Technical Data Notebook

UPPER AGUA FRIA WATERSHED ZONE A FLOODPLAIN DELINEATION STUDY WATERSHED NO. 2 (TABLE MESA ROAD AREA)

CONTRACT FCD 2000C020

Prepared for:

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

Prepared By:

RBF CONSULTING
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Roy B. McDaniel, P.E.

Registered Professional Engineer (Civil)
CERTIFICATE No. 36122
ROY B. McDANIEL
Date Signed 12/11/02
ARIZONA, U.S.A.

Roy B. McDaniel

December 11, 2002

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Prepared for:
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2801 West Durango Street
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(602)506-1501

Project Manager:
Richard Harris, P.E.

Prepared By:
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(602) 467-2200

Engineer:
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Section 1: Introduction

1.1 Purpose of Study

The purpose of this study is to delineate Zone A Floodplains for a portion of Watershed "UU" (Table Mesa Road Area) on all washes that have drainage areas greater than ½ square mile. At the outset of the project the Flood Control District of Maricopa County had a goal to delineate all of the floodplains in Maricopa County within a 5 year period. One of the purposes of this goal is to delineate floodplains before development occurs in order to better control floodplain management and minimize losses due to flooding. The Flood Control District had decided upon delineating Zone A floodplains in the rural areas in order to speed up the delineation process.

1.2 Authority for the Study

The Flood Control District of Maricopa County contracted RBF Consulting to perform the study based on existing topographic mapping. The main contacts, addresses, and other information about both the Flood Control District and RBF Consulting are:

Flood Control District of Maricopa County

Address:	2801 West Durango Street
	Phoenix, Arizona 85009
Phone:	(602)506-2201
Project Manager:	Mr. Richard Harris, P.E.

RBF Consulting

Address:	16605 North 28th Avenue, Suite 100
	Phoenix, Arizona 85053
Phone:	(602)467-2200
Principal-in-Charge:	Scott M. Larson, P.E., R.L.S.
Project Manager:	Roy B. McDaniel, P.E.

1.3 Site Location and Description

The Watershed "UU", the Upper Agua Fria Watershed, is located in the north part of Maricopa County, north of the New Waddell Dam, which creates Lake Pleasant (See Figure 1-1). The portion of the Upper Agua Fria Watershed that is being studied under this contract is east of the Agua Fria River.

The floodplain delineations have been divided into four areas, each of which are discussed in separate reports and submittals to FEMA. This report discusses the delineation of approximately 13.2 miles of washes in the Table Mesa Road Area. These washes drain into the Agua Fria River, and are classified as desert-mountain washes with steep slopes. The drainage area for these washes has been classified as Watershed No. 2 (Table Mesa Road Area), and the washes have been named according to the Township, Range, and Section where the headwaters are located, according to Maricopa County requirements. See Figure 1-2 for a location of Watershed No. 2 and the floodplains being delineated as part of this report.

1.4 Methodology

1.4.1 Hydrology

Peak flows were determined for the 100-year 6-hour storm using the Army Corps of Engineers HEC-1 software package, version 4.01E, dated May 1991, as outlined in Section 4 of this report. HEC-1 Model parameters were determined using WMS 6.1, the Watershed Modeling System, distributed by Environmental Modeling Systems- Incorporated (EMS-I). WMS describes itself as a "comprehensive environment for hydrologic analysis...developed by the Environmental Modeling Research Laboratory of Brigham Young University in cooperation with the U.S. Army Corps of Engineers Waterways Experiment Station." (BYU-EMRL, pg 1-1). The Flood Control District of Maricopa County provided RBF Consulting with a digital elevation model (DEM) that contains elevation data points on 10 foot grid elements. The Flood Control District created this DEM from an existing grid of points spaced at 50 foot intervals, breaklines, and flow lines. WMS analyzed the DEM, SCS soils data, and land use data in order to create a HEC-1 model based on the Flood Control District's criteria. The peak flows produced by the HEC-1 model were then compared to regional regression equations from the USGS's National Flood Frequency Program (NFF). A more detailed explanation of the hydrologic methodology and the results are provided in Section 4.

1.4.2 Hydraulics and Floodplain Delineation

Both normal depth and critical depth of the peak flow rate were calculated for each wash. Normal depth was used to delineate the Zone A floodplains if it was subcritical flow. Critical depth was used to map the floodplain when normal depth indicated supercritical flow. Manning's equation was used to determine normal depth. A Triangulated Irregular Network (TIN) was created from the DEM discussed in Section 1.4.1. WMS was used to determine the cross section geometry at different locations in each wash, and to determine the normal depth for the 100-year storm using Manning's equation. Once the normal depth was determined, WMS was used to automatically delineate the Zone A floodplain using the TIN.

1.5 Summary of Results

The study resulted in the delineation of approximately 13.2 miles of Zone A floodplain through approximate methods. The floodplains have been plotted on the Hydraulic Study Maps, located at the end of this report.

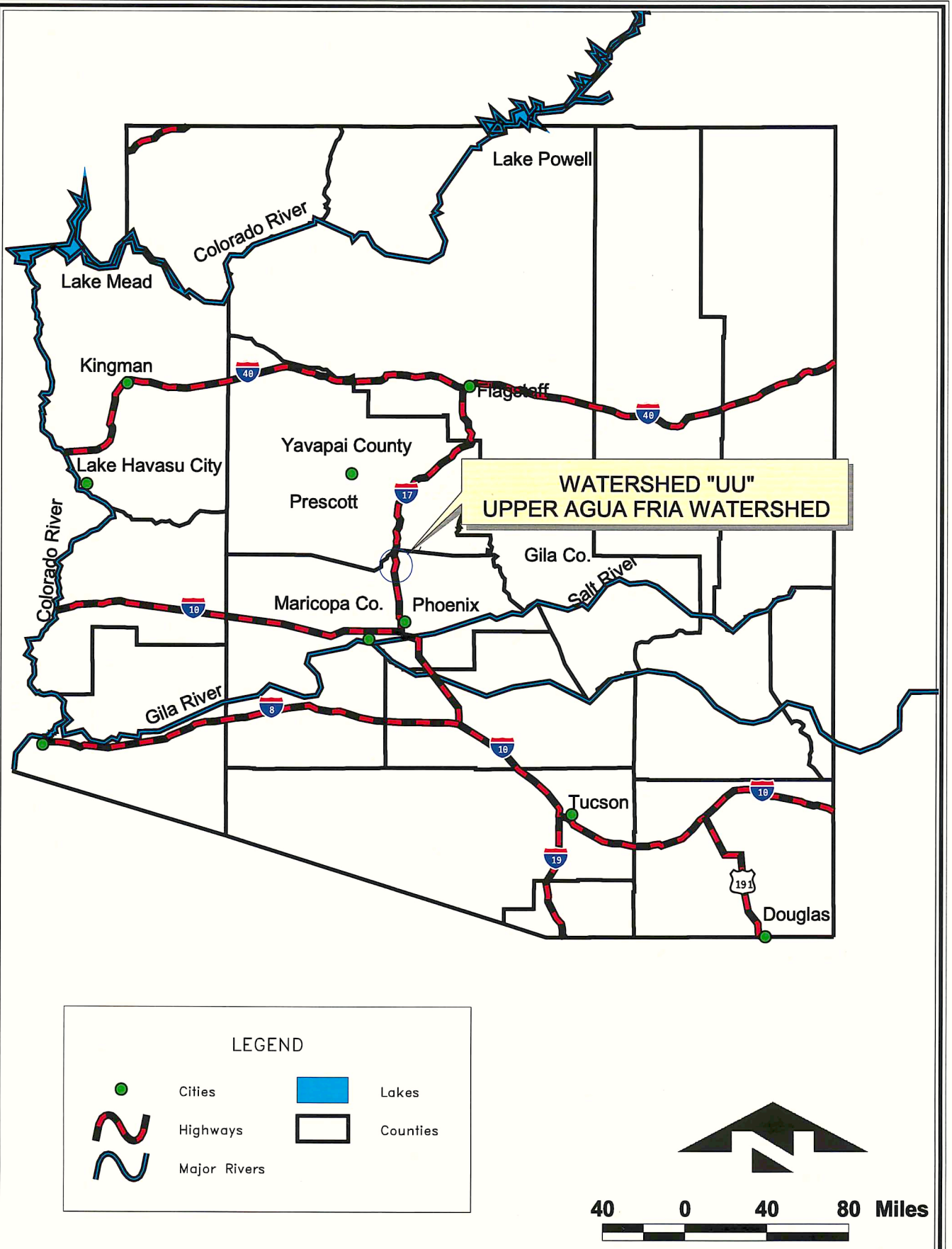

FIGURE 1-1 - LOCATION MAP

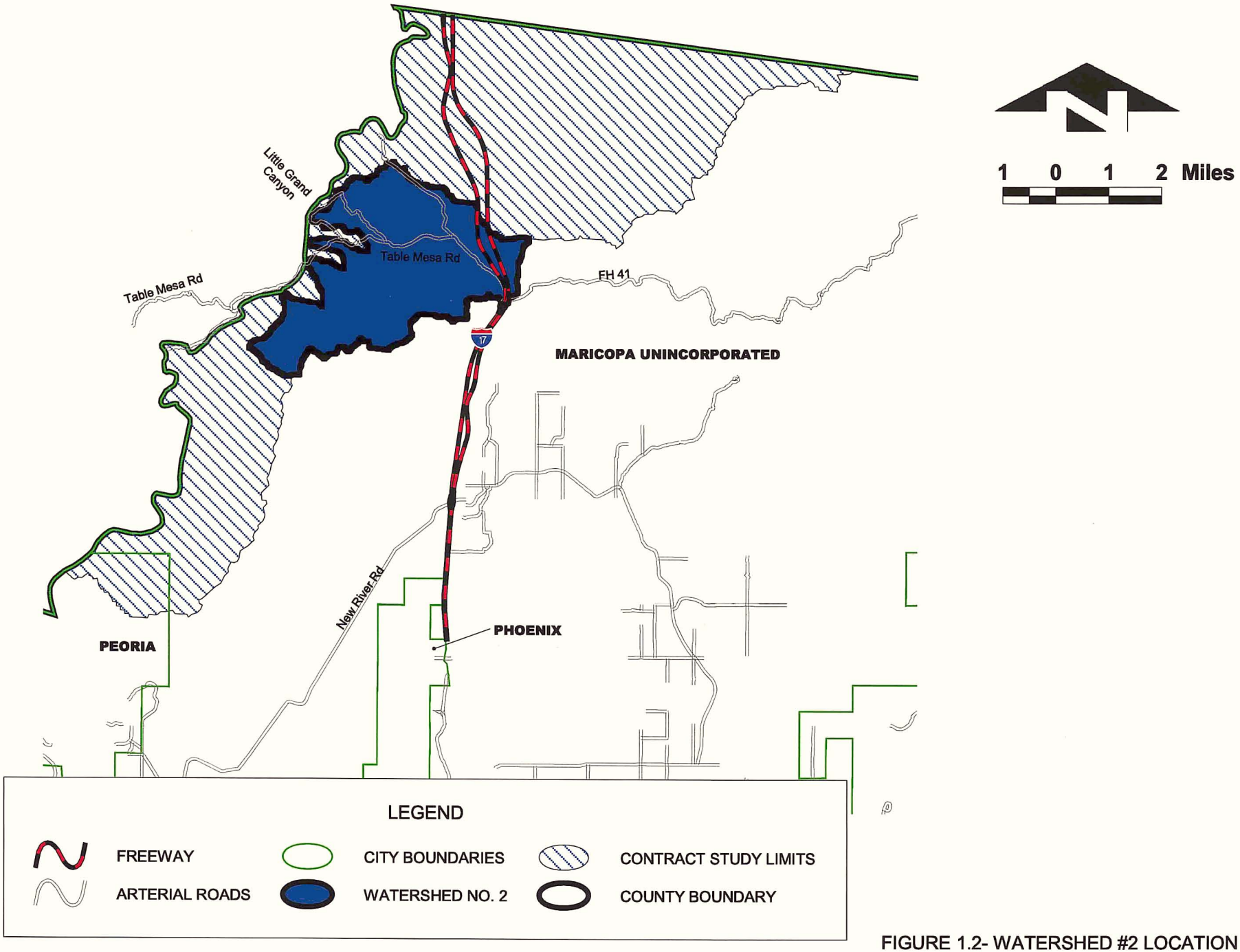

FIGURE 1.2- WATERSHED #2 LOCATION

Section 2: FEMA Forms and Local Government Abstracts

2.1 Study Documentation Abstract for FEMA Submittals

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

2.1.1	Date Study Accepted	
2.1.2	Study Contractor Contacts Address Phone Internal Reference No.	RBF Consulting Roy B. McDaniel, P.E., Scott M. Larson, P.E., R.L.S. 16605 North 28th Avenue, Suite 100 Phoenix, Arizona 85053 (602)467-2200 45-100648
2.1.3	FEMA Technical Review Contractor Contact Address Phone Internal Reference No.	Michael Baker, Jr., Inc. Pernille Buch-Pederson 3600 Eisenhower Ave, Suite 600 Alexandria, VA 22304 703-317-6224
2.1.4	FEMA Regional Reviewer Phone	Michael Baker, Jr., Inc. 703-960-8800
2.1.5	State Technical Reviewer Phone	N/A
2.1.6	Local Technical Reviewer Phone	Flood Control District of Maricopa County (FCDMC) (602)506-1501
2.1.7	Reach Description	Washes 7N2ES7, 7N2ES6S, 7N2ES6N, 7N2ES6N-T1, 8N2ES31, 8N2ES31-T1, 8N2ES31-T2, 8N2ES31-T3, AND 8N2ES31-T4 are desert-mountain washes that all drain into the Agua Fria River.
2.1.8	USGS Quad Sheet Original photo date Latest photo revision date	Black Canyon City, AZ — Daisy Mountain, AZ — New River, Arizona 1968 — 1962 — 1964 — — 1981
2.1.9	Unique Conditions and Problems	
2.1.10	Coordination of Q's Discharges (Agency, Date, Comments)	

2.2 FEMA Forms

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

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

PAPERWORK BURDEN DISCLOSURE NOTICE

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

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

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

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

B. OVERVIEW

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

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
040037	Maricopa County	AZ	04013C	375F	7/19/01

2. Flooding Source: Washes 7N2ES7, 7N2ES6S, 7N2ES6N, 7N2ES7N T1, 8N2ES31, 8N2ES31 T1, 8N2ES31 T2, 8N2ES31 T3, AND 8N2ES31 T4

3. Project Name/Identifier: Approximate Zone A Floodplain Delineation Study of Watershed "UU" (Upper Agua Fria) FCD 2000C020

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

5. Basis for Request and Type of Revision:

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

☐ Physical Change ☐ Improved Methodology/Data

☐ Regulatory Floodway Revision ☒ Other (Attach Description)

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

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

Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)

☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

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

☐ Dam ☐ Fill ☐ Other, Attach Description

C. REVIEW FEE

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

☒ No, Attach Explanation New Delineation RM

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: Richard Harris, P.E.	Company: Flood Control District of Maricopa Count	
Mailing Address: 2801 West Durango Street Phoenix, Arizona 85009	Daytime Telephone No.: 602-506-4528	Fax No.: 602-506-4601
	E-Mail Address: rph@mail.maricopa.gov	
Signature of Requester (required): Richard P. Harris		Date: 10/24/02

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: Michael S. Ellegood, P.E.		Telephone No.: 602-506-1501
Community Name: Flood Control District of Maricopa County	Community Official's Signature (required): MS. Ell	Date: Nov 15, 2002

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: Roy B. McDaniel, P.E.	License No.: 36122 (AZ)	Expiration Date: 3/31/2004
Company Name: RBF Consulting	Telephone No.: 602-467-2200	Fax No.: 602-467-2201
Signature: Roy B. McDaniel		Date: Oct 16, 2002

Ensure the forms that are appropriate to your revision request are included in your submittal.

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

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Date Signed 10/16/02 ARIZONA U.S.A.

Roy B. McDaniel

Seal (Optional)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

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Flooding Source: Wash 7N2ES7
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with Agua Fria	1.07	N/A	2,050

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

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Flooding Source: Wash 7N2ES6S
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with Agua Fria	1.27	N/A	1,947
4,301 FEET UPSTREAM	1.00	N/A	1,733

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

PAPERWORK REDUCTION ACT

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

Flooding Source: Wash 7N2ES6N
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with Agua Fria	1.66	N/A	1,684
4,301 FEET UPSTREAM	1.47	N/A	1,349

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

PAPERWORK REDUCTION ACT

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Flooding Source: Wash 7N2ES6N T1
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with Agua Fria	0.53	N/A	560

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

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

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D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

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Flooding Source: Wash 8N2ES31
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with Agua Fria	6.14	N/A	4,891
4,863 feet upstream	4.86	N/A	4,074
5,828 feet upstream	3.82	N/A	3,664

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

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C. MAPPING REQUIREMENTS

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

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D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

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Flooding Source: Wash 8N2ES31
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
9,026 feet upstreami	3.62	N/A	3,601
14,127 feet upstream	2.52	N/A	2,788
18,650 feet upstream	0.73	N/A	1,275

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

PAPERWORK REDUCTION ACT

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Flooding Source: Wash 8N2ES31 T1
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with 8N2ES31	0.93	N/A	1,096

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

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Flooding Source: Wash 8N2ES31 T2
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with 8N2ES31	0.92	N/A	651

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

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C. MAPPING REQUIREMENTS

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

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D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

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Flooding Source: Wash 8N2ES31 T3
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with 8N2ES31	0.52	N/A	641

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

4. Models Submitted

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

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

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C. MAPPING REQUIREMENTS

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

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D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
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Flooding Source: Wash 8N2ES31 T4
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Confluence with 8N2ES31	0.79	N/A	1,562

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

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

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

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

Section 3: Survey and Mapping Information

3.1 Field Survey Information

Field survey related to this contract consisted of surveying any man made structures that would impact the floodplains within this watershed and setting elevation reference monuments (ERMs). Field survey was conducted under the supervision of Brent J. Smith, R.L.S. Field notes for the ERMs are contained in the document *Upper Agua Fria Floodplain Delineation Study, Elevation Reference Monuments.* Field notes for the hydraulic structure survey are provided in the document *Upper Agua Fria Floodplain Delineation Study, Structure Survey.* Copies of the field notes that pertain to Watershed #2 are provided in Appendix C.

3.2 Mapping

RBF used existing digital elevation models (DEM) and digital terrain models (DTM) provided by the Flood Control District of Maricopa County. Landata Airborn Systems created the DTM from digital ortho-photos that were created as part of the Maricopa County Ortho-photo project in 2000 and 2001. Landata Airborn Systems produced the photography and DTMs under the supervision of Kas Ebrahim.

RBF Consulting set the panels and supplied the horizontal and vertical control for the Maricopa County Ortho-photo project under the supervision of Brent J. Smith, R.L.S. The coordinate system is based on NAD 83, Arizona State Plane- Central Zone. The vertical coordinate system is NAVD 88. The RBF Consulting job number for the mapping is 45-100774.

As part of the Maricopa County Ortho-photo project Landata flew aerial photography for the entire county. The dates the photos were flown are December 16, 2000 through March 15, 2001. The vertical control was based on GDACS monuments established by the Maricopa County Department of Transportation.

Appendix C contains part of the narrative from the "Maricopa County Ortho-photo GPS-Summary of Procedure Final Report" stamped by Brent J. Smith, R.L.S. Appendices A through C are provided on a CD in Appendix C.

Section 4: Hydrology

4.1 Method Description

The purpose of the hydrologic analysis is to provide peak flow data for the Zone A flood plain delineation of all washes in this watershed that have a drainage area of at least one-half square mile. Peak flows for the 100-year 6-hour storm were computed using the Army Corps of Engineers' Flood Hydrograph Package HEC-1, version 4.01E, dated May 1991. Environmental Modeling Systems Incorporated's (EMS-I) Watershed Modeling System version 6.1 (WMS), dated June 1, 2002, was used to build the hydrologic model using a grid of elevation data and geographic information system (GIS) data provided by the Flood Control District of Maricopa County (FCD). Additionally, WMS was used to verify the HEC-1 peak flow calculations using the USGS's and FHWA's National Flood Frequency (NFF) equations for Arizona.

4.2 Parameter Estimation

Hydrologic parameters were estimated using the FCD's methodology, as outlined in Volume I of the *Drainage Design Manual For Maricopa County* (DDM), dated January 1, 1995. The following sections discuss the parameter estimation in detail.

4.2.1 Drainage Area Boundaries

Figure 4.1 shows the sub-basin delineation for the Upper Agua Fria Watershed #2. There are four tributaries to the Agua Fria River in Watershed #2 that have drainage areas greater than ½ square mile. Watershed #2 consists of 4 sub-watersheds that are tributary to the Agua Fria River (Sub-Watersheds 2A through 2D). The furthest downstream drainage points for each sub-watershed are located at the wash's confluence with the Agua Fria River. Watershed #2 is mostly undeveloped. There are several dirt roads within the watershed, a power line easement, campgrounds, a few buildings, and the Interstate-17 Freeway.

Sub-basin delineation was performed by WMS using an digital elevation model (DEM) produced from the digital orthophotos, dated May 26, 2001 . The grid spacing of the DEM is 10 feet and it has an accuracy of plus or minus five feet.

4.2.2 Watershed Work Maps

Figure 4.1 and Exhibit 1 show the sub-basin boundaries, confluence or concentration points, routing reaches, longest flow path, and a peak flow summary of Watershed #2. The subwatersheds are labeled with Sub-watershed 2A having the most southern outlet to the Agua Fria River, with the sub-watersheds increasing alphanumerically to the north, where the outlet for sub-watershed 2D is the most northern outlet in Watershed #2. Within each watershed the sub-basins are labeled by the sub-watershed name, followed by a number. The number starts with one at the most downstream sub-basin, and increases as the sub-basins go upstream. The concentration point for each sub-basin is labeled with a "CP" in front of the name of the upstream sub-basin. The routing reach is named by replacing the "CP" with an "R" for the reach downstream of the concentration point.

There are 24 sub-basins divided between the four sub-watersheds, labeled 2A1 through 2D15.

There are 18 concentration points labeled CP2A1 through CP2D14, and 14 routing reaches labeled R2A2 through R2D14.

Figure 4.2 shows the watershed boundaries overlain on top of the soil map units, according to the Aguila-Carefree Soil Survey. Figure 4.3 shows the land use designation for Watershed #2.

4.2.3 Gage Data

Table 4.1 lists the rain gage locations in the vicinity of Watershed #2. None of these gages are within Watershed #2.

Table 4.1- List of Gages Near Watershed #2

Gage I.D.	Name	Installation Date	Type
5650	Lake Pleasant	12/10/1991	Precipitation
5630	New River Landfill	4/29/1993	Precipitation
5625	Sun Up Ranch	3/21/1984	Precipitation
5583	Skunk Creek near New River	6/2/95	Telemetry Stage

4.2.4 Statistical Parameters

Statistical Parameters have not been considered at this stage of the study.

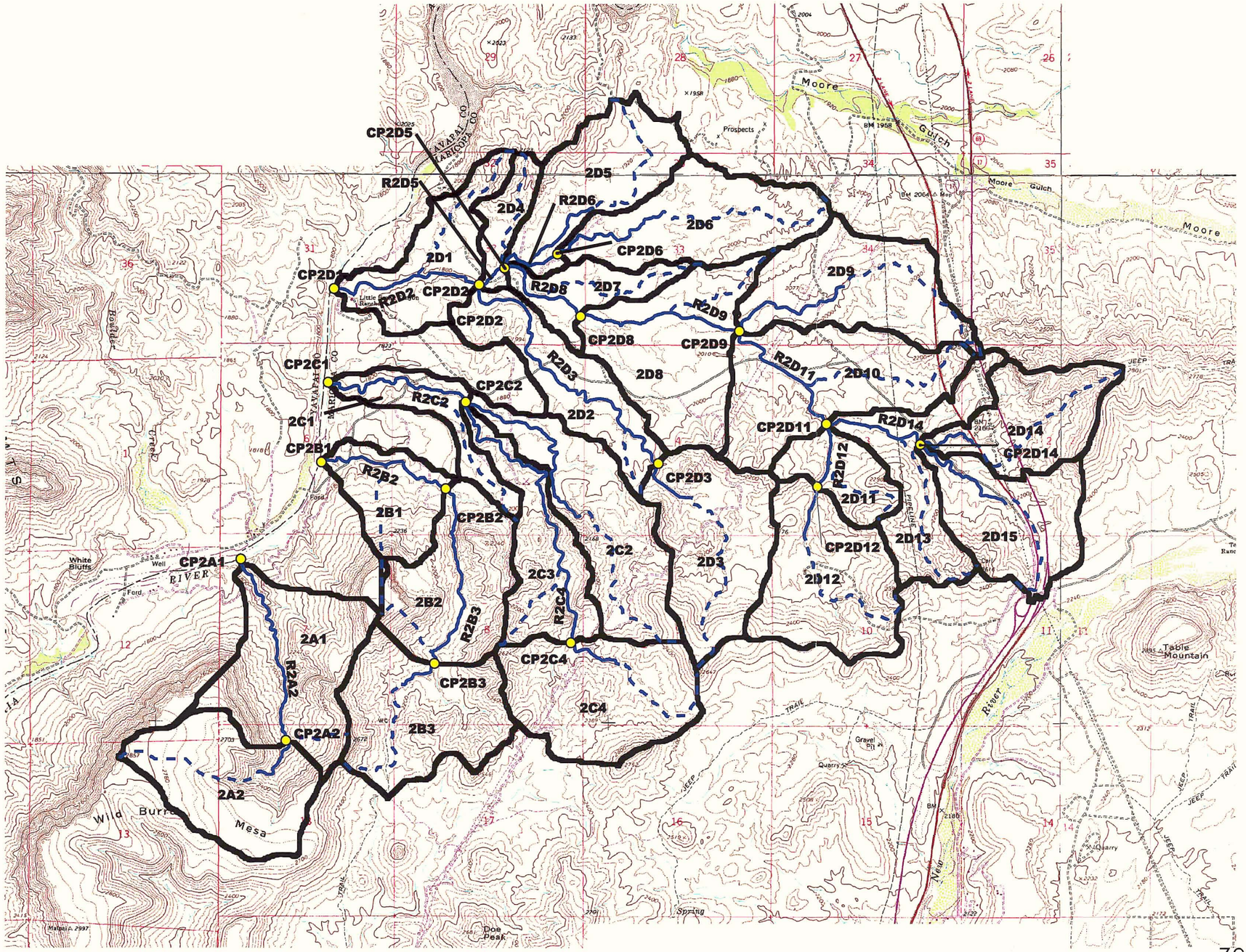
4.2.5 Precipitation

The NOAA Atlas II was used to obtain a 100-year 6-hour point precipitation value of 3.50 inches for Watershed #2. According to the DDM's Design Rainfall Criteria for Maricopa County (pg. 2-3), watersheds with drainage areas of 20 square miles or less should be analyzed using the 6-hour local storm.

HEC-1's JD card option was used to reduce point precipitation values using the depth-area reduction factors from the DDM. Table 4.2 lists the depth-area rainfall relations that were input onto the JD card. The appropriate rainfall distribution pattern for the 6-hour storm was also input onto the corresponding PC cards.

Table 4.2- Depth-Area Relation used in the HEC-1 Model

Depth Inches	Area Square Miles	Rainfall Distribution Pattern
3.50	0.0001	1
3.48	0.5	1
3.41	2.8	2
3.23	16.0	3



3000 0 3000 6000 Feet

LEGEND

- Concentration Points
- CP2A1 Confluence Name
- Washes
- Path of Longest Flow
- Sub-Basin Boundaries
- 2A1 Sub-Basin Name
- R2A2 Routing Reach Name

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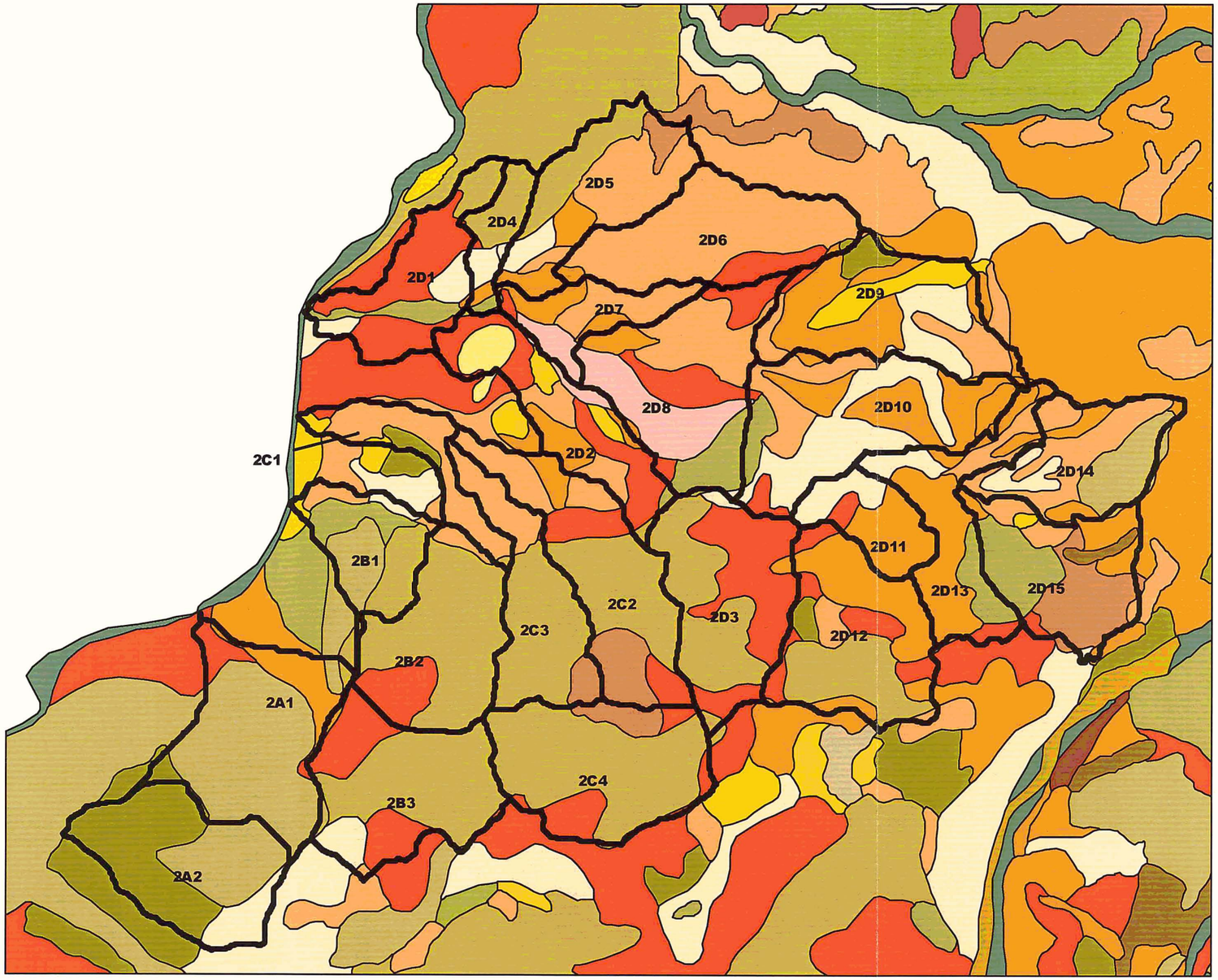
UPPER AGUA FRIA WATERSHED
ZONE A FLOODPLAIN DELINEATION STUDY
WATERSHED #2 (TABLE MESA ROAD AREA)
SUB-BASIN BOUNDARIES
FIGURE 4.1



3000 0 3000 6000 Feet

LEGEND

Sub-Basin Boundaries

WMS I.D., Soil Name, Map Unit Symbol

- 45, Anthony-Arizo complex, 6
- 47, Arizo cobbly sandy loam, 8
- 63, continental clay loam, 0 to 3 percent slopes, 24
- 65, Continental cobbly clay loam, 1 to 8 percent slopes, 26
- 67, Continental-Ohaco complex, 28
- 70, Dixaleta-Rock outcrop complex, 25 to 65 percent slopes, 31
- 72, Eba very gravelly loam, 1 to 8 percent slopes, 33
- 73, Eba very gravelly loam, 8 to 20 percent slopes, 34
- 75, Eba-Continental complex, 1 to 8 percent slopes, 36
- 76, Eba-Continental-Cave association, 3 to 20 percent slopes, 37
- 79, Eba-Pinaleno complex, 3 to 20 percent slopes, 40
- 80, Eba-Pinaleno complex, 20 to 40 percent slopes, 41
- 91, Gachado-Lomitas-Rock outcrop complex, 7 to 55 percent slopes, 52
- 102, Gran-Wickenburg-Rock outcrop complex, 1 to 7 percent slopes, 63
- 105, Greyeagle-Suncity Variant complex, 1 to 7 percent slopes, 66
- 111, Lehmans-Rock outcrop complex, 8 to 65 percent slopes, 72
- 132, Nickel-Cave complex, 8 to 30 percent slopes, 93
- 134, Ohaco gravelly loam, 95
- 135, Pinaleno-Tres Hermanos complex, 1 to 10 percent slopes, 96
- 142, Rock outcrop-Gachado complex, 5 to 55 percent slopes, 103
- 150, Torriorthents, 15 to 40 percent slopes, 111
- 143, Rock outcrop-Lehmans complex, 15 to 65 percent slopes, 104
- 159, Tres Hermanos gravelly sandy loams, 120

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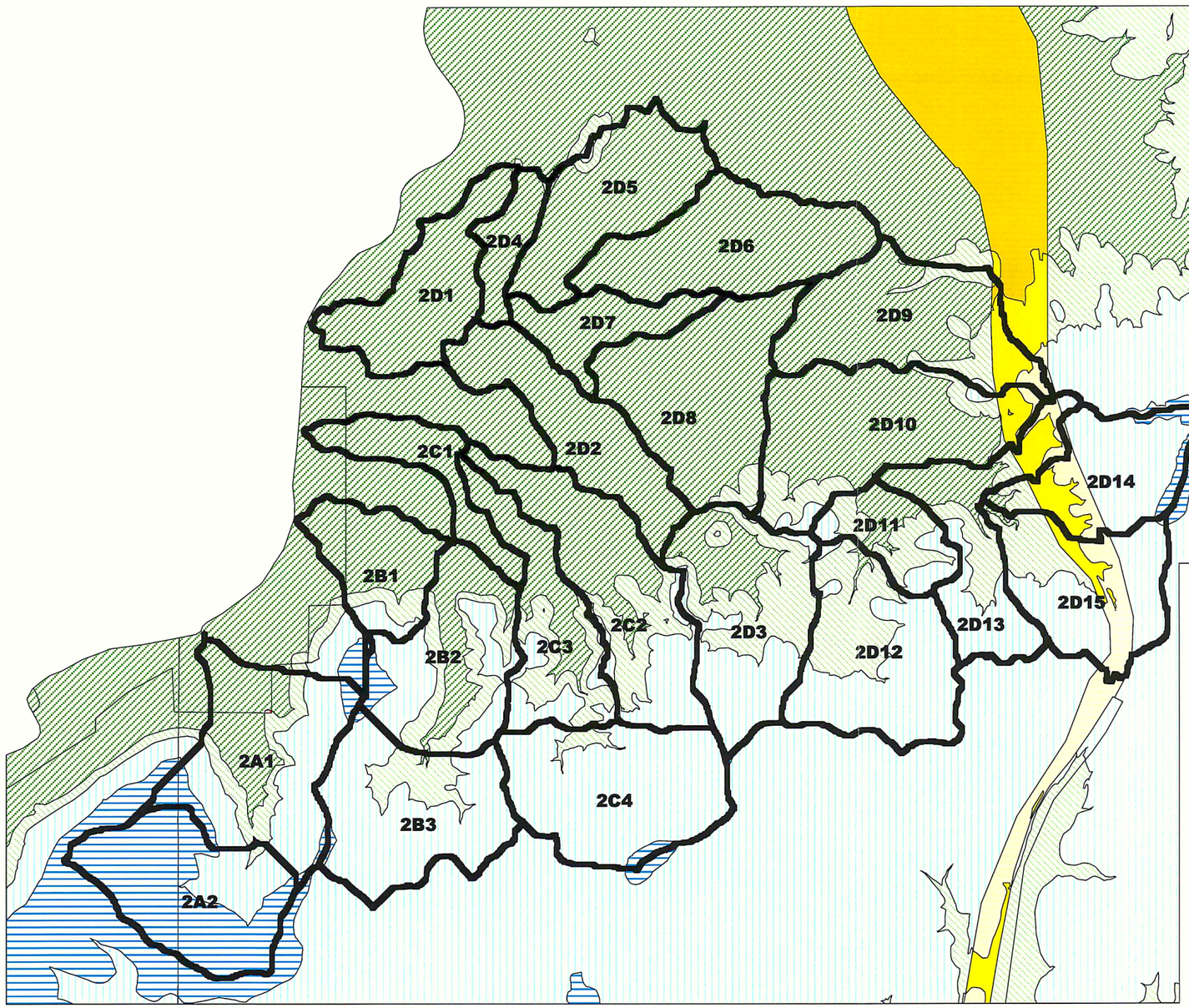
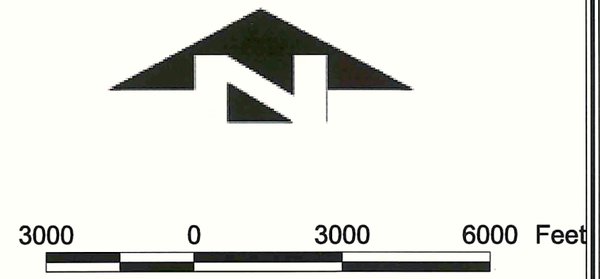
UPPER AGUA FRIA WATERSHED
ZONE A FLOODPLAIN DELINEATION STUDY
WATERSHED #2 (TABLE MESA ROAD AREA)
SOILS MAP
FIGURE 4.2





LEGEND

- Sub-Basin Boundaries

Land use coverage

- Recreational Open Space, 25% Vegetative
- Recreational Open Space, 30% Cover
- Transportation, 20% Vegetative Cover
- Transportation, 25% Vegetative Cover
- Transportation, 30% Vegetative Cover
- Vacant, 20% Vegetative Cover
- Vacant, 25% Vegetative Cover
- Vacant, 30% Vegetative Cover
- Vacant, 35% Vegetative Cover
- Water

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UPPER AGUA FRIA WATERSHED
ZONE A FLOOD PLAIN DELINEATION STUDY
WATERSHED #2 (TABLE MESA ROAD AREA)
LAND USE CLASSIFICATION
FIGURE 4.3

4.2.6 Physical Parameters

Rainfall Losses

The Green and Ampt infiltration equations were used within HEC-1 to estimate rainfall losses according to the procedures outlined in the DDM. WMS was used to calculate the logarithmic area averages of the hydraulic conductivities of each map unit within each sub-basin. WMS also selects the capillary suction (PSIF) and soil moisture deficit (DTHETA) using the average XKSAT value. After PSIF and DTHETA are calculated the XKSAT value is adjusted for vegetative cover.

A GIS based soils map of the SCS *Soil Survey of Aguila-Carefree Area, Parts of Maricopa County and Pinal Counties, Arizona,* issued April 1986 was obtained from the FCD for input into WMS. Figure 4.2 shows the soils map for Watershed #2. A table relating the Map Unit numbers to the XKSAT values was obtained from Appendix A of the DDM. Table 4.3 lists the map unit values that were input into WMS to compute the rainfall losses.

Table 4.3- Sub-Basin Soils used in Rainfall Loss Calculations

WMS I.D.	SCS MUSYM	Description	XKSAT inch/hr	Impervious Area %	% Effective
45	6	Anthony-Arizo Complex	0.62	0	100
47	8	Arizo Cobbly Sandy Loam	0.96	0	100
63	24	Continental Clay Loam, 0-3% slopes	0.02	0	100
65	26	Continental Cobbly Clay Loam, 1-8% slopes	0.01	0	100
67	28	Continental-Ohaco Complex	0.02	0	100
70	31	Dixaleta-Rock outcrop complex, 25-65% slopes	0.33	35	100
72	33	Eba very gravelly loam, 1-8% slopes	0.23	0	100
73	34	Eba very gravelly loam, 8-20% slopes	0.23	0	100
75	36	Eba-Continental Complex, 1-8% slopes	0.07	0	100
76	37	Eba-Continental Cave Association, 3-20% Slopes	0.13	0	100
79	40	Eba-Pinaleno Complex, 3-20% Slopes	0.17	0	100
80	41	Eba-Pinaleno Complex, 20-40% Slopes	0.17	35	100
91	52	Gachado-Lomitas-Rock outcrop complex, 7 to 55% slopes	0.16	20	100

Table 4.3- Sub-Basin Soils used in Rainfall Loss Calculations

WMS I.D.	SCS MUSYM	Description	XKSAT inch/hr	Impervious Area %	% Effective
102	63	Gran-Wickenburg-Rock Outcrop complex, 1-7% slopes	0.14	25	100
105	66	Greyeagle-Suncity variant complex, 1-7% Slopes	0.23	0	100
111	72	Lehmans-Rock outcrop complex	0.09	30	100
132	93	Nickel-Cave complex	0.33	0	100
134	95	Ohaco gravelly loam	0.04	0	100
135	96	Pinaleno-Tres Hermanos complex, 1-10% slope	0.07	0	100
142	103	Rock outcrop-Gachado complex	0.10	65	100
143	104	Rock outcrop-Lehmans complex	0.14	60	100
150	111	Torriorthents	0.40	0	100
159	120	Tres Hermanos gravelly sandy loams	0.06	0	100

The FCD provided land use data in shape file (GIS) format based on Maricopa Associated Governments (MAG) Data. The percent vegetative cover was varied according to the elevation range as specified by the Flood Control District of Maricopa County. A description is provided in Appendix D. Table 4.4 lists the land use data that was imported into WMS to help determine rainfall losses. The land use data provided initial abstraction calculations. Because the difference in land use between "Recreational Open Space" and "Vacant" in Watershed #2 is in name only, all of the area defined as "Recreational Open Space" was changed to "Vacant" for modeling purposes.

Table 4.4- Land Use Characteristics used to Compute Green and Ampt Parameters

Land Use Classification	Description	Initial Abstraction inches	Soil Condition	Impervious Area %	Vegetative Cover %
Recreational Open Space	Hillslopes, Sonoran Desert	0.10	Normal	0	20-30
Vacant	Hillslopes, Sonoran Desert	0.15	Dry	0	20-35
Transportation	Developed	0.10	Normal	80	20-30

Unit Hydrograph Procedure

The Clark Unit Hydrograph procedure was used because the DDM states that it "is recommended for watersheds or subbasins less than about 5 square miles in size with an upper limit of application of 10 square miles."

The Papadakis and Kazan equation shown below is used to compute T_c for the Clark Unit Hydrograph Procedure in Maricopa County:

$$T_c = 11.4L^{0.50}k_b^{0.52}S^{-0.31}i^{-0.38}$$

where T_c = time of concentration, hours
L = length of flow path for T_c, miles
k_b = representative watershed resistance coefficient
S = watercourse slope, feet/mile
i = average rainfall excess intensity during the time T_c, inches/hour (DDM, pg 5-10)

WMS uses the Green and Ampt parameters for each sub-basin and the 6-hour precipitation depth (3.5 inches) to compute *i*. Both L and S are computed from the DEM by WMS, and the watershed resistance coefficient is based on the drainage area, computed by WMS, and the sub-basin roughness type. A maximum roughness (Type D, Table 5.1 of the DDM, pg. 5-13) was chosen because of the mountainous terrain and the short flow paths present in the watershed. WMS will also adjust the watercourse slope for steep slopes according to Figure 5.4 in the DDM. Table 4.5 lists the values WMS used to calculate the time of concentration (T_c) and storage value (R) for the Clark Unit Hydrograph.

Table 4.5- Values Used to Compute Clark Unit Hydrograph Parameters

Sub-Basin	Area square miles	Length of Longest Flow Path* miles	Measured Slope* feet/mile	Adjusted Slope feet/mile
2A1	0.5744	1.506	638.67	315.00
2A2	0.5000	1.169	624.78	315.00
2B1	0.2699	1.217	841.89	315.00
2B2	0.4775	1.432	599.42	312.92
2B3	0.5225	1.094	507.16	302.87
2C1	0.1970	1.690	219.34	217.73
2C2	0.5345	2.305	305.05	264.27
2C3	0.3696	1.989	363.12	282.59
2C4	0.5624	1.132	418.54	296.11
2D1	0.3569	1.533	260.47	246.11

Table 4.5- Values Used to Compute Clark Unit Hydrograph Parameters

Sub-Basin	Area square miles	Length of Longest Flow Path* miles	Measured Slope* feet/mile	Adjusted Slope feet/mile
2D2	0.3902	1.946	174.75	174.75
2D3	0.5354	1.549	415.07	295.49
2D4	0.1235	0.913	352.88	249.52
2D5	0.4188	1.714	125.63	125.63
2D6	0.5000	1.987	109.57	109.57
2D7	0.1990	1.436	121.50	121.50
2D8	0.5759	1.324	162.05	162.05
2D9	0.5211	1.919	175.79	175.79
2D10	0.6188	1.774	187.92	187.92
2D11	0.1971	0.847	381.27	287.72
2D12	0.5322	1.324	374.87	285.97
2D13	0.3812	1.585	383.08	288.21
2D14	0.3677	1.550	478.27	301.58
2D15	0.4242	1.482	213.76	212.55

* WMS reports "Length of Longest Flow Path" as "MFD" (Maximum Flow Distance), and "Measures Slope" as "MFS" (Maximum Flow Slope).

Table 4.6 lists the sub-basin parameters that WMS prepared for input into HEC-1.

Table 4.6- HEC-1 Sub-Basin Parameters for Watershed #2

Sub-Basin	Area sq. mi.	IA inches	DTHETA	PSIF	Adj. XKSAT in./hr	RTIMP %	T_c hours	R hours
2A1	0.5744	0.150	0.343	7.105	0.114	22.8	0.471	0.305
2A2	0.5000	0.150	0.196	10.967	0.280	9.7	0.388	0.217
2B1	0.2699	0.150	0.390	5.737	0.189	33.6	0.429	0.357
2B2	0.4775	0.150	0.350	4.535	0.344	27.5	0.475	0.329
2B3	0.5225	0.150	0.368	5.181	0.257	21.6	0.396	0.206

Table 4.6- HEC-1 Sub-Basin Parameters for Watershed #2

Sub-Basin	Area sq. mi.	IA inches	DTHETA	PSIF	Adj. XKSAT in./hr	RTIMP %	T_c hours	R hours
2C1	0.1970	0.150	0.370	5.220	0.231	.304	0.679	0.925
2C2	0.5345	0.150	0.350	4.591	0.325	14.8	0.733	0.731
2C3	0.3696	0.150	0.350	4.336	0.385	24.1	0.650	0.701
2C4	0.5624	0.150	0.350	4.491	0.369	26.5	0.417	0.215
2D1	0.3569	0.150	0.383	6.339	0.148	11.227	0.550	0.482
2D2	0.3902	0.150	0.397	5.932	0.17	9.3	0.771	0.808
2D3	0.5354	0.150	0.354	4.936	0.278	17.6	0.513	0.357
2D4	0.1235	0.150	0.39	5.72	0.187	25.8	0.392	0.400
2D5	0.4188	0.150	0.35	4.644	0.302	9.3	0.846	0.776
2D6	0.5000	0.150	0.35	4.559	0.32	0.0	1.042	0.995
2D7	0.1990	0.150	0.392	6.165	0.157	0.0	0.767	0.924
2D8	0.5759	0.150	0.397	6.058	0.164	8.3	0.592	0.354
2D9	0.5211	0.144	0.363	6.339	0.150	9.5	0.738	0.645
2D10	0.6188	0.147	0.382	5.798	0.181	8.6	0.683	0.504
2D11	0.1971	0.150	0.380	5.465	0.218	0.0	0.367	0.269
2D12	0.5322	0.150	0.380	5.421	0.227	11.9	0.467	0.285
2D13	0.3812	0.143	0.366	5.664	0.205	20.8	0.525	0.453
2D14	0.3677	0.138	0.343	5.305	0.242	27.4	0.508	0.438
2D15	0.4242	0.138	0.339	5.181	0.256	35.3	0.563	0.436

Channel Routing

There are fourteen reaches that require channel routing. Normal depth routing was performed in HEC-1 for the reaches listed in Table 4.7. The Cross-sections were created in WMS using the cross section editor on a TIN created from the DEM and contour data. Normal depth was calculated using WMS's channel calculator. Cross-section plots are provided in Appendix D.3, along with the calculation results. Table 4.7 summarizes the normal depth routing calculations.

Table 4.7- Channel Routing Parameters for Normal Depth Routing

Reach	Reach Length* feet	Slope ft/ft	Velocity fps	NSTPS
R2A2	6185	0.06943	14.79	1
R2B2	4313	0.03623	11.20	1
R2B3	5922	0.03857	11.08	2
R2C2	5066	0.02543	6.47	3
R2C4	9869	0.03165	10.63	3
R2D2	4867	0.01574	10.17	2
R2D3	9665	0.01992	7.44	4
R2D5	965	0.01254	7.20	1
R2D6	2035	0.02060	2.96	2
R2D8	3199	0.01614	5.83	2
R2D9	5102	0.01206	8.91	2
R2D11	4525	0.01760	9.01	2
R2D12	1971	0.02704	10.28	1
R2D14	3306	0.01785	9.50	1

* Reach length and slope are obtained from WMS by listing the stream segment length (SL) and stream segment slope (SS). These values may match maximum stream length (MSL) and maximum stream slope (MSS) in some cases, but not in all cases. SL and SS will not match MSL and MSS if there is a stream defined in WMS that is not the routing reach, but it is longer than the routing reach.

4.3 Problems Encountered During the Study

4.3.1 Special Problems and Solutions

Modeling watersheds in WMS using DEMs, TINs, and Map Objects presents a problem when two branches of a stream join at a confluence point. When using the DEM, TIN, or Map modules for watershed modeling, WMS will not allow two outlets or confluence points to be next to each other without having any area between the two outlets. If two washes are combining, and each wash is receiving routed flow from an upstream sub-basin, four hydrographs will be generated and combined at the confluence point. It is often desirable, especially in floodplain modeling, to know the combined peak flow of a routing reach and a sub-basin before the flows are combined at a tributary confluence. For Watershed #2 this problem was avoided by creating a base HEC-1 model in WMS and then manually editing the input file outside of WMS to add extra HC cards to combine hydrographs in sets of two at the most. For example, CP2C3, an HC card combining R2C4 and 2C3, was added just upstream of CP2C in order to determine what the peak flow in that reach will be prior to it combining with the flow from sub-basin 2C2. Similarly, CP2D2U, C2D11U, CP2D10,

CP2D13, CP2D7, CP2D5U, and CP2D4 were added to more accurately determine the peak flow in individual washes. The model created purely by WMS is called "wmsbase.hc1", while the revised model is called "0648ws2r.hc1". A copy of "wmsbase.hc1" (input file only) is provided in Appendix D, along with the output file "0648ws2r.out" (output file) for comparison purposes.

Another shortcoming of WMS is that it automatically adds a routing reach to the downstream end of the lowest drainage point. These routing reaches were taken out of the revised model, along with the KO cards for the concentration points and the sub-basins.

WMS also only allows three lines of ID cards at the beginning of the HEC-1 files. More explanation has been added to "0648ws2r.hc1".

4.3.2 Modeling warning and error messages

The HEC-1 model did not produce any error or warning messages.

4.4 Calibration

Recorded data has not been used to calibrate the model at this stage of the study. The NFF equations for Arizona have been used as a comparison.

4.5 Final Results

4.5.1 Hydrologic Analysis Results

Table 4.8 lists the results of the hydrologic analysis.

Table 4.8- HEC-1 Results

Drainage ID	Peak Discharge cfs	Time to Peak hours	Runoff Volume acre-feet	Area sq. miles	Unit Peak cfs/sq. mi.
2A2	1304	4.25	71.60	0.50	2608
R2A2	1216	4.25	71.60	0.50	2432
2A1	1156	4.33	73.65	0.57	2028
CP2A1	2050	4.33	142.54	1.07	1916
2B3	1215	4.25	60.09	0.52	2337
R2B3	1141	4.33	60.09	0.52	2194
2B2	883	4.33	55.93	0.48	1840
CP2B2	1733	4.33	141.93	1.00	1733
R2B2	1646	4.42	110.53	1.00	1646

Table 4.8- HEC-1 Results

Drainage ID	Peak Discharge cfs	Time to Peak hours	Runoff Volume acre-feet	Area sq. miles	Unit Peak cfs/sq. mi.
2B1	518	4.25	34.95	0.27	1919
CP2B1	1947	4.33	141.93	1.27	1533
2C4	1249	4.25	63.95	0.56	2230
R2C4	1110	4.42	63.95	0.56	1982
2C3	415	4.50	41.38	0.37	1122
CP2C3	1349	4.42	100.78	0.93	1451
2C2	560	4.50	56.58	0.53	1057
CP2C2	1626	4.42	164.42	1.47	1106
R2C2	1587	4.58	148.67	1.47	1080
2C1	178	4.50	19.56	0.20	890
CP2C1	1684	4.58	164.42	1.66	1014
2D3	935	4.33	59.37	0.54	1731
R2D3	815	4.58	59.37	0.54	1509
2D2	405	4.58	43.28	0.39	1038
CP2D2U	1096	4.58	98.39	0.93	1178
2D12	1027	4.25	57.47	0.53	1938
R2D12	1030	4.33	57.47	0.53	1943
2D11	402	4.25	19.56	0.20	2010
C2D11U*	1275	4.33	74.94	0.73	1747
2D14	611	4.33	45.07	0.37	1651
2D15	698	4.42	54.61	0.42	1662
CP2D14	1192	4.33	97.13	0.79	1509
R2D14	1143	4.42	97.13	0.79	1447
2D13	610	4.33	45.13	0.38	1605
CP2D13	1562	4.42	137.73	1.17	1335
CP2D11	2340	4.42	202.71	1.90	1232

Table 4.8- HEC-1 Results

Drainage ID	Peak Discharge cfs	Time to Peak hours	Runoff Volume acre-feet	Area sq. miles	Unit Peak cfs/sq. mi.
R2D11	2304	4.50	20.20	1.90	1213
2D10	841	4.50	67.05	0.62	1356
CP2D10	2788	4.50	259.12	2.52	1106
2D9	641	4.50	59.50	0.52	1233
CP2D9	3145	4.50	308.43	3.04	1035
R2D9	3083	4.58	308.43	3.04	1014
2D8	980	4.42	63.02	0.58	1690
CP2D8	3601	4.58	358.48	3.62	994
R2D8	3558	4.67	358.48	3.62	982
2D7	185	4.58	20.88	0.20	925
CP2D7	3664	4.67	374.34	3.82	959
2D6	381	4.75	46.72	0.50	762
R2D6	367	4.92	46.72	0.50	734
2D5	414	4.58	43.18	0.42	986
CP2D5U	651	4.83	84.38	0.92	707
CP2D5	3999	4.67	435.90	4.74	844
R2D5	4004	4.75	435.90	4.74	845
2D4	223	4.25	15.24	0.12	1858
CP2D4	4074	4.75	447.93	4.86	838
CP2D2	4733	4.75	554.66	5.79	817
R2D2	4689	4.83	554.66	5.79	810
2D1	544	4.42	41.07	.36	1511
CP2D1	4891	4.83	564.73	6.14	797

* It was necessary to use C2D11U as the Drainage ID in lieu of the expected CP2D11U Drainage ID due to the 6 character limitation for HEC-1 concentration point identifiers

Table 4.9 lists the peak flow values that will be used in the hydraulic modeling phase of the study.

Table 4.9- Peak Discharges Used in Hydraulic Calculations

Wash	Drainage ID	Peak Discharge
7N2ES7	CP2A1	2,050 cfs
7N2ES6S Reach 1	CP2B1	1,947 cfs
7N2ES6S Reach 2	CP2B2	1,733 cfs
7N2ES6N Reach 1	CP2C1	1,684 cfs
7N2ES6N Reach 2	CP2C3	1,349 cfs
7N2ES6N T1	2C2	560 cfs
8N2ES31 Reach 1	CP2D1	4,891 cfs
8N2ES31 Reach 2	CP2D4	4,074 cfs
8N2ES31 Reach 3	CP2D7	3,664 cfs
8N2ES31 Reach 4	CP2D8	3,601 cfs
8N2ES31 Reach 5	CP2D10	2,788 cfs
8N2ES31 Reach 6	C2D11U*	1,275 cfs
8N2ES31 T1	CP2D2U	1,096 cfs
8N2ES31 T2	CP2D5U	651 cfs
8N2ES31 T3	2D9	641 cfs
8N2ES31 T4	CP2D13	1,562 cfs

* It was necessary to use C2D11U as the Drainage ID in lieu of the expected CP2D11U Drainage ID due to the 6 character limitation for HEC-1 concentration point identifiers

4.5.2 Verification of Results

Verification of the study results cannot be performed by flood frequency analysis because the washes and watersheds in this study are ungaged. The only method of verification of peak discharges used in this study is indirect methods. The National Flood Frequency equations for Arizona were used as a verification of the 100-year peak flow. The calculations are provided in Appendix D6. Table 4.10 compares the NFF 100-year peak flows with the HEC-1 results at the four major confluences with the Agua Fria River. Appendix D6 contains comparisons of each sub-basin HEC-1 output to the NFF equations.

Table 4.10- Comparison of HEC-1 Results with NFF Peak Flows for the 100-yr 6-hr Storm

Drainage ID	Peak Flow, cfs			Mean Elevation	Rainfall, inches
	HEC-1	Southwest U.S. Equation	Arizona Equation		
CP2A1	2,050	1,700	2,020	2,440	13.89
CP2B1	1,947	2,030	2,580	2,200	14.12
CP2C1	1,684	2,520	3,160	2,160	14.26
CP2D1	4,891	6,450	7,600	2,080	14.80

The NFF program reports that the standard error for 100-year peak discharge is 66% using the Arizona Equation and 39% for the Southwest U.S. Equation. The variation of the HEC-1 peak flows from the NFF Peak Flows are all within the standard error of each equation. There are a few individual sub-basins, particularly upstream of CP2C1, that fall outside of the standard error. Each of these sub-basins has a long time of concentration, large storage coefficient, and a small drainage area. The sub-basins are narrow and long, explaining why the peak flows are outside of the range of the NFF peak flows.

Section 5: Hydraulics

5.1 Method Description

All of the washes delineated in this study are desert-mountain washes that drain directly into the Agua Fria River. Environmental Modeling Systems Incorporated's (EMS-I) Watershed Modeling System version 6.1 (WMS), dated August 13, 2002, was used to create a Triangulated Irregular Network (TIN) from the existing elevation data provided by the Flood Control District. Different tools within WMS were used to obtain cross sections and calculate both the normal and critical depths at each cross section. Locations of the cross sections are shown on the work study maps and in Appendix E5. The floodplain delineation tools within WMS were then used to interpolate water surface elevations along the wash and to delineate the Zone A boundary for each wash.

Each delineated wash was named according to the township, range, and section where its confluence with the Agua Fria River is located. For example, wash 7N2ES7 is located in Section 7 of Township 7 North, Range 2 East of the Gila and Salt River Base and Meridian. When the downstream study limits of several washes are located in the same section the different washes are differentiated by placing either the letter "S" for south, or "N" for north at the end of the name described above. When there is a tributary to a wash, the different reaches of the wash are differentiated by adding a T (for Tributary), followed by a number at the end of the name of the wash. For example 7N2ES6N-T1 is the first tributary upstream of the confluence of the Agua Fria River along the wash whose confluence is within the north part of section 6, township 7 north range 2 east.

5.2 Work Study Maps

Work study maps that show the floodplain delineations have been prepared at a scale of 1 inch = 200 feet, according to FEMA standards. A cover sheet shows the location of each wash and the corresponding floodplain in relation to each other. Each work study map shows the thalweg of each wash, the Zone A boundaries, and the cross sections used in the delineation.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

The procedures used to determine the Manning's "n" roughness coefficients are outlined in the USGS publication "Estimated Manning's Roughness Coefficients for Stream Channels and Floodplains in Maricopa County, Arizona" (April 1991). Based on field observations, the Manning's Roughness Coefficients were calculated for each wash in the channel and overbanks. A list of the roughness coefficients for each wash, photos of each wash, and description of how the roughness coefficients were obtained is provided in Appendix E.1.

5.4 Cross Section Description

Cross section locations were selected within each sub-basin that has a drainage area greater than 0.5 square miles. The location within each sub-basin was selected by looking at the profile and finding the most mild slope. A cross section location was selected along the portion of the wash with the mildest slope where the cross section would give the deepest water depth. This method was used to make sure that the depth of water within that reach was either equal to or greater than the portion of that reach with a steeper slope.

The cross sections were digitized into WMS, and a TIN was created of the elevation points. The plan and profile of each wash based on the TIN is provided in Appendix E5. Tools within WMS were used to "cut" the cross sections and weed out any unnecessary points. The peak flows listed in Tables 4.9 and 5.1 were then used in WMS's channel calculator to calculate both critical depth and normal depth at each cross section. Critical depth was used to delineate the floodplain in all locations where supercritical flow was calculated. A plot of each cross section and the calculation results are provided in Appendix E.5.

5.5 Modeling Considerations

Because this study is only producing approximate Zone A delineations, many of the modeling considerations that would accompany a detailed study have not been considered in this study.

5.6 Floodway Modeling

Because this study is only producing approximate Zone A delineations floodways have not been modeled.

5.7 Problems Encountered During the Study

The straight forward procedures of Zone A delineations eliminated all significant problems. WMS, the hydraulic modeling software, does not produce any warning or error messages for normal depth calculations.

5.8 Calibration

Calibration was not performed as part of this study.

5.9 Final Results

Table 5.1 lists the results of the hydraulic calculations for both normal depth and critical depth. Table 5.2 lists the values used to map the floodplain. The floodplain delineation tools in WMS 6.1 were used to map the Zone A floodplain limits using the depth values listed in Table 5.2.

Table 5.1- Results of the Hydraulic Calculations

Wash	R.S. (mile)	Peak Q (cfs)	Normal Depth Calculations				Critical Depth Calculations	
			Depth (ft)	Top Width (ft)	Avg. Vel. (ft/s)	Froude No.	Depth (ft)	Avg. Vel. (ft/s)
7N2ES7	0.630	2,050	7.7	32	15.5	1.356	8.8	12.2
7N2ES6S Reach 1	0.260	1,947	8.7	42	10.5	0.883	8.2	11.6
7N2ES6S Reach 2	1.327	1,733	8.9	43	8.9	0.743	7.9	11.3
7N2ES6N Reach 1	0.620	1,684	3.8	131	7.0	0.916	3.7	7.6
7N2ES6N Reach 2	1.531	1,626	4.8	58	8.4	0.803	4.3	9.8
7N2ES6N T1	0.113	560	3.7	52	4.1	0.451	2.5	7.3
8N2ES31 Reach 1	0.510	4,891	6.9	78	17.0	1.570	8.3	12.0
8N2ES31 Reach 2	1.0256	4,074	3.7	131	12.1	1.32	4.3	9.8
8N2ES31 Reach 3	1.577	3,999	4.0	206	9.9	1.25	4.4	8.4
8N2ES31 Reach 4	2.223	3,601	4.7	72	16.4	1.666	6.1	11.1
8N2ES31 Reach 5	3.157	2,788	4.3	66	13.6	1.365	5.1	10.7
8N2ES31 Reach 6	3.865	1,275	6.3	30	13.5	1.332	7.1	10.7
8N2ES31 T1	1.297	1,096	3.8	47	10.2	1.186	4.1	8.9
8N2ES31 T2	0.255	651	2.6	63	7.9	1.209	2.8	6.8

Table 5.1- Results of the Hydraulic Calculations

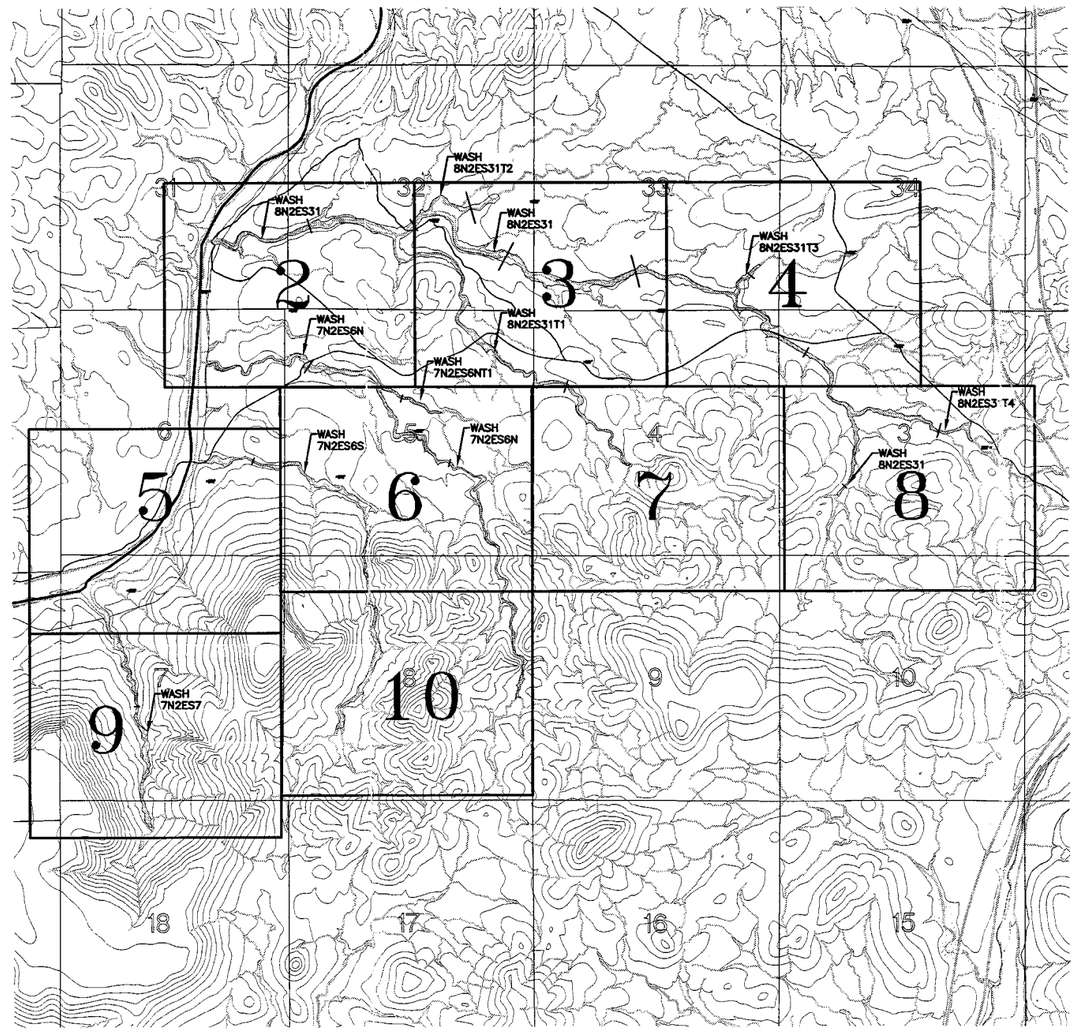
Wash	R.S. (mile)	Peak Q (cfs)	Normal Depth Calculations				Critical Depth Calculations	
			Depth (ft)	Top Width (ft)	Avg. Vel. (ft/s)	Froude No.	Depth (ft)	Avg. Vel. (ft/s)
8N2ES31 T3	0.110	641	6.1	92	2.0	0.193	2.9	7.5
8N2ES31 T4	0.420	1,562	6.3	34	14.5	1.44	7.3	10.9

Table 5.2- Hydraulic Calculations Used in Floodplain Mapping

Wash	R.S. (mile)	Peak Q (cfs)	Depth Method and Velocity Used	Depth Used (ft)	Top Width Used (ft)	Vel. Used (ft/s)
7N2ES7	0.630	2,050	Critical	8.8	37	12.2
7N2ES6S Reach 1	0.260	1,947	Normal	8.7	42	10.5
7N2ES6S Reach 2	1.327	1,733	Normal	8.9	43	8.9
7N2ES6N Reach 1	0.620	1,684	Normal	3.8	131	7.0
7N2ES6N Reach 2	1.531	1,626	Normal	4.8	58	8.4
7N2ES6N T1	0.113	560	Normal	3.7	52	4.1
8N2ES31 Reach 1	0.510	4,891	Critical	8.3	94	12.0
8N2ES31 Reach 2	1.0256	4,074	Critical	4.3	140	9.8
8N2ES31 Reach 3	1.577	3,999	Critical	4.4	235	8.4
8N2ES31 Reach 4	2.223	3,601	Critical	6.1	83	11.1
8N2ES31 Reach 5	3.157	2,788	Critical	5.1	73	10.7
8N2ES31 Reach 6	3.865	1,275	Critical	7.1	36	10.7
8N2ES31 T1	1.297	1,096	Critical	4.1	50	8.9
8N2ES31 T2	0.255	651	Critical	2.8	78	6.8
8N2ES31 T3	0.110	641	Normal	6.1	92	2.0
8N2ES31 T4	0.420	1,562	Critical	7.3	42	10.9

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

SUB WATERSHED #2
UPPER AGUA FRIA WATERSHED
ZONE A FLOODPLAIN DELINEATION STUDY
CONTRACT F.C.D. 2000C020



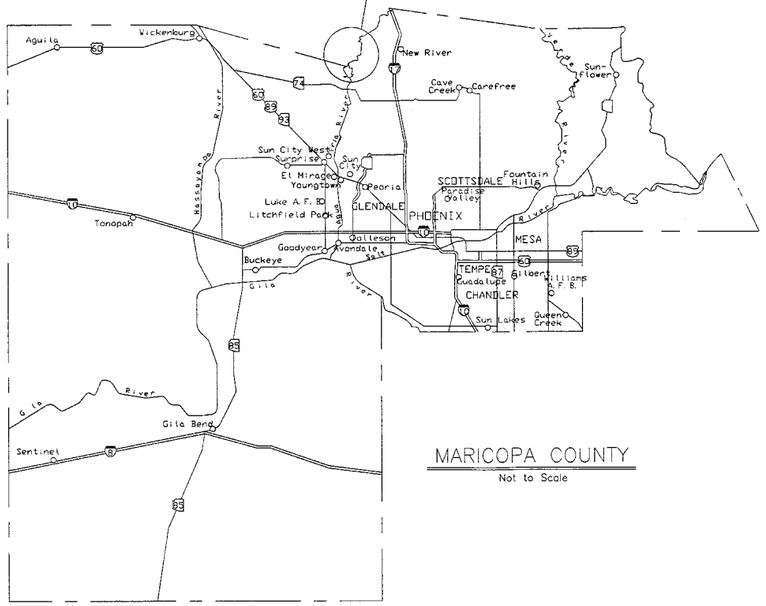
HYDROLOGY & HYDRAULICS
RBF CONSULTING
16605 N 28TH AVENUE, SUITE 100
PHOENIX, ARIZONA, 85053
(602)467-2200

AERIAL PHOTOGRAPHY
LANDATA AIRBORN SYSTEMS

CONTOUR INTERVAL: 10 FEET

GROUND CONTROL
RBF CONSULTING
16605 N 28TH AVENUE, SUITE 100
PHOENIX, ARIZONA, 85053
(602)467-2200

PROJECT LOCATION



MARICOPA COUNTY
Not to Scale

STUDY AREA MAP
AND SHEET INDEX

SHEET INDEX
SHEET 2-10 FLOOD DELINEATION STUDY

1500' 0' 1500' 3000'
SCALE: 1"= 3000 FEET
FLIGHT DATES:
12/16/2000-03/15/2001

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/16/02
PLANS	JMM	5/02/02
PLANS CHK.	RBM	5/22/02

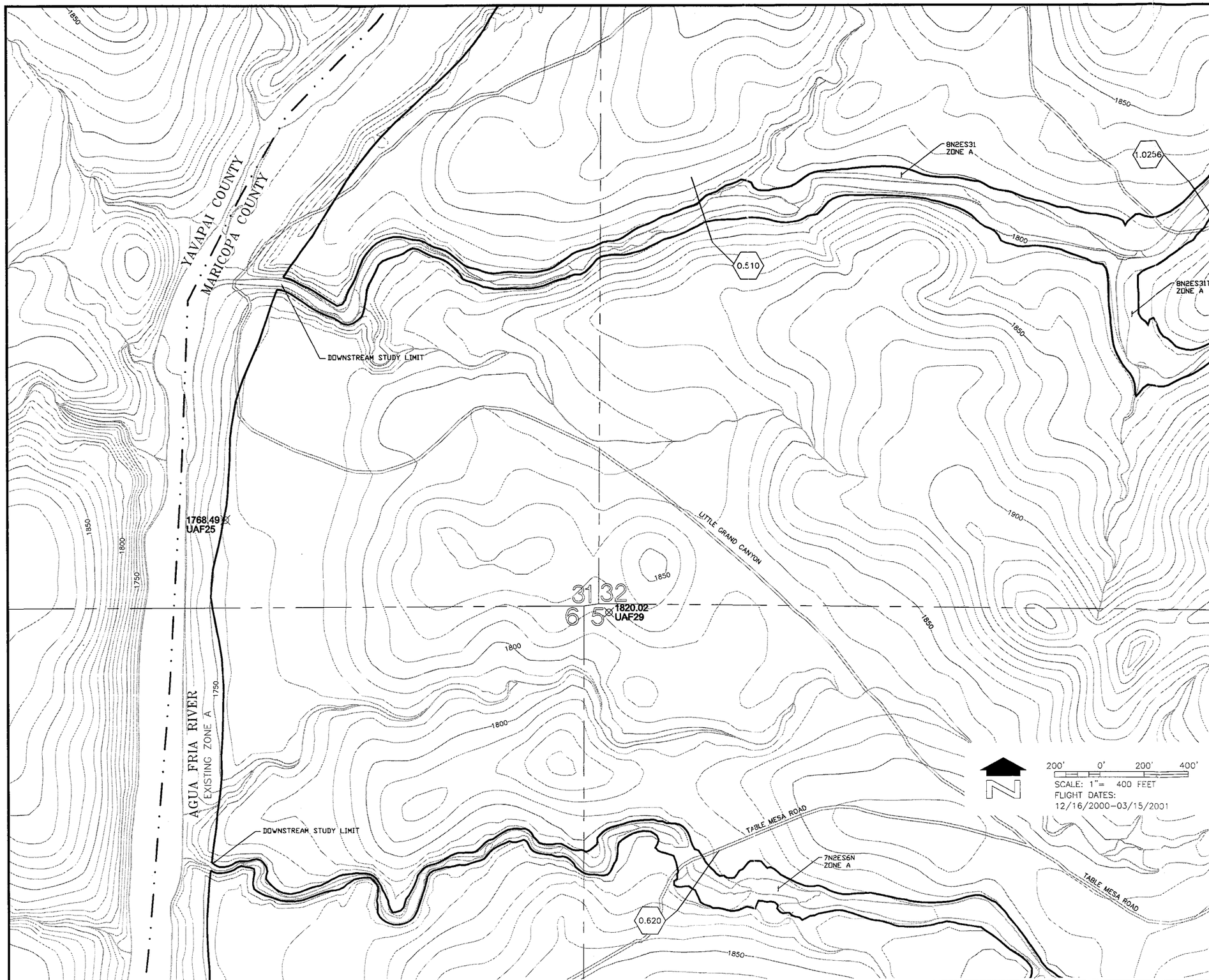
SHEET 01 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

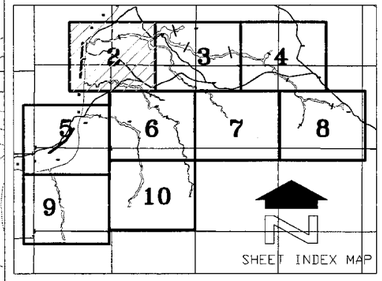
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION INDICATOR)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 25	1768.49	SET FCDMC BRASS CAP AT LAT. N 33° 59' 18" LONG W. 112° 11' 34".
UAF 29	1820.02	SET FCDMC BRASS CAP AT LAT. N 33° 59' 14" LONG W. 112° 11' 13"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

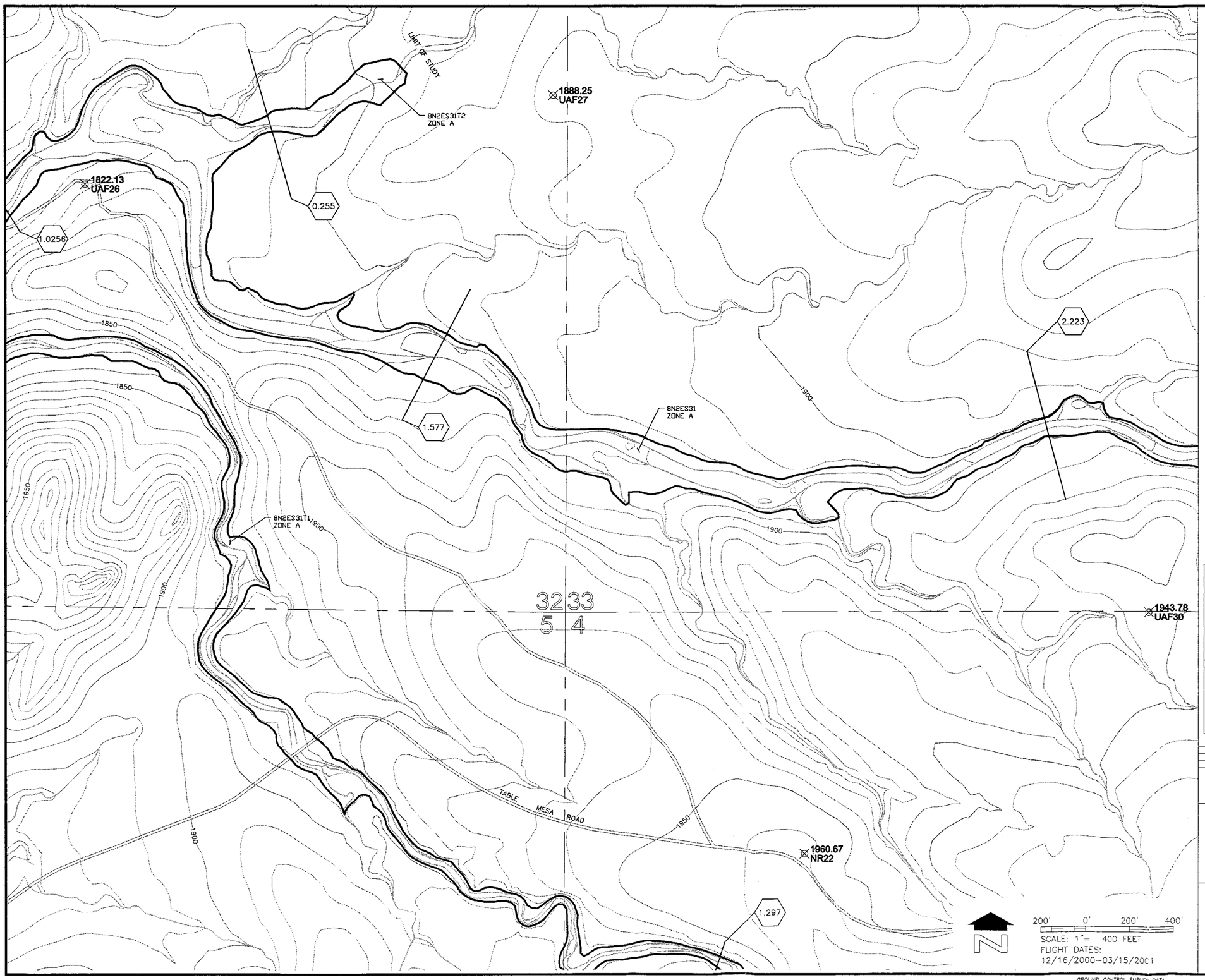
SHEET 02 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

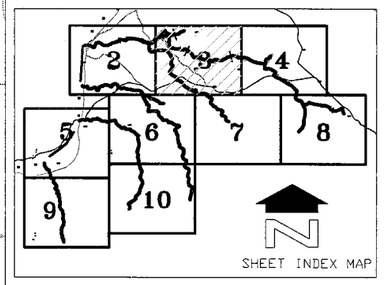
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION (0.1000)	CROSS SECTION TAKE M.E. DESIGNATION
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 26	1822.13	SET FCDMC BRASS CAP AT LAT. N 33° 59' 33" LONG W. 112° 10' 37".
UAF 27	1888.25	SET FCDMC BRASS CAP AT LAT. N 33° 59' 37" LONG W. 112° 10' 11"
UAF 30	1943.78	SET FCDMC BRASS CAP AT LAT. N 33° 59' 13" LONG W. 112° 09' 39"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK	RBM	8/22/02

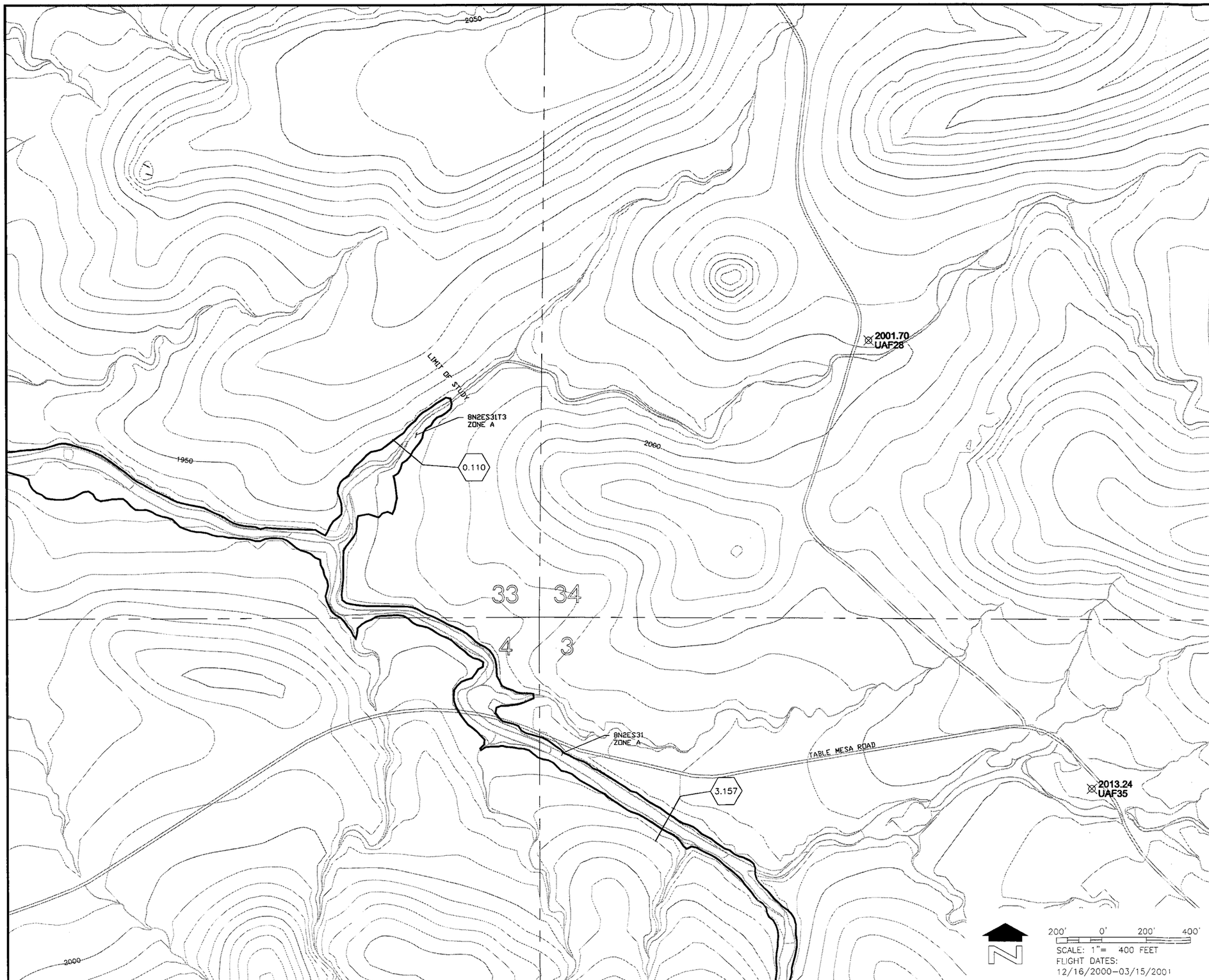
SHEET 03 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

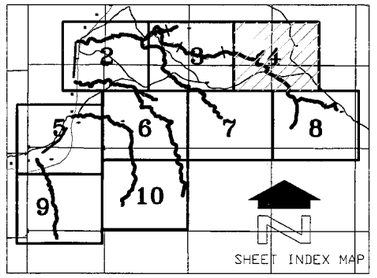
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION (0.1000) — CROSS SECTION RIVER MILE DESIGNATION	
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 28	2001.70	SET FCDMC BRASS CAP AT LAT. N 33° 59' 26" LONG W. 112° 08' 51".
UAF 35	2013.24	SET FCDMC BRASS CAP AT LAT. N 33° 59' 06" LONG W. 112° 08' 40"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/15/02
PLANS CHK.	RBM	8/22/02

SHEET 04 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

LEGEND

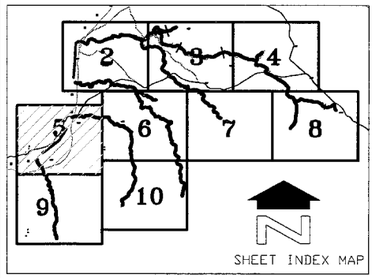
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION PAGE NO. DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 31	1792.26	SET FCDMC BRASS CAP AT LAT. N 33° 58' 14" LONG W. 112° 11' 54".
UAF 32	1758.96	SET FCDMC BRASS CAP AT LAT. N 33° 58' 40" LONG W. 112° 11' 34"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

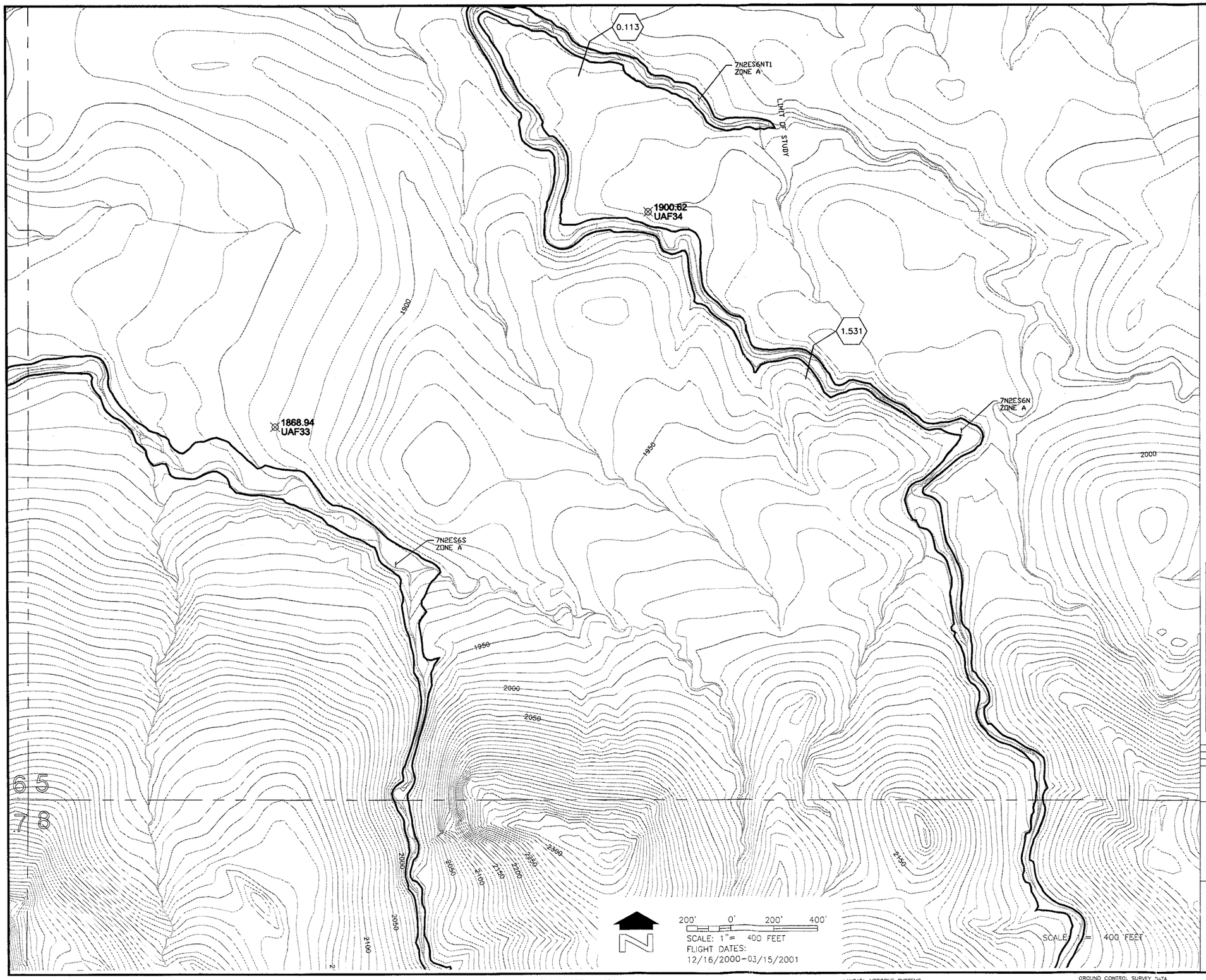
SHEET 05 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

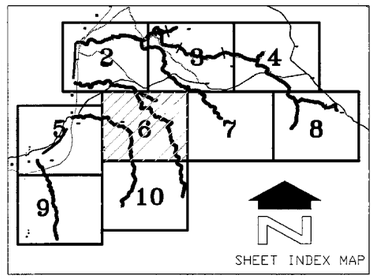
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION PACE NO. DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	⊗1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 33	1868.94	SET FCDMC BRASS CAP AT LAT. N 33° 58' 39" LONG W. 112° 11' 01".
UAF 34	1900.62	SET FCDMC BRASS CAP AT LAT. N 33° 58' 48" LONG W. 112° 10' 40"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

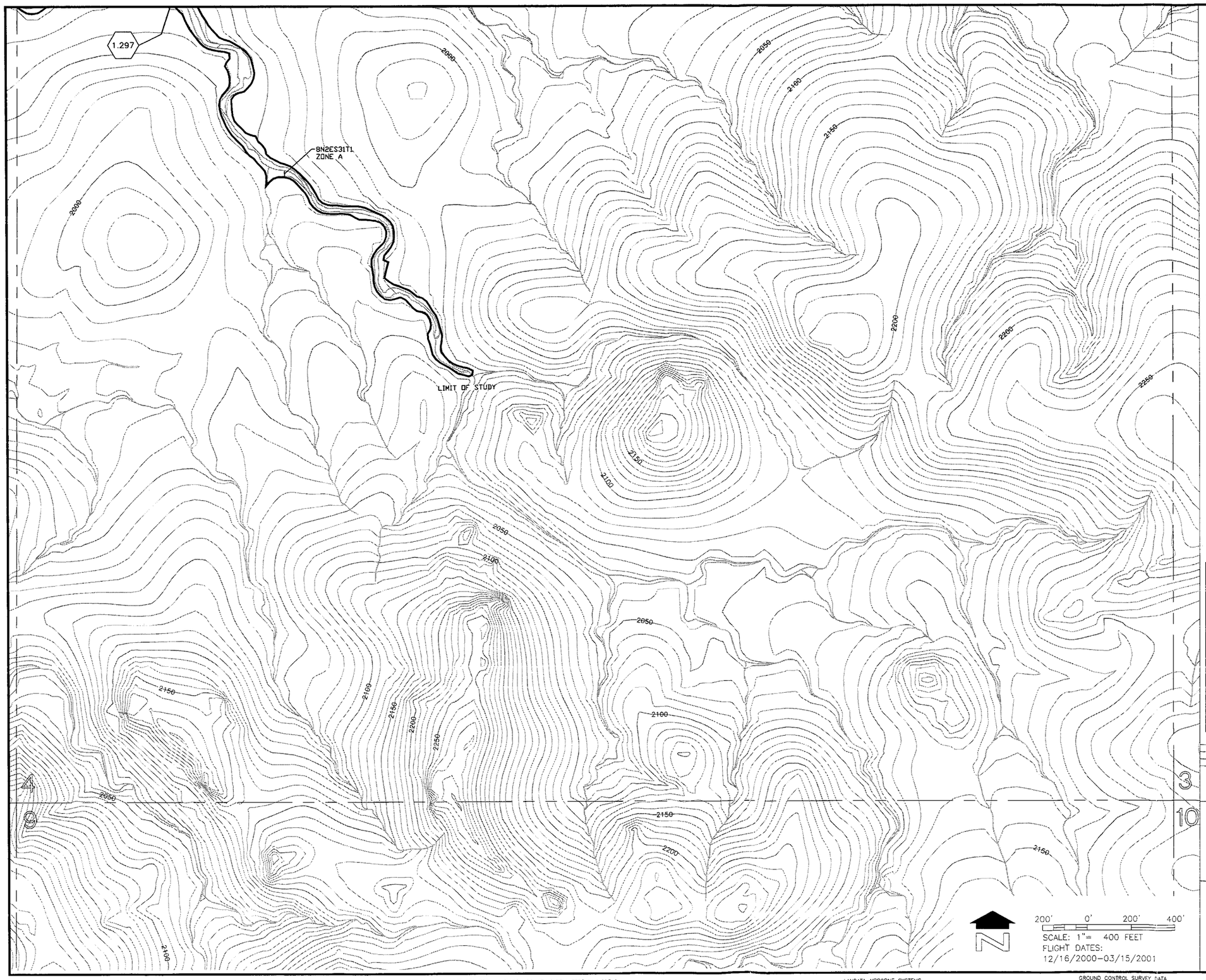
SHEET 06 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

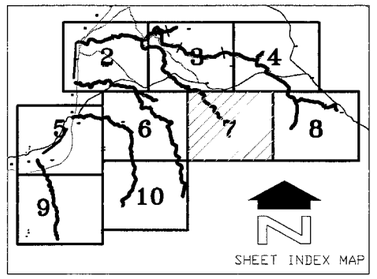
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION (0.1000)	
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	⊗1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

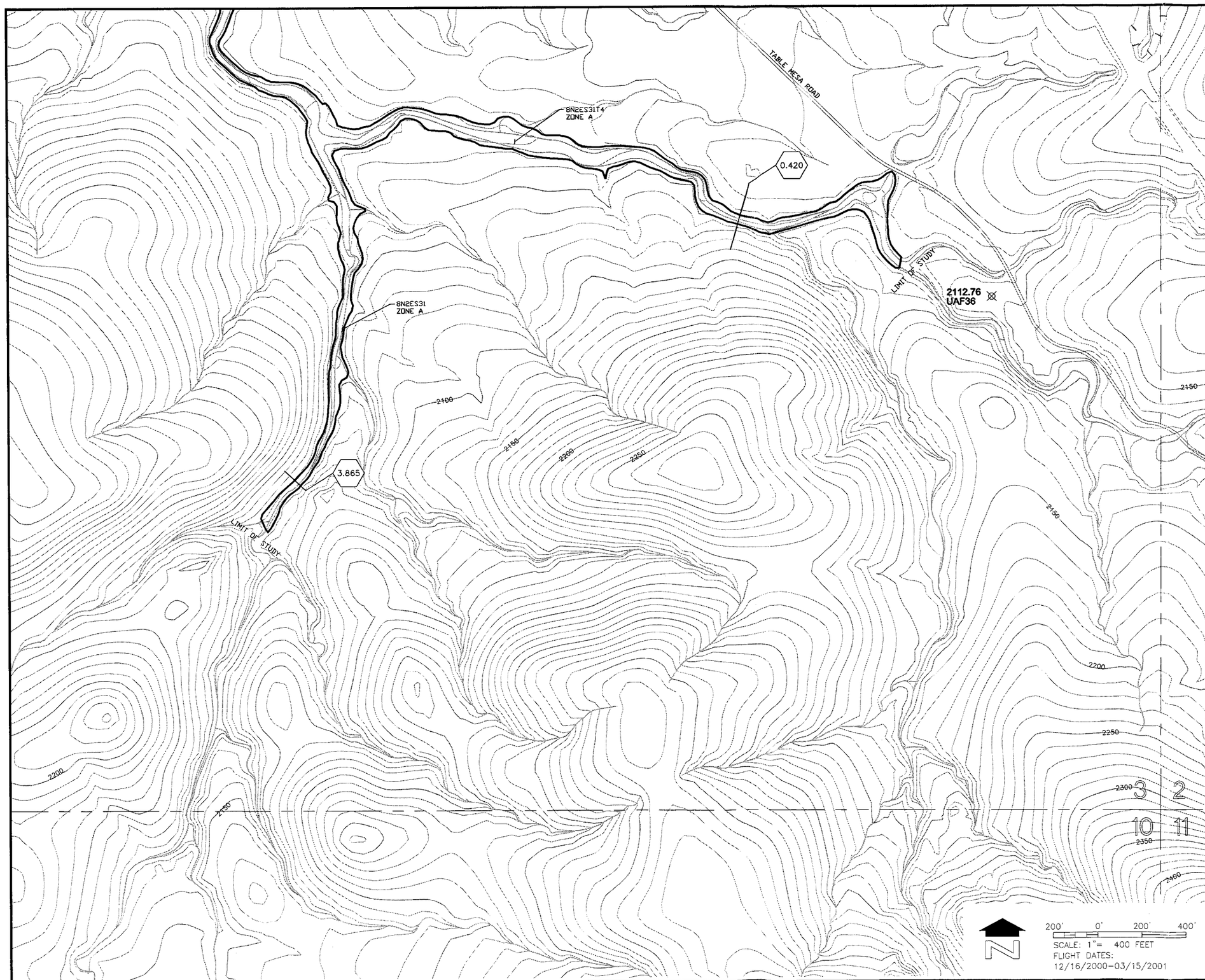
SHEET 07 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

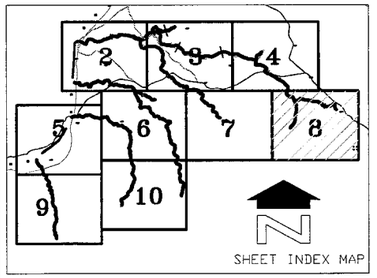
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION (0.1000) — CROSS SECTION PROJ. MILE DESIGNATION	
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	⊗1758.96 UAF32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 36	2112.76	SET FCDMC BRASS CAP AT LAT. N 33° 58' 45" LONG W. 112° 08' 15".

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 08 OF 10

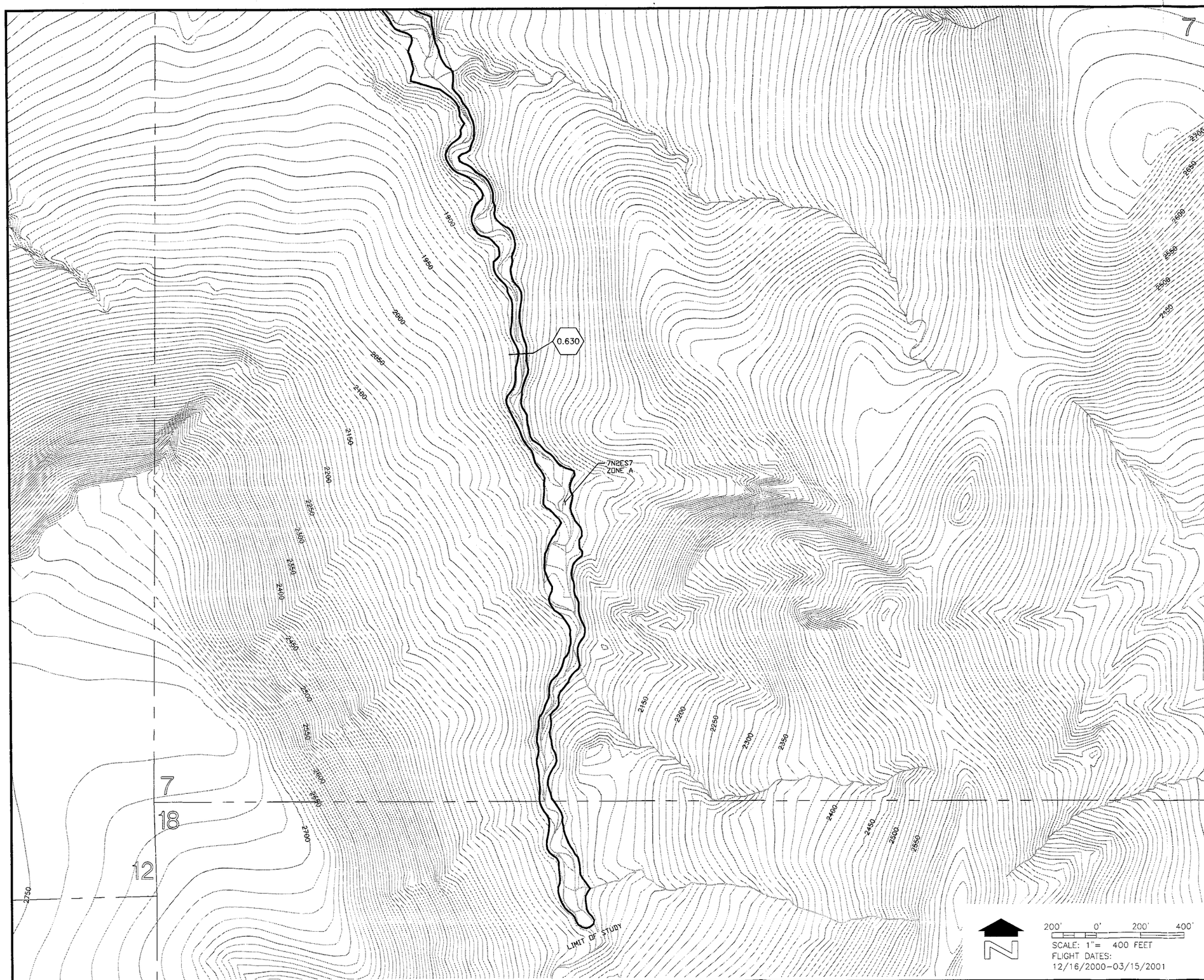
200' 0' 200' 400'
SCALE: 1" = 400 FEET
FLIGHT DATES:
12/16/2000-03/15/2001

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

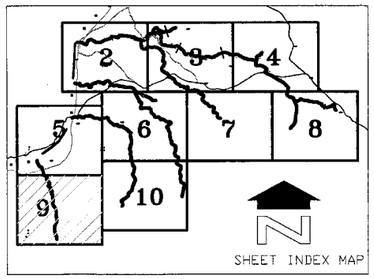
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION INDEX NO. DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	⊗1758.96 UAF32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK	RBM	8/22/02

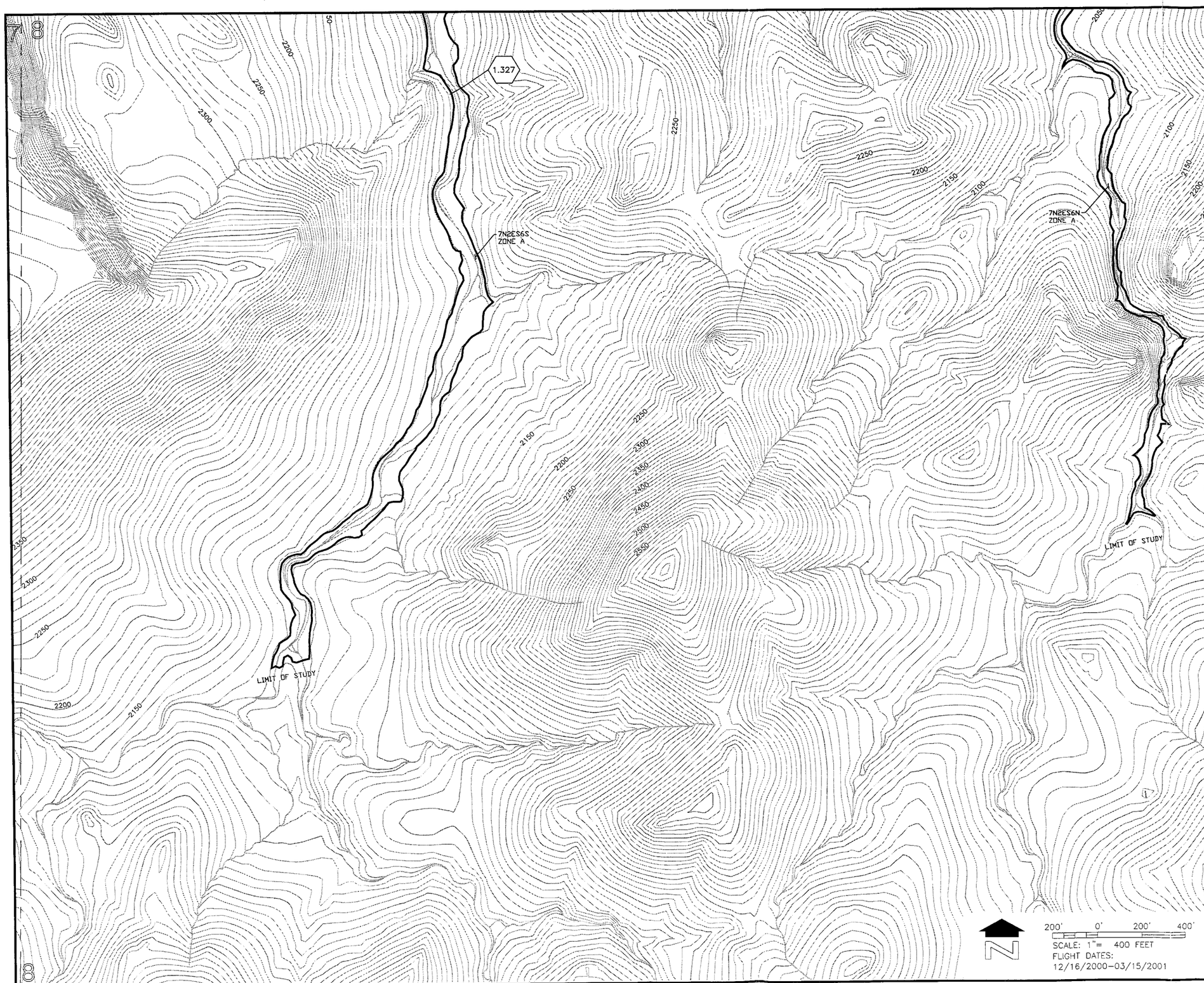
SHEET 09 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648



LEGEND

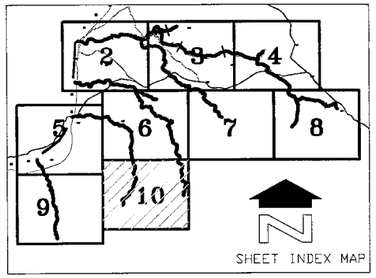
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 10 OF 10

THIS MAP WAS PREPARED FROM [illegible] DIGITAL TERRAIN MODELS [illegible] IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

Section 6: Erosion and Sediment Transport

Erosion and sediment transport is not being considered in this study.

Section 7: Draft FIS Report Data

7.1 Summary of Discharges

Table 7.1- Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak 100-year Discharge (cfs)
7N2ES7 Confluence with the Agua Fria River	1.07	2,050
7N2ES6S Confluence with the Agua Fria River	1.27	1,947
7N2ES6S 4,301 feet upstream of the Agua Fria River	1.00	1,733
7N2ES6N Confluence with the Agua Fria River	1.66	1,684
7N2ES6N 5,058 feet upstream of the Agua Fria River	1.47	1,349
7N2ES6N T1 Confluence with 7N2ES6N	0.53	560
8N2ES31 Confluence with the Agua Fria River	6.14	4,891
8N2ES31 4,863 feet upstream of the Agua Fria River	4.86	4,074
8N2ES31 5,828 feet upstream of the Agua Fria River	3.82	3,664
8N2ES31 9,026 feet upstream of the Agua Fria River	3.62	3,601
8N2ES31 14,127 feet upstream of the Agua Fria River	2.52	2,788
8N2ES31 18,650 feet upstream of the Agua Fria River	0.73	1,275
8N2ES31 T1 Confluence with 8N2ES31 at 4,863 feet upstream of the Agua Fria River	0.93	1,096
8N2ES31 T2 Confluence with 8N2ES31 at 5,828 feet upstream of the Agua Fria River	0.92	651

Table 7.1- Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak 100-year Discharge (cfs)
8N2ES31 T3 Confluence with 8N2ES31 at 14,127 feet upstream of the Agua Fria River	0.52	641
8N2ES31 T4 Confluence with 8N2ES31 at 18,650 feet upstream of the Agua Fria River	1.17	1,562

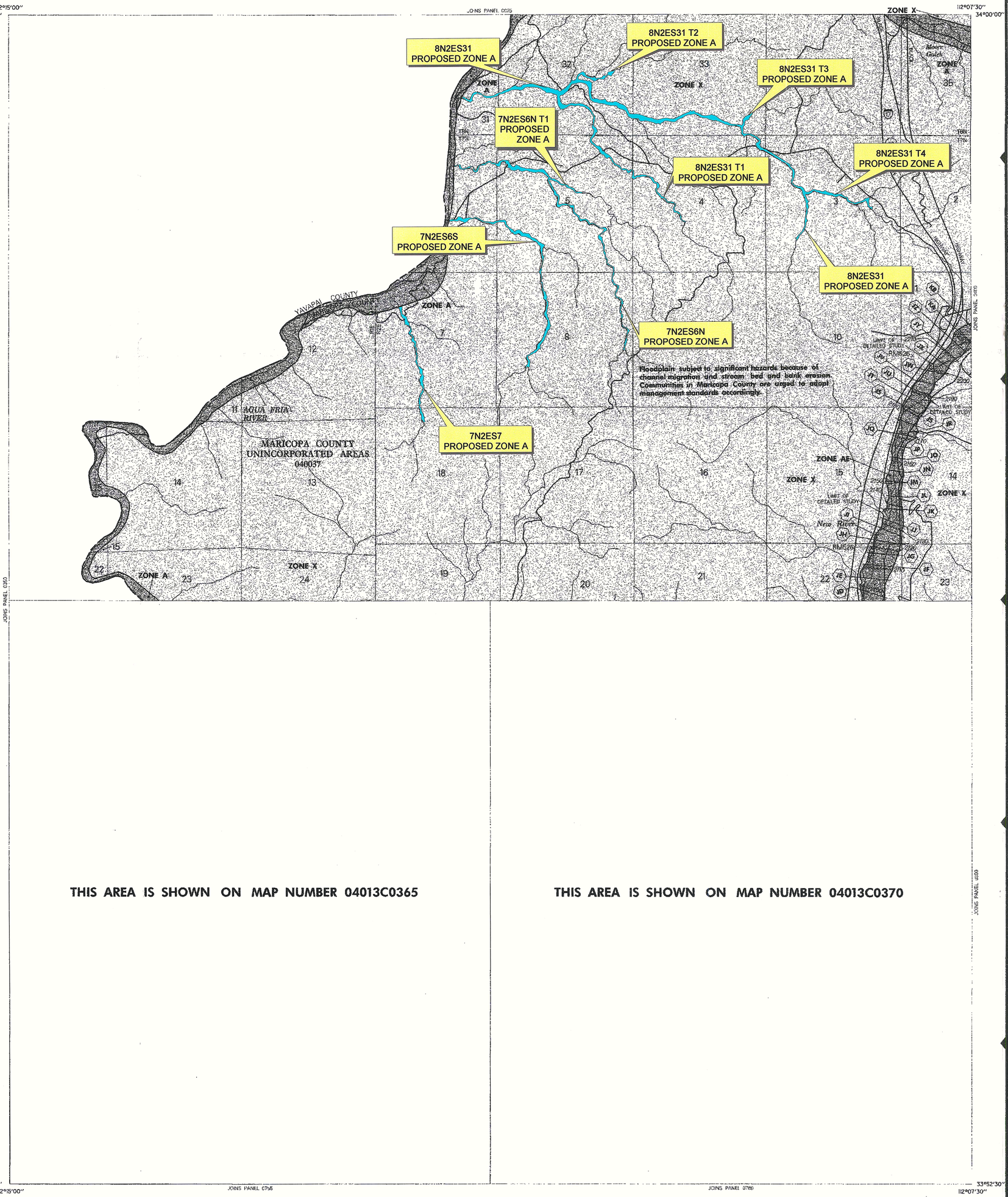
7.2 Floodway Data and Flood Profiles

Because this is an approximate delineation for Zone A flood plains, there is no floodway data nor Flood Profiles.

7.3 Annotated FIRMs

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM525	2307.18 A	+-inch rebar set 30 feet q north of two saguaros atop flat knoll, proceed west on Track Road 0.1 q mile from Table Mesa Interchange then south along a meandering road 0.4q mile to bend turning west, proceed west 650 feet q to mark, approximately 1800 feet q north of the southwest corner of section 11, T7N, R2E.
RM526	2157.48 A	PK nail and shiner in the safety lane of northbound I-17 0.15 q mile north of mile post no. 234, 1100 feet q east of the northeast corner of section 22, T7N, R2E.



THIS AREA IS SHOWN ON MAP NUMBER 04013C0365

THIS AREA IS SHOWN ON MAP NUMBER 04013C0370

LEGEND

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

FIRM elevations listed on this map were obtained and/or developed to establish vertical control for determination of flood elevations and floodplain boundaries portrayed on this map. Users should be aware that these FIRM elevations may have changed since the publication of this map. To obtain up-to-date elevation information on National Geodetic Survey (NGS) BFMs shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS FIRM benchmark elevations when using these elevations for construction or floodplain management purposes.

Coasts: BFE's shown on this map apply only landward of 0.0' NGVD. Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be inundated by 100-year flood by Federal flood protection system under construction; no base flood elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Floodway Boundary

Flood Zone Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum

(D)—(D) — Cross Section Line

EL 987 — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 × — Elevation Reference Mark

● M2 — River Mile

97°07'30", 32°22'30" — Maricopa Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BFEs, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AO, A1, A2, A99, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 120 feet.

Corporate limits shown are current as of the date of this map. Users should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and/or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

For community map revision history prior to countywide mapping, see Section 8.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 16, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:
SEPTEMBER 28, 1989

Map revised July 19 2001 to update corporate limits, to change base flood elevations, to add base flood elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to update map format, to add notes, and to incorporate previously issued Letters of Map Revision.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 375 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	0375	F

PROPOSED ZONE A FLOODPLAINS

MAP NUMBER 04013C0375 F

MAP REVISED: JULY 19, 2001

Federal Emergency Management Agency

A.1 Data Collection Summary

The following reports and studies were used in the preparation of this study.

Soil Survey of the Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona, April 1986, USDA Soil Conservations Service (SCS)

"Maricopa County Ortho-Photo GPS Summary of Procedure Final Report", April 2001, RBF Consulting, Phoenix, Arizona

"Upper Agua Fria Floodplain Delineation Study, Elevation Reference Monuments", July 1, 2002, RBF Conslulting, Phoenix, Arizona

"Upper Agua Fria Floodplain Delineation Study, Structure Survey", July 1, 2002, RBF Consulting, Phoenix, Arizona

A.2 Referenced Documents

Sabol, George, et al, *Drainage Design Manual for Maricopa County, Arizona, Volume I*, January 1995, Flood Control District of Maricopa County

Thomsen, B.W., and H.W. Hjalmarson, *Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona*, April 1991, U.S. Geological Survey Water Resources Division

Jennings, M.E., W.O. Thomas, Jr., and H.C. Riggs, *Nationwide Summary of U.S. Geological Survey Regional Regression Equations for Estimating Magnitude of Frequency of Floods for Ungaged Sites, 1993*, U.S. Geological Survey Water Resources Investigative Report 94-4002., 1994, Reston, Virginia

WMS Watershed Modeling System Reference Manual, 1999, Brigham Young University, Environmental Modeling Research Laboratory, Provo, Utah

B.1 Special Problem Reports

B.2 Contact (Telephone) Reports

	Incoming Call	Job No.	45-100648
X	Outgoing Call	Date	10-11-01
Individual Contact	Angela Mobile	By	Travis Nuttall
Title	Reality Specialist	Phone	(623)580-5500
Company /Agency	BLM/ Phoenix	Project Name	Upper Agua Fria Zone A Flood Plain Delineaton Study
Address	21605 North 7th Ave		
Subject of Contact	Searching for As-Built Data on the BLM Property		
Items Discussed	They have R.O.W. files and maps of what is going to be built. Costs 13 cents per page to copy, paid by check, plastic, or cash. The are open 7:30 a.m. to 4:00 p.m. Mon-Fri.		
Action to be Taken			
Route to			

	Incoming Call	Job No.	45-100648
X	Outgoing Call	Date	10-11-01
Individual Contact	Sarah	By	Travis Nuttall
Title		Phone	(602)225-5200
Company/ Agency	Tonto National Forest Soil Survey Team	Project Name	Upper Agua Fria Zone A Flood Plain Delineaton Study
Address			
Subject of Contact	Searching for soil survey information in Yavapai County. Black Canyon City and Rock Springs area.		
Items Discussed	Maybe the NRCS has some. Call Hays Dye at 602-280-8815. She will call me back after doing some research herself. These areas are out of their jurisdiction. Rock Springs in BLM area. Black Canyon City in NRCS area.		
Action to be Taken			
Route to			

	Incoming Call	Job No.	45-100648
X	Outgoing Call	Date	10-11-01
Individual Contact	Hays Dye	By	Travis Nuttall
Title	Regional Manager	Phone	(623)280-8815
Company/ Agency	NRCS	Project Name	Upper Agua Fria Zone A Flood Plain Delineaton Study
Address			
Subject of Contact	Looking for Soil Survey Data		
Items Discussed	Phil Camp- 602-280-8837 is the Arizona Manager. Can download off of website. Http://www.ftw.nrcs.usda.gov/ssur.data.html. ID# AZ645- In ArcInfo format. GIS Specialist is Eric Wolfbrandt, 280-8822		
Action to be Taken			
Route to			

B.3 Meeting Minutes or Reports

Flood Control District
Scoping Meeting
August 25, 2000

There are about 44-45 watersheds within Maricopa County. Performing floodplain delineation within those watersheds is prioritized, primarily when cities request delineation.

The watershed we will be studying is the part of Watershed UU west of the Agua Fria River.
We want to map as many bluelines that we can.
Want to do all of the blue lines in Maricopa County within 5 years.
The Flood Control District (FCD) has a contract with BYU (EMS-I) to implement features into WMS that aid in flood control.

Write into the contract that we will work with BYU (ems-i) and WMS to modify WMS to work out the bugs.

Upper Agua Fria Zone A Floodplain Delineation

Basic reason for Zone A-

Zone A floodplains usually have 20% more area than floodplains delineated using detailed methods.

The FCD wants to pre-empt development. They want to get the floodplains delienated before any development occurs.

Zone A delineations are cost effective.

Zone A is used in outlying areas.

In advance of development.

Most miles per $.

Some bluelines are not washes, and some washes aren't bluelines. RBF and the FCD will need to decide together what are, and what are not washes. We may go out with a hand held GPS unit. One cross section per mile. About 100 miles of delineation.

Constraints

- Only delineate washes within Maricopa County
- Hydrology outside of county
- Watershed based hydrology to the east of Lake Pleasant.
- No watershed with a drainage area less than one square mile (maybe ½).
- No new mapping.
- We'll get aerial photos from them
- We'll get the DEM from them.
- Meet HIS deliverable requirements

- CAD Operator required to take 6-hour course.
- Consultant Guidelines
- Lump Sum contract. Put timeline together. Forebearance letters (3) if you're behind schedule. Schedule is important. Minimal project management on Joe's part. If there is a problem, recommend 3 solutions. He won't solve the problems. Use milestones/ deadlines.
- Most of the land is forest service & BLM.
- Use FEMA 265.
- Have Scott and I go out and look.
- First 2 or 3 watersheds will be setting up watersheds by subsections.
- No existing HEC-1/hydrology. Can use regression equations.
- Not doing the Agua Fria
- No ERMs or benchmarks required.
- Backing away from the technical. Going back 20 years. Verification is not necessary. May take some field cross sections. Interpolate DEM. Compare to field sections. Minimize survey. Maximize engineering time.
- Modify existing Zone As.
- Naming washes at the T,R,S of the confluence (T1NR1S Sec 32).
- Comply with SS 1-97- Come look at a typical Zone A TDN.
- Start project with a 'Pilot' watershed for first submittal.
- Maybe divide it into two (or several) projects. (North and south)
- Breaking it down is nicer for FCD and FEMA, especially for review.
- Joe and FCD would like to go to the field with us.
- Joe come to office once a month or every other week.
- Access through rough terrain
- Constraint- Eagle's habitat. Babbit wants to turn it over to a regional park

- DPGS may be an option.
- May make 1,2, or 3 submittals to FEMA.
- After a workable floodplain map.
- Usually $1500 to $2500 per mile.

Kick-Off Meeting
August 30, 2001

People Attending:

Scott Larson, RBF	Richard Harris, FCD	Marta Dent, FCD
Roy McDaniel, RBF	Michael Duncan, FCD	Bing Zhao, FCD
Tim Murphy, FCD	Dave Degerness, FCD	

- Use State Standard 1-97 for the Technical Data Notebook.
- The Flood Control District gets the original Legal Advertising.
- Richard Harris will give me sample right-of-entry examples and legal counsel for right-of-entry.
- Received a copy of general guidelines
- Marta will give us the ASCII Grid files, RMS is approximately 2.5 feet.
- GDACS is the basis for ground control.
- We need to schedule a field trip.
- Naming convention of the washes should include section, township, and range.
- Contact Dave Degerness about naming convention.
- The HIS training is coming up.
- Advertise the study in the Desert Advocate and the Arizona Republic
- Get property ownership from Jim Smith. Use the survey letter as the initial letter. Give 72 hours notice. Give surveyors a copy of the state statute to have on hand. About 40 owners.
- Task 5.4c should read DRNPTH. Look at the book.
- Got a copy of the Estimate Manning's Roughness book for Maricopa County
- Scheduled a field trip for 1 week from yesterday. Come up with a route map if we are taking different vehicles. Meet at RBF office at 8:00 a.m.
- Have a meeting every 2 weeks at our office.
- We will do a public mailing instead of a public meeting at the end of the project.
- If we need to get on private property, use certified mail.
- Mapping scale- Work with Richard. Use either 1" = 400' or 1" = 1000'. Topo maps will be printed at 1" = 500'. Explore this.
- Borrow an example TDN from Richard.
- David Evans- May be designing a proposed subdivision in the area. The FCD will check.
- The "Sweat Canyon TDN" and the New River TDN are good examples for comparative hydrology.
- Use 100-year 24-hour and Clark Unit Hydrograph for the 1st study, if applicable.
- Study FEMA 37 and FEMA 265 (January 95)
- CADD Techs and Engineers should attend the HIS Training.
- Get new soils info. From Marta and Dave.
- Meet Wed for Field Trip.
- Plan a meeting at our office on the 12th, 8:30 a.m.

B.4 General Correspondence

RBF CONSULTING

April 8, 2003

JN 45-100648.001

Mr. Richard Harris, P.E.
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Subject: *Upper Agua Fria Watershed Floodplain Delineation Study*
Policy for the determination of the WTR_ELV field in the CAD Deliverable file: **fpxfcd-a.xls**

Dear Richard:

The WTR_ELV field in the CAD Deliverable file *fpxfcd-a.xls* was obtained by taking the lowest elevation along each cross-section extracted from WMS, and adding the normal depth (or critical depth, whichever is higher) to obtain water surface elevations. The lowest, or thalweg, elevations, as well as the water depths, are found in Appendix E of each Technical Data Notebook for this study. Screen captures and calculation outputs are provided for every reach utilized to delineate the floodplain. These values were manually entered into the WTR_ELV field of the fpxfcd-a.xls file.

Sincerely,

William J. King, P.E.
Water Resources

H:\PDATA\45100648\Word\cadeliv-fpxfcd-a.doc

ANNOUNCEMENT OF INTENT TO PERFORM FLOODPLAIN DELINEATION STUDY

The Flood Control District of Maricopa County (FCDMC), under authority of the National Flood Insurance Act of 1968 (PL-90-448), as amended, and the Flood Disaster Protection Act of 1973 (PL-93-234), is funding a study of flood hazard areas along the shores of and near Lake Pleasant. The FCDMC has contracted with RBF Consulting to perform floodplain delineations of approximately 30 miles of washes that are tributary to the Agua Fria River. The study area will extend from Lake Pleasant northward to the Maricopa County line. All washes to be delineated are located in the Upper Agua Fria River Watershed, and will include Moore Gulch, Little Squaw Creek, washes in the Table Mesa Road area, and several other nearby washes.

This study will examine and evaluate the flood hazard areas for the Upper Agua Fria Watershed. The results will be published to update the flood insurance rate maps (FIRMS) used by the Federal Emergency Management Agency (FEMA). The FIRMS will be used to determine flood insurance rates.

This announcement is intended to inform all interested persons and communities of the commencement of this study so that they may have an opportunity to bring any relevant technical information to the attention of the FCDMC/FEMA, to be considered during the course of this study. Your comments should be addressed to Mr. Richard Harris, P.E., Project Manager at the Flood Control District of Maricopa County, 2801 West Durango Street, Phoenix, AZ 85009, (602)506-1501.

01693- September 28; October 5, 2001

THE ARIZONA REPUBLIC

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

TOM BIANCO, being first duly sworn, upon oath deposes and says: That he is the legal advertising manager of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic/West Zone

September 28; October 5, 2001

Sworn to before me this
9 TH day of
October A.D. 2001

OFFICIAL SEAL
GLORIA SALDIVAR
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm. Expires Dec. 1, 2003

Gloria Saldivar
Notary Public

THE DESERT ADVOCATE
47027 N. New River Rd.
New River, Arizona 85087
Tel: 623-465-9384 Fax: 623-465-5729
E-Mail: desertadvocate@uswest.net

CERTIFICATE OF PUBLICATION

The Desert Advocate newspaper has published Floodplain Delineations Study under authority of NFIA of 1968 (PL-90-448). The Public Notice was commissioned to be published on October 2, 2001 and October 16, 2001 issues as requested by the Flood Control District of Maricopa County.

Date: October 23, 2001

Karen K. Seemeyer
Publisher,
The Desert Advocate

RBF CONSULTING

September 25, 2001

ROCK LTD PARTNERSHIP
Hc I Box 2000
Rock Springs, AZ 85324

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 01 001

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

The intent of this letter is to notify you of the commencement of surveying activities in support of the above mentioned study. In order to perform these surveys it may be necessary to enter your property. This activity should not result in any inconvenience or damage to property. If you have any objections to the entry onto your property you must notify Mr. Richard Harris, P.E., of the Flood Control District at (602) 506-1501. Otherwise it will be assumed that you consent to the entry onto your property.

The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revision of Flood Insurance Rate Maps. This study will be available to the public in approximately 9 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Mr. Richard Harris, P.E., of the Flood Control District or Mr. Roy McDaniel, P.E., of RBF Consulting.

Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

Arlo W Richardson
1124 S Palo Verde St
Mesa, AZ 85208

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 01 002, 202 01 003, 202 01 004, 202 01 005, 202 02 001A, 202 03 001

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revision of Flood Insurance Rate Maps. This study will be available to the public in approximately 9 months.

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Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

EXUM & ASSOC LTD
12322 E Doubletree Ranch Rd
Scottsdale, AZ 85259

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 01 006

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revision of Flood Insurance Rate Maps. This study will be available to the public in approximately 9 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Mr. Richard Harris, P.E., of the Flood Control District or Mr. Roy McDaniel, P.E., of RBF Consulting.

Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

Richard & Norine Tr Rick
3010 E Madison St
Phoenix, AZ 85034

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 02 002A

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Mr. Richard Harris, P.E., of the Flood Control District or Mr. Roy McDaniel, P.E., of RBF Consulting.

Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

Jeanette Louise Shoecraft
1320 W Elliot Rd #103-505
Tempe, AZ 85284

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 03 002

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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If you have any questions regarding this study or the right of entry, please contact Mr. Richard Harris, P.E., of the Flood Control District or Mr. Roy McDaniel, P.E., of RBF Consulting.

Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

Charles V Wilder Jr.
5950 W Table Mesa Rd
Phoenix, AZ 85087

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 03 003

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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If you have any questions regarding this study or the right of entry, please contact Mr. Richard Harris, P.E., of the Flood Control District or Mr. Roy McDaniel, P.E., of RBF Consulting.

Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

U S A
23636 N 7Th St
Phoenix, AZ 85024

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 04 001, 202 04 002, 202 05 004, 202 05 005, 202 05 006A, 202 05 008, 202 24 001

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

UNITED STATES OF AMERICA
PO Box 9980
Phoenix, AZ 85068

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 05 001A, 202 05 002, 202 05 003, 202 05 007A

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

John F & Belle S Swartz
PO Box 10500
Phoenix, AZ 85064

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 24 002

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

DI PIETRO ARIZONA FAMILY LIMIT
10320 W Indian School Rd
Phoenix, AZ 85037

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 05 007D, 202 05 007E

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

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Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

September 25, 2001

DI PIETRO ARIZONA FAMILY LP
440 Lake Cook Rd
Deerfield, IL 60015

Subject: Right of Entry for Surveying Purposes

Parcel Nos.: 202 05 007F

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with RBF Consulting to perform a floodplain delineation study for the Upper Agua Fria Watershed. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcel of land within the limits of the study area.

The intent of this letter is to notify you of the commencement of surveying activities in support of the above mentioned study. In order to perform these surveys it may be necessary to enter your property. This activity should not result in any inconvenience or damage to property. If you have any objections to the entry onto your property you must notify Mr. Richard Harris, P.E., of the Flood Control District at (602) 506-1501. Otherwise it will be assumed that you consent to the entry onto your property.

The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revision of Flood Insurance Rate Maps. This study will be available to the public in approximately 9 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Mr. Richard Harris, P.E., of the Flood Control District or Mr. Roy McDaniel, P.E., of RBF Consulting.

Mr. Richard Harris, P.E., Project Manager, Flood Control District, (602) 506-1501.

Mr. Roy McDaniel, P.E., Project Manager, RBF Consulting, (602) 467-2200

Sincerely,

Roy McDaniel

Roy McDaniel, P.E.
Project Manager

RBF CONSULTING

November 8, 2002

JN 45-100648

Mr. Richard Oxford
Arizona State Land Department
1616 West Adams
Phoenix, Arizona 850007

Subject: Notification of Floodplain Delineation

Dear Mr. Oxford:

The Flood Control District of Maricopa County, under authority of the National Flood Insurance Act of 1968 (P.L. 90-448) as amended, and the Flood Disaster Act of 1973 (P.L. 93-234), has completed an approximate study of flood hazard areas in northern Maricopa County, Arizona, for five tributaries to the Agua Fria River. The study area surrounds is in the vicinity of Table Mesa Road, west of Interstate-17.

The purpose of this study was to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. Flood hazard zones will be used by Maricopa County to insure compliance to the floodplain management objectives of the National Flood Insurance Program. They will also be used by insurance agents as the basis for determining appropriate flood insurance premium rates applicable for buildings and their contents.

This announcement is intended to notify all interested persons of this study so that they may have an opportunity to bring any relevant facts and technical data concerning local flood hazards to the attention of the Flood Control District. The study will be available for review at the Flood Control District Office, located at 2801 West Durango Road, Phoenix, Arizona, beginning November 13.

The study results will be submitted to the Federal Emergency Management Agency (FEMA) for approval. Upon approval by FEMