcontractor shall attempt to contract with another M/WBE subcontractor.

B. The failure of either party to enforce any of the provisions of this contract or to require performance of the other party of any of the provisions hereof shall not be construed to be a waiver of such provisions, nor shall it affect the validity of this contract or any part thereof, or the right of either party to thereafter enforce each and every provision.

C. The Consultant shall be responsible for the cost of any additional design, field layout, testing, construction, and supervision necessary to correct those errors or omissions attributable to the Consultant and for any damage incurred by the District as a result of additional construction costs caused by such Consultant errors or omissions.

D. The fact that the District has accepted or approved the Consultant's work shall in no way relieve the Consultant's responsibility.

E. It is mutually understood and agreed that this contract shall be governed by the laws of the State of Arizona, both as to interpretation and performance. Any action at law, suit in equity, or judicial proceeding for the enforcement of this contract, or any provision thereof, shall be instituted only in the courts of the State of Arizona.

F. The Consultant agrees during the execution of this contract that no clients other than the District, or the Federal Emergency Management Agency, will be retained within the study area without expressed written authority from the Chief Engineer and General Manger of the District.

SECTION XII—SUCCESSORS AND ASSIGNS

This contract shall not be assigned by either party without prior written approval of the other except that the Consultant may use in the performance of this contract without prior approval of the District, personnel or services of its related entities and affiliated companies as if they were an integral part of the Consultant; and it shall extend to and be binding upon the heirs, executors, administrators, successors and assigns of the parties hereto.

SECTION XIII—NO KICK-BACK CERTIFICATION

The Consultant warrants that no person has been employed or retained to solicit or secure this contract upon any agreement or understanding for a commission, percentage, brokerage, or contingent fee; and that no member of the Board of Directors or any employee of the District has any interest, financially or otherwise, in the Consultant's firm.

For breach or violation of this warranty, the District shall have the right to annul this contract without liability, or at its discretion, to deduct from the contract price or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

SECTION XIV—ANTI-DISCRIMINATION PROVISION

The District will endeavor to ensure in every way possible that minority and women-owned business enterprises shall have every opportunity to participate in providing professional services, purchased goods, and contractual services to the District without being discriminated against on the grounds of race, religion, sex, age, or national origin.

The Consultant agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, or disability and further agrees not to engage in any unlawful employment practices. The Consultant further agrees to insert the foregoing provisions in all subcontracts hereunder.

SECTION XV—INDEMNIFICATION

Indemnification for Professional Liability:
To the fullest extent permitted by law, the Consultant shall indemnify and hold harmless the District and Maricopa County, their agents, representatives, officers, directors, officials, and employees from and against all claims, damages, losses and expenses, including but not limited to attorney fees, court costs, expert witness fees, and the cost of appellate proceedings, relating to, arising out of, or alleged to have resulted from the Consultant's negligent acts, errors, omissions or mistakes relating to professional services in the performance of this contract. Consultant's duty to indemnify and hold harmless the District and Maricopa County, their agents, representatives, officers, directors, officials, and employees shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, or injury to, impairment, or destruction of property, including loss of use resulting therefrom, caused by any negligent acts, errors, omissions or mistakes, related to professional services in the performance of this contract including any person for whose negligent acts, errors, omissions or mistakes, the Consultant may be legally liable.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

For all other hazards, liabilities, and exposures:
To the fullest extent permitted by law, the Consultant shall defend, indemnify and hold harmless the District, Maricopa County, their agents, representatives, officers, directors, officials, and employees from and against all claims, damages, losses and expenses (including but not limited to attorney fees, court costs, expert witness fees, and the cost of appellate proceedings), relating to, arising out of or resulting from the Consultant's work or services. Consultant's duty to defend, indemnify and hold harmless the District and Maricopa County, their agents, representatives, officers, directors, officials, and employees

shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, injury to, impairment or destruction of property including loss of use resulting therefrom, caused in whole or in part by any act or omission of the Consultant, anyone Consultant directly or indirectly employs or anyone for whose acts Consultant may be liable.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

Abrogation of Arizona Revised Statutes § 34-226:
In the event that A.R.S. § 34-226 shall be repealed or held unconstitutional or otherwise invalid by a court of competent jurisdiction, then this duty of indemnification shall extend to all claims, damages, losses and expenses, including but not limited to attorney fees, court costs, expert witness fees, and the cost of appellate proceedings, relating to, arising out of, or alleged to have resulted therefrom, caused in whole or in part by any negligent acts, errors, or omissions relating to professional work or services in the performance of this contract by the Consultant, or anyone directly employed by the Consultant or anyone for whose acts Consultant may be liable regardless of whether it is caused by any party indemnified hereunder, including the District and Maricopa County.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

The scope of this indemnification does not extend to the sole negligence of the District.

SECTION XVI—INSURANCE REQUIREMENTS

Consultant, at Consultant's own expense, shall purchase and maintain the herein stipulated minimum insurance with companies duly licensed, possessing a current A.M. Best Company, Inc. Rating of at least B++ or a Financial Performance Rating (FPR) of at least 6, or approved unlicensed companies in the State of Arizona with policies and forms satisfactory to the District.

All insurance required herein shall be maintained in full force and effect until all work or service required to be performed under the terms of the contract is satisfactorily completed and formally accepted. Failure to do so may, at the sole discretion of the District, constitute a material breach of this contract.

The Consultant's insurance shall be primary insurance as respects the District and any insurance or self-insurance maintained by the District shall not contribute to it.

The policies required hereunder, except Workers' Compensation and Professional Liability, shall contain a waiver of transfer of rights of recovery (subrogation) against the District, its agents, representatives, officers, directors, officials, and employees for any claims arising out of the Consultant's work or service.

Any failure to comply with the claim reporting provisions of the insurance policies or any breach of an insurance policy warranty shall not affect coverage afforded under the insurance policies to protect the District.

The insurance policies may provide coverage which contains deductibles or self-insured retentions. Such deductible and/or self-insured retentions shall not be applicable with respect to the coverage provided to the District under such policies. The Consultant shall be solely responsible for the deductible and/or self-insured retention and the District, at its option, may require the Consultant to secure payment of such deductibles or self-insured retentions by a surety bond or an irrevocable and unconditional letter of credit.

The District reserves the right to request and to receive, within ten (10) working days, certified copies of any or all of the herein required insurance policies and/or endorsements. The District shall not be obligated, however, to review such policies and/or endorsements or to advise Consultant of any deficiencies in such policies and endorsements, and such receipt shall not relieve Consultant from, or be deemed a waiver of, the District's right to insist on strict fulfillment of Consultant's obligations under this contract.

The insurance policies required by this contract, except Workers' Compensation and Professional Liability, shall name the District, its agents, representatives, officers, directors, officials, and employees as Additional Insureds.

Commercial General Liability:
Consultant shall maintain Commercial General Liability insurance with a limit of not less than $1,000,000 for each occurrence with a $2,000,000 Products/Completed Operations Aggregate and a $2,000,000 General Aggregate Limit. The policy shall include coverage for bodily injury, broad form property damage, personal injury, products and completed operations and blanket contractual coverage including, but not limited to, the liability assumed under the indemnification provisions of this contract which coverage will be at least as broad as Insurance Service Office, Inc. Policy Form CG 00 01 10 93 or any replacements thereof.

The policy shall contain a severability of interest provision, and shall not contain a sunset provision or commutation clause, or any provision which would serve to limit third party action over claims.

The Commercial General Liability additional insured endorsement shall be at least as broad as the Insurance Service Office, Inc.'s Additional Insured, CG 20 10 11 85, and shall include coverage for Consultant's operations and products and completed operations.

Automobile Liability:
Consultant shall maintain Automobile Liability insurance with an individual single limit for bodily injury and property damage of no less than $1,000,000, each occurrence, with respect to Consultant's vehicles (whether owned, hired, non-owned), assigned to or used in the performance of this contract. Coverage will be at least as broad as coverage code 1, "any auto" (Insurance Services Office, Inc. Policy Form CA 00 01 12 93, or any replacements thereof). Such insurance shall include coverage for loading and off-loading and off-loading hazards. If hazardous substances, materials, or wastes are to be transported, MCS 90 endorsement shall be included and $5,000,000 per accident limits for bodily injury and property damage shall apply.

Workers' Compensation:
The Consultant shall carry Workers' Compensation insurance to cover obligations imposed by federal and state statutes having jurisdiction of Consultant's employees engaged in the performance of the work or services, as well as Employer's Liability insurance of not less than $1,000,000 for each accident, $1,000,000 disease for each employee, and $1,000,000 disease policy limit.

In case any work is subcontracted, the Consultant will require the Subconsultant to provide Worker's Compensation and Employers' Liability insurance to at least the same extent as required of the Consultant.

Professional Liability:
The Consultant retained by the District to provide the work or service required by this contract shall maintain Professional Liability insurance covering negligent acts, errors, or omissions arising out of the

work or services performed by the Consultant, or any person employed by the Consultant, with a limit of not less than $1,000,000 each claim.

Certificates of Insurance:
Prior to commencing work or services under this contract, Consultant shall furnish the District with Certificates of Insurance (Attachment 4), or formal endorsements as required by the contract, issued by Consultant's insurer(s), as evidence that policies providing the required coverage's, conditions, and limits required by this contract are in full force and effect. Such certificates shall identify this contract number and title.

In the event any insurance policy(ies) required by this contract is(are) written on a "claims made" basis, coverage shall extend for two (2) years past completion and acceptance of the Consultant's work or services and as evidenced by annual Certificates of Insurance.

If a policy does expire during the life of the contract, a renewal certificate must be sent to the District fifteen (15) days prior to the expiration date.

Cancellation and Expiration Notice:
Insurance required herein shall not expire, be cancelled, or materially changed without thirty (30) days prior written notice to the District.

IN WITNESS WHEREOF, the parties herein have executed this contract.

JE Fuller/Hydology & Geomorphology, Inc.

Principal (Signature)

Jonathan Fuller

Printed Name

President

Title

10-19-00

Date

86-0785301

Federal Tax Identification Number

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY:

11/13/00

Michael S. Ellegood, P.E. Date
Chief Engineer and General Manager

ACCEPTED AND APPROVED:

12/06/2000

Chairman, Board of Directors Date

ATTEST:

12/06/2000

~~Clerk~~ of the Board Date

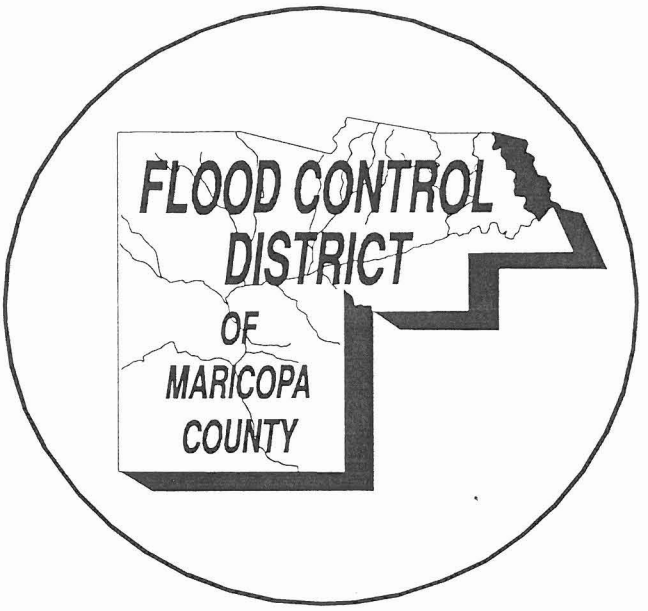
LEGAL REVIEW

Approved as to form and within the powers and authority granted under the laws of the State of Arizona to the Flood Control District of Maricopa County.

11/15/00

General Counsel, District Date

EXHIBIT A



SCOPE OF WORK

CONTRACT FCD 2000C019

JACKRABBIT WASH WATERSHED ZONE A FLOODPLAIN DELINEATION STUDY

EXHIBIT A

SCOPE OF WORK

CONTRACT FCD 2000C019

Jackrabbit Wash Watershed Zone A Floodplain Delineation Study

GENERAL

The goal of this project is to delineate an estimated 374 miles of approximate Zone A 100-year floodplains in Watershed "OO" (a.k.a., Jackrabbit Wash Watershed). The limits of Watershed "OO" are shown on Exhibit A1.

In order to accomplish the study's goal, the CONSULTANT will have to 1) coordinate the study with the DISTRICT and others, 2) collect and analyze existing data, 3) use existing USGS and/or other topographic mapping, 4) perform field surveys as required, 5) develop the 100-year peak discharges, 6) delineate the Zone A floodplains and optionally delineate approximate method floodways and alluvial fan landforms, 7) prepare the study results in an electronic form (HIS data will be submitted with each appropriate task deliverable), and 8) deliver all of the study documentation in formats acceptable to the DISTRICT and Federal Emergency Management Agency (FEMA).

The CONSULTANT must use sound engineering judgment in the development of the hydrologic data and hydraulic models. All work must meet Arizona Department of Water Resources (ADWR) and the Federal Emergency Management Agency (FEMA) requirements for Zone A floodplain delineation's. Prior to the finalization of this contract, FEMA and the DISTRICT must review and accept the results of this study, and all items called for in this Scope of Work must be delivered to the DISTRICT. All work completed under this scope of services is to conform with the District's Consultant Guidelines dated August 1, 2000.

The floodplain delineations will be phased according to the sub-watershed identification as identified in Exhibit A and in Table 1, below.

Table 1: Sub-Watershed Delineation Schedule

Sub-Watershed	Study Phase	Delineation Mileage
'Coyote Wash	1	45
Daggs Wash & Hassayampa Tributaries	1	72
Upper Jackrabbit Wash	2	104
Hassayampa Plain/Powerline Piedmont	2	153
Total Area		374

The time frame for delineation of the Zone floodplains will be 300 days including 90 days for FCD review. Additional time, equal to 270 days will be allowed for FEMA review. All work must be completed including FEMA review within 570 days from the notice to proceed. If topographic mapping is provided by the DISTRICT the project schedule will be extended by the number of days after notice to proceed the topographic mapping is provided to the consultant. The schedule will be extended as indicated on the project schedule to be delivered under Task 1.1 if any of the optional tasks are approved by the DISTRICT.

TASK 1 - COORDINATION

1.1 Within fourteen days of Notice to Proceed, the CONSULTANT will submit a project schedule to the District's Project Manager showing coordination meetings and completion dates for each task

identified in the scope of work. The CONSULTANT will update this project schedule when appropriate.

1.2 The CONSULTANT will participate in regular coordination meetings (at least every 4 weeks) with the District's Project Manager and in milestone coordination meetings in the development of the hydrologic and hydraulic analyses. The CONSULTANT is responsible for the minutes of any meetings. Whenever possible, coordination and milestone meetings will be combined.

1.3 The CONSULTANT will submit an estimate of the monthly billing within 14 days of Notice to Proceed. Thereafter, this estimate will be updated and submitted to the District's project manager at least 10 days before the end of each quarter.

1.4 The CONSULTANT will submit monthly progress reports at least 5 days before submittal of monthly invoices. The report shall be brief and should be no longer than two typed pages. At a minimum, the monthly report shall contain the following:

a. A description of the work accomplished by task during the reporting month.

b. Percent (%) completed for the month and percent (%) cumulative completed for each task.

c. A brief description of the work to be accomplished in the following month.

d. A description of any problems encountered and a recommended solution.

1.5 The CONSULTANT is responsible for placing the legal advertising at the beginning of the study, notifying the public of the study. The ad will be run in a widely circulated local newspaper twice, with approximately one week between runs. The ad must also be run twice in a local newspaper that serves the area being studied. After the newspapers run the ad, the CONSULTANT will supply the DISTRICT with the original affidavit of publication from each newspaper for each day that the ad ran.

1.6 The CONSULTANT will notify all property owners by regular mail and obtain any necessary Rights of Entry for the study area, using a list of property owners furnished by the DISTRICT. The CONSULTANT will furnish the DISTRICT with a sample of the Notification/ Right of Entry letter.

1.7 The CONSULTANT will meet with officials from the DISTRICT and any incorporated communities affected.

1.8 The DISTRICT will provide any public notice beyond that described in Task 1.6.

1.9 Consultant/District Performance Evaluations will be performed. An informal evaluation will be performed at the completion of the hydrologic analysis. A formal evaluation will be performed at the completion of the project upon receipt of all deliverables.

TASK 2 - DATA COLLECTION

2.1 The CONSULTANT will collect and review pertinent data from the DISTRICT and other outside sources. Data to be collected will include previous flood hazard reports and hydrology for the study area; existing readily available topographic mapping; proposed development plans, historical flooding information; as-built plans for existing structures; FEMA Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions, and other pertinent information.

2.2 A written report summarizing the data collected will be included as a section in the Technical Data Notebook (TDN). A preliminary draft of this section is due within 90 days of Notice to Proceed.

TASK 3 - TOPOGRAPHIC MAPPING

The CONSULTANT will use existing USGS topographic mapping and/or other topographic mapping provided by the DISTRICT.

TASK 4 - FIELD SURVEY

4.1 Field measurements of bridges, culverts, and hydraulic structures are to be obtained by the CONSULTANT when as-built plans are not available, or when conditions have changed that impact the Zone delineation. This information should be reduced and compiled into an 11"x 17" (maximum size) drawing for inclusion in the TDN. The information presented in the drawing should be in a ormat appropriate for use in future HEC-RAS models.

4.2 Copies of the survey field books and office calculations must be included in the TDN. This information can be submitted separately if approval is obtained from the District's Project Manager.

4.3 (OPTIONAL) The CONSULTANT shall provide field survey data for cross sections used for approximate floodplain delineations where USGS DEM data are not adequate. **This task is not authorized with the NTP and may be authorized in writing by the DISTRICT.**

4.4 Digital data in either a CADD or GIS format will be prepared in conformance with the District's Hydrologic Information System Data Delivery Specifications, Revision 3.1 (or CADD Data Delivery Specifications Rev. 1.0, January 2000). The following themes are the ones generally used for the data developed for Field Survey. However, for this study there may not be data for every theme identified here, or the CONSULTANT might develop data for themes not listed here. Therefore, only those themes for which there are data need to be completed. If the CONSULTANT has data that don't fit one of the themes listed here, the District's Project Manager shall be contacted to determine the appropriate theme for that data.

a. CORNERS (if any)

b. CTRL (Misc.Control Survey Pts.)

c. FPCTLFCD (ERMs))

d. STRCT (Structure)

e. PRJ (Project Boundary)

TASK 5 - HYDROLOGY

5.1 The CONSULTANT will use the hydrology results from the existing Jackrabbit Wash Flood Insurance Study. The peak discharges for sub-watersheds will be developed using discharge-drainage area relationships and/or regressions equations. Development of new hydrology (such as applying area/discharge relationships and/or HEC-1) will be required for the northeast portion of the watershed (located east of 307th Avenue and draining directly to the Hassayampa River). The CONSULTANT must analyze the data carefully and in some instances correlate data against other hydrologic data such as regression equations in order to obtain the most realistic results.

5.2 Meetings shall be held with DISTRICT staff at the following milestones:

a. Meeting number 1: field trip at the start of the project to scope out the critical points of the watershed and problem areas.

b. Meeting number 2: as soon as basic data are gathered and the sub-basins have been delineated. A copy of the draft maps of the sub-basins must be delivered to the District at this meeting. The method for generating the peak discharges will be agreed upon at this meeting.

c. Meeting number 3: to review of final document and comments by the DISTRICT.

5.3 The Hydrologic Report

The findings of the hydrologic study will be presented in Section 4 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT, following SSA 1-97 format. Specific deviations from this hydrologic scope shall not be undertaken without the specific written authorization from the District's Project Manager.

5.4 Digital data in either a CADD or GIS format will be prepared in conformance with the District's Hydrologic Information System Data Delivery Specifications, Revision 3.1 (or CADD Data Delivery Specification, Rev. 1.0, January 2000). The following themes are the ones generally used for the data developed for hydrology. However, for this study there may not be data for every theme identified here, or the CONSULTANT might develop data for themes not listed here. Therefore, only those themes for which there are data need to be completed. If the CONSULTANT has data that don't fit one of the themes listed here, the District's Project Manager shall be contacted to determine the appropriate theme for that data.

a. DRNBSN (Drainage Basins)

b. PRJDAT (Project Identification)

c. DRNPTH (Drainage Flow Paths)

TASK 6 - FLOODPLAIN DELINEATION

6.1 Floodplain delineations will be conducted using methodology as outlined by FEMA. The CONSULTANT will prepare the study using the guidelines established in FEMA 37, *Flood Insurance Study Guidelines and Specification for Study Contractors*, January 1995, FIA 12, *Appeals, Revisions, and Amendments to Flood Insurance Maps*, December 1993, and FEMA 265, *Managing Floodplain Development in Approximate Zone A Areas*, April 1995.

6.2 The delineation work shall meet requirements for floodplain delineations as prescribed by FEMA and the Arizona Department of Water Resources.

6.3 The delineation of 322 miles of the study (outside of the piedmont areas shown in Exhibit A) shall be based on the final results of the hydrologic study as directed by the District.

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

a. Draft field reconnaissance section of the TDN and estimation of Manning's "n" values.

b. Proposed location and alignment of the cross sections.

c. Methodology used for both the floodplain and optional floodway delineations.

d. Approximate floodplain (natural) delineation.

e. Approximate floodway delineations

f. Final hydraulics section of the TDN.

6.4 The delineation of 52 miles of the study (inside the piedmont areas shown in Exhibit A) shall be based on the final results of the hydrologic study as directed by the DISTRICT and geomorphic analyses of the piedmont surface. The purpose of this delineation will be to identify the overall boundary of the piedmont areas using low-level geomorphic approaches in order to provide a limit of the approximate Zone A delineations. This will include interpretation of aerial photographs, USGS topographic maps, stereo photos developed under the USGS Aerial Photography Program (NAPP, 1997), and observations in the field.

6.5 (OPTIONAL) Approximately 52 miles of piedmont floodway corridors will be delineated inside the piedmont areas shown on Exhibit A based on geomorphic principles. The piedmont floodway corridors will be defined using existing soils data, surficial geology and/or vegetation patterns observed in the field and from recent aerial photography. **This task is not authorized with the NTP and may be authorized in writing by the DISTRICT.**

6.6 (OPTIONAL) The CONSULTANT will provide approximate method floodways for the reaches located outside the piedmont area shown on Exhibit A. The approximate method floodways will be defined using existing soils data, surficial geology and/or vegetation patterns observed in the field and from recent aerial photography. **This task is not authorized with the NTP and may be authorized in writing by the DISTRICT.**

6.7 Field Reconnaissance

6.7.1 The CONSULTANT will conduct a field reconnaissance of the study area. This will include observation of channel and floodplain conditions for estimating Manning's "n" values; photographic documentation of floodplain characteristics; determination of channel bank characteristics; observation of possible overflow areas; observation of levees or other flood control structures; and measurement of bridge dimensions.

6.7.2 Manning's "n" values are to be determined using the methodology in the USGS report, *Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona*, April 1991. Copies of the report are available through the District. Manning's Roughness Coefficients will be presented for typical reach types observed in the project area, rather than specific reaches of specific named washes. It is anticipated that between 5 and 10 typical reach types will be identified during the field reconnaissance.

6.7.3 Representative "n" values for each typical reach type will be selected. The reconnaissance report will present the determination of channel and overbank "n" values using captioned color photographs or color photocopies for each identified reach type in the project area. The report will also discuss floodplain conditions affecting the delineation, describe structures and obstructions, and provide color photos or photocopies of major hydraulic structures. Photo locations, structures, and "n" values will be displayed on reduced scale mapping and included in the Final Report. The reconnaissance or n-value report will be included in all subsequent phased TDN submittals associated with this contract.

6.8 Cross Sections

6.8.1 The location and alignment of cross sections will be submitted for the District's review and approval before developing the cross section data. The CONSULTANT must coordinate the methodology for generating the cross section geometric data. Acceptable methods might include collecting the data directly off paper copies of the USGS maps, use of a computer program to develop the data from digital information, or field surveys possibly using GPS.

6.8.2 The cross section plots will at a minimum show computed normal depth and "n" values. All plots are to be accompanied by a legend. These plots should be available at all reviews.

6.9 The hydraulics of bridges and culverts should be incorporated into assessing the floodplain around such structures especially in areas where ponding will occur. The Zone A, limits must be determined according to FEMA criteria and clearly labeled on the final drawings. Conveyance through minor structures such as small culverts (i.e., less than 30" in diameter), or structures which are likely to become clogged during the 100-year peak discharge shall not be included in the hydraulic analyses.

6.10 The findings of the floodplain delineation study will be presented in Section 4 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT standards, following SSA 1-97 format.

6.11 The CONSULTANT shall fill out all the forms required by FEMA for the submittal of a Floodplain Delineation Study.

6.12 The CONSULTANT will provide work maps on monochrome USGS digital raster graphic quadrangle USGS maps (used as base maps). The CONSULTANT will develop check plots and certify that they have been examined, and that the check plots faithfully represent the data and maps used in the report and /or work maps. The work map drawings will be 24" X 36" in size. The work map scale will be determined by the CONSULTANT, and will vary between 1"=400' and 1"=1000' scale, depending on the terrain and the floodplain widths. The District's Project Manager must approve the horizontal scale being used.

A cover sheet will be part of the work study drawings and shall have on it the project title, source and date of topographic mapping, and a location map showing geographic range covered by each specific mapping sheet. Each drawing will include the floodplain, approximate method floodway (if developed), piedmont surface land forms (if developed), a north arrow, scale, section corners, current streets and highway names, State Plane Coordinate System, major drainage features, corporate boundaries, cross section lines, index map, the floodplain boundaries, peak discharges at concentration points, and Section, Township, Range for each wash delineated.

6.13 Digital data in either a CADD or GIS format will be prepared in conformance with the District's Hydrologic Information System Data Delivery Specifications, Revision 3.1 (or CADD Data Delivery Specifications, Rev. 1.0, January 2000). The following themes are the ones generally used for the data developed for hydraulics. However, for this study there may not be data for every theme identified here, or the CONSULTANT might develop data for themes not listed here. Therefore, only those themes for which there are data need to be completed. If the CONSULTANT has data that don't fit one of the themes listed here, the District's Project Manager shall be contacted to determine the appropriate theme for that data.

a.	PRJ (Project Boundary)*	b.	CARTO (Cartographic Features)
c.	DQ (Data Quality)	d.	FPXFCD (Cross Sections)
e.	FPZNFCD (Floodplain Zones)	f.	NDXPRJ (Map Sheet Index)
g.	PRJDAT (Project Identification)	h.	Hydraulic Table **

* Only delivered if mapping is not part of study.

** An additional table of hydraulic results for each cross section hot-linked to the cross sections will also be provided in ArcView format.

6.14 (OPTIONAL) The CONSULTANT will provide an additional 35 miles of approximate method Zone A delineation at the same level of detail and effort as described under Task 6. **This task is not authorized with the NTP and may be authorized in writing by the DISTRICT.**

6.15 (OPTIONAL) The CONSULTANT will perform an analysis to compare a GIS-based floodplain approximation method to the results of this study in 3 selected test reaches. The approximation method will be developed by the CONSULTANT and will be in the form of a set of empirically derived regime relationships which relate discharge, floodplain top width, and channel slope for the 100-year discharge. The deliverable for this task will be a technical memorandum describing assumptions, methods and results, and a map showing the differences between the GIS delineation

method and the approximate delineation methodology used for the rest of the study area. **This task is not authorized with the NTP and may be authorized in writing by the** DISTRICT.

TASK 7 - DELIVERABLES

7.1 Both paper and electronic deliverables will be made at the completion of each task. In addition, the CONSULTANT will deliver the following items to the DISTRICT before delivering the FEMA submittal package:

7.1.1 Original Affidavits of Publication of the legal advertisements. Additional copies are to be included in the Technical Data Notebook.

7.1.2 Any related data for the District's Hydrologic Information System.

7.1.3 If bound separately from the Technical Data Notebook, two (2) copies of the field survey notes and office calculations.

7.2 The CONSULTANT will submit the following items to the DISTRICT for review by FEMA and any other appropriate governmental agency. The CONSULTANT will submit four separate TDN's, one for each sub-watershed division established in Table 1 and shown in Exhibit A. All of the following products are considered deliverables for the FEMA submittal:

7.2.1 Two (2) complete sets of 24" X 36" blackline drawings with the topographic data and floodplain delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

7.2.2 Two (2) complete copies of the Technical Data Notebook. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The notebook will be organized as specified by the DISTRICT, following SSA 1-97 format. These copies will be updated if necessary based upon FEMA's review comments. Completed FEMA forms will be included in the Technical Data Notebook.

7.3 Final Submittal: Unless directed otherwise by the DISTRICT, all printed deliverable items shall be black and white for ease of reproduction. The CONSULTANT will submit four separate TDN's, one for each sub-watershed division established in Table 1 and shown in Exhibit A. The following products are considered deliverables for the final submittal to the DISTRICT after FEMA approval is issued:

7.3.1 One (1) complete composite set of sealed non-erasable mylars with the topographic data and floodplain delineations shown. Two (2) complete sets of sealed blueline copies of the delineation exhibits. The sheets shall be 24" X 36" in size, and all drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

7.3.2 All remaining hydrologic and floodplain delineation data in conformance with the District's HIS Specifications.

7.3.3 Two (2) complete copies of the Technical Data Notebooks. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The notebook will be organized as specified by the DISTRICT, following SSA 1-97 format. This submittal of the Technical Data Notebook shall include any correspondence and/or meeting minutes with the reviewing agencies and shall reflect any revisions required by those reviewing agencies.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
WATERSHED "OO"
APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY
JE FULLER/HYDROLOGY & GEOMORPHOLOGY, INC., 9/22/00

PIEDMONT CONVEYANCE CORRIDORS
52 MILES
JEF (OPTIONAL)

HASSAYAMPA PLAIN
101 MILES
JEF

JACKRABBIT WASH
104 MILES
WPA

DAGGS WASH &
HASSAYAMPA TRIBS
72 MILES
JEF/ARGUS

TOYOTA

COYOTE WASH
45 MILES
WPA

DOUGLAS RANCH

HUMMINGBIRD SPRINGS
WILDERNESS AREA

Stop #1
Stop #2
Stop #3
Stop #4
Stop #5
Stop #6

LEGEND

- FCDMC fpznfcd (existing detailed studies)
- FCDMC Bluelines (selected USGS thalwegs)
- Douglas Ranch
- Toyota Technical Center
- Hummingbird Springs Wilderness Area
- Watershed Boundaries

EXHIBIT A
NO SCALE

SECTION 7: DRAFT FIS REPORT DATA

7.1 Summary of Discharges

See Chapter 4 and Table 4.5 for detail regarding the origin of the discharges presented below.

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-year	100-Year	500-Year
Vulture Mountains					
53	5.700	--1	--1	4,100	--1
53A (10F_1)	1.063	--1	--1	1,200	--1
53B (10F_1+10F_2)	2.361	--1	--1	2,400	--1
53C (10F_1+2+4)	3.256	--1	--1	2,700	--1
53D (10F_3)	0.912	--1	--1	1,100	--1
53E (10F_3+5)	2.249	--1	--1	2,400	--1
59A (10F-1+2+3+4+5+10G_1)	6.675	--1	--1	4,100	--1
60	6.900	--1	--1	3,500	--1
60A (10I_1)	0.771	--1	--1	1,000	--1
60B (10I_1+2)	1.172	--1	--1	1,300	--1
60C (10I_1+2+3)	1.696	--1	--1	2,200	--1
60D (10I_4)	0.793	--1	--1	1,000	--1
60E (10I_4+5)	1.709	--1	--1	2,200	--1
60F (10I_1+2+3+4+5+6)	3.591	--1	--1	2,800	--1
62 (10K1+23% of 60C)	1.243	--1	--1	2,000	--1
65	1.900	--1	--1	2,400	--1
67A (10M1+M3_1)	3.759	--1	--1	2,900	--1
73	3.100	--1	--1	3,200	--1
73A (10O_1)	1.429	--1	--1	1,400	--1
74	9.200	--1	--1	5,900	--1
74A (10O_1+2+10P_1)	4.338	--1	--1	3,700	--1
74B (10O_1+2+10P_1+2)	7.543	--1	--1	5,200	--1
75 (includes 60% of 74B area)	6.252	--1	--1	4,700	--1
75A (10Q_1)	1.676	--1	--1	1,400	--1
76A (10Q_1+2+10R_2)	3.585	--1	--1	2,800	--1
76B	--2	--1	--1	3,000	--1
76C	--2	--1	--1	4,900	--1
78	5.300	--1	--1	3,800	--1
78A (10W_1)	1.504	--1	--1	1,400	--1
78B (10W_2)	1.187	--1	--1	1,300	--1
78C (10W_2+3)	2.428	--1	--1	2,400	--1
86	4.900	--1	--1	3,600	--1
86A (12A_1)	4.093	--1	--1	3,000	--1
87A (12B_1)	0.639	--1	--1	800	--1
88A (12A_1+2+12C_1)	5.038	--1	--1	3,600	--1
88B	--2	--1	--1	2,700	--1
88C (12A_1+2+12C_1+2)	5.898	--1	--1	1,500	--1
120 (20A)	1.038	--1	--1	1,200	--1

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-year	100-Year	500-Year
121 (20A+20B)	1.727	--1	--1	2,200	--1
122 (21A)	0.846	--1	--1	1,000	--1
123 (21A+21B)	1.766	--1	--1	2,200	--1
124 (22_1+2)	1.847	--1	--1	1,500	--1
124A (22_1)	1.421	--1	--1	1,400	--1
125 (22A)	2.136	--1	--1	2,300	--1
126 (22A+B)	3.482	--1	--1	2,800	--1
127 (22A+B+C)	5.702	--1	--1	3,600	--1
128 (22A+B+C+D)	7.764	--1	--1	4,300	--1
129 (23A)	1.313	--1	--1	1,300	--1
130 (24A+66% of 88A Area)	6.809	--1	--1	4,000	--1
131 (23A+B+24A+B+66% of 88A Area)	9.795	--1	--1	5,000	--1
Northwest Mountains					
8A (1H_1)	0.983	--1	--1	1,100	--1
8B (1H_1+2)	5.040	--1	--1	2,900	--1
8C (1H_1+2+3 Less 15% of 1H_1+2)	7.407	--1	--1	4,200	--1
11A (1K_1)	1.493	--1	--1	1,400	--1
11B (1K_1+2)	3.271	--1	--1	2,000	--1
11C (1K_4)	0.624	--1	--1	800	--1
11D (1K_3+4)	1.162	--1	--1	1,300	--1
11E (1K_1+2+3+4)	4.432	--1	--1	2,600	--1
19	6.000	--1	--1	3,500	--1
19A (3A_1)	0.860	--1	--1	1,000	--1
19B (3A_1+2)	1.088	--1	--1	1,300	--1
19C (3A_1+2+3)	2.420	--1	--1	1,700	--1
19D (3A_1+2+3+4)	3.370	--1	--1	2,000	--1
19E (3A_5)	0.164	--1	--1	300	--1
19F (3A_5+6)	1.474	--1	--1	1,400	--1
Upper Jackrabbit Wash Main Stem					
1	6.700	--1	--1	7,400	--1
2	12.400	--1	--1	9,000	--1
4	16.500	--1	--1	8,900	--1
7	23.200	--1	--1	8,900	--1
8	30.800	--1	--1	11,400	--1
10	37.600	--1	--1	13,500	--1
11	45.200	--1	--1	13,200	--1
12	79.100	--1	--1	18,800	--1
21	102.100	--1	--1	21,100	--1
22	105.000	--1	--1	20,800	--1
32	134.500	--1	--1	21,400	--1
Belmont Mountains					
6A (1F_1)	1.135	--1	--1	1,200	--1
9A (1I_1)	1.135	--1	--1	1,200	--1
9B (1I_2)	0.873	--1	--1	1,100	--1

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-year	100-Year	500-Year
9D (1I_3)	0.362	--1	--1	600	--1
9C (1I_1+2+5)	3.418	--1	--1	2,200	--1
9E (1I_3+4)	1.068	--1	--1	1,200	--1
9F (1I_1+2+3+4+5+6)	4.597	--1	--1	2,800	--1
13	7.800	--1	--1	5,700	--1
13A (2A_1)	0.985	--1	--1	1,100	--1
13B (2A_2)	1.239	--1	--1	1,200	--1
13C (2A_1+2+3)	2.837	--1	--1	1,900	--1
13D (2A_4)	2.898	--1	--1	1,900	--1
13E (2A_1+2+3+4+5)	6.075	--1	--1	3,600	--1
13F (2A_6)	1.059	--1	--1	1,200	--1
14A (2B_1)	0.547	--1	--1	800	--1
14B (2B_2)	0.955	--1	--1	1,100	--1
14C (2B_1+2+3)	1.825	--1	--1	1,400	--1
15A (2C_1)	1.381	--1	--1	1,300	--1
17A (2D_1)	0.968	--1	--1	1,100	--1
23D (4A_1)	0.532	--1	--1	700	--1
23E (4A_1+3)	0.840	--1	--1	1,000	--1
23F (4A_2)	0.258	--1	--1	500	--1
23G (4A_2+4)	0.712	--1	--1	900	--1
23H (4A_1+2+3+4)	1.552	--1	--1	1,300	--1
39	4.600	--1	--1	2,700	--1
39A (9A_1)	0.587	--1	--1	800	--1
40	13.100	--1	--1	6,500	--1
40A (9B_1)	0.564	--1	--1	800	--1
40B (9B_1+2)	2.006	--1	--1	1,400	--1
40C (9B_3)	1.304	--1	--1	1,200	--1
40D (9B_1+2+3+4)	3.619	--1	--1	2,300	--1
40E (9B_1+2+3+4+5)	5.399	--1	--1	3,200	--1
40F (9B_6)	0.468	--1	--1	700	--1
40G (9B_6+7)	1.655	--1	--1	1,300	--1
40H (9B_6+7+8)	2.491	--1	--1	1,700	--1
40I (9A+9B_6+7+8+9)	7.245	--1	--1	4,400	--1
41	20.500	--1	--1	5,900	--1
41A (9C_1)	1.406	--1	--1	1,300	--1
41B (9C_1+2)	3.335	--1	--1	2,100	--1
42	6.200	--1	--1	3,800	--1
42A (9D_1)	1.189	--1	--1	1,200	--1
42B (9D_1+2)	2.417	--1	--1	1,600	--1
42C (9D_1+2+3)	4.128	--1	--1	2,500	--1
42D (9D_4)	1.302	--1	--1	1,200	--1
42E (9D_4+5)	1.985	--1	--1	1,400	--1
43	26.700	--1	--1	7,900	--1
43A (9E_1)	0.587	--1	--1	800	--1
43B (9E_1+2)	2.274	--1	--1	1,500	--1
43C (9D+9E_1+2+3)	8.893	--1	--1	5,400	--1
44	34.200	--1	--1	7,900	--1

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-year	100-Year	500-Year
44A (9F_1)	1.391	--1	--1	1,300	--1
45	35.500	--1	--1	4,100	--1
Belmont Foothills					
3	0.800	--1	--1	1,500	--1
5	1.100	--1	--1	1,200	--1
6	3.100	--1	--1	2,300	--1
7A (1E+1F_1+2+1G_1)	4.339	--1	--1	2,700	--1
9	6.900	--1	--1	3,400	--1
12A (2F_1)	1.009	--1	--1	1,200	--1
12B (2F_1+2)	2.622	--1	--1	2,200	--1
12C (C12.2)	28.000	--1	--1	7,900	--1
14	12.100	--1	--1	7,600	--1
15	15.900	--1	--1	7,600	--1
16	2.100	--1	--1	1,600	--1
16A (2E_1)	0.938	--1	--1	1,100	--1
17	21.000	--1	--1	7,500	--1
17B (2D-1+2)	3.055	--1	--1	1,700	--1
18	23.100	--1	--1	7,700	--1
23	11.500	--1	--1	4,300	--1
23A (4B_1)	0.769	--1	--1	1,000	--1
23B (4B_1+2)	2.925	--1	--1	2,100	--1
23C (4B_1 +2+3)	4.054	--1	--1	2,600	--1
23I (4A_1+2+3+4+5)	2.230	--1	--1	1,800	--1
23J (4A_1+2+3+4+5+6)	6.188	--1	--1	3,500	--1
24	14.200	--1	--1	5,300	--1
25	119.100	--1	--1	21,900	--1
32A (5A_1)	0.678	--1	--1	900	--1
32B (5A_1+2)	4.232	--1	--1	2,700	--1
32C (5B_1)	0.910	--1	--1	1,100	--1
32D (5B_1+2)	3.398	--1	--1	2,300	--1
32E (5A)	8.000	--1	--1	3,800	--1
33A (5C_1)	0.569	--1	--1	800	--1
33B (5C_1+2)	1.614	--1	--1	1,500	--1
35A (6A-1)	1.370	--1	--1	1,400	--1
35B (6A-2)	1.010	--1	--1	1,200	--1
35C (6A_1+2+3)	2.837	--1	--1	2,100	--1
39B (9A_1+2)	3.467	--1	--1	2,400	--1
Piedmont					
21A (3C_1)	6.847	--1	--1	3,400	--1
21B (3C_1+2+3D)	10.427	--1	--1	5,100	--1
26	5.200	--1	--1	3,600	--1
27	11.300	--1	--1	3,400	--1
27A (7A+7B_2)	5.790	--1	--1	4,000	--1
27B (7B_1)	3.441	--1	--1	2,100	--1
29A (7C+7D_1)	7.631	--1	--1	4,000	--1

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-year	100-Year	500-Year
52	4.500	--1	--1	2,900	--1
52A (10D_1)	1.121	--1	--1	1,300	--1
52B (10D_1+2)	1.361	--1	--1	1,300	--1
59B (10F+10G+10H_1) +26% of CP60	11.640	--1	--1	4,100	--1
59C (10D_1+2+3+10E)	7.507	--1	--1	3,700	--1
59D (10D +10E+10F+10G+10H_1+2) +26% of CP60	22.300	--1	--1	4,800	--1
61A (10I+10J_1+2) - 26% of CP60	6.891	--1	--1	3,400	--1
61B	--2	--1	--1	5,700	--1
63 (63C+63D+10K_5)	12.724	--1	--1	5,400	--1
63A (10K_1)	1.120	--1	--1	1,300	--1
63B (10K1+10K_2+46% OF 10K_1+23% of 60C)	2.727	--1	--1	1,800	--1
63C (10K1+10K_2+10K_1+23% of 60C+10K_3)	4.529	--1	--1	2,500	--1
67	6.2			3,800	--1
69	3.800	--1	--1	2,600	--1
69A (10T_1)	1.869	--1	--1	1,500	--1
69B	--2	--1	--1	900	--1
69C	--2	--1	--1	900	--1
70	3.900	--1	--1	3,200	--1
70A (10S_1)	0.835	--1	--1	1,000	--1
76	16.800	--1	--1	6,600	--1
79 (10W+10X -45% of 10W due to split)	5.615	--1	--1	3,000	--1
83	1.600	--1	--1	1,400	--1
84A (10AA+10AB_1)	3.376	--1	--1	2,100	--1
87 (87B+87C +12B_4)	6.983	--1	--1	3,500	--1
87B (12B_1+2-57% of 12B_1+45% of 78)	4.948	--1	--1	2,700	--1
87C (12B_3 +57% of 12B_1)	0.996	--1	--1	1,200	--1
90A (12E_1)	0.780	--1	--1	1,000	--1
90B (12E_1+2)	1.390	--1	--1	1,400	--1
91	0.900	--1	--1	1,600	--1
132 (25A)	0.709	--1	--1	900	--1
133 (25A+B)	1.435	--1	--1	1,400	--1
South of CAP					
95	2.095	--1	--1	1,500	--1
95A (15A_1)	0.802	--1	--1	600	--1
95B (15B_1)	1.612	--1	--1	1,200	--1
100	2.2	--1	--1	1,600	--1
CAP 6	2.2	--1	--1	115	--1
CAP 7	2.2	--1	--1	130	--1
CAP 6+7	2.2	--1	--1	245	--1
CAP 9	0.9	--1	--1	210	--1

[1] Not Computed

[2] Area not computed due to flow split.

7.2 Floodway Data

Floodway data tables are not presented in this TDN.

7.3 Annotated Flood Insurance Rate Maps

See Exhibit C, Volume 6 of this TDN

7.4 Flood Profiles

Flood profiles are not presented in this TDN.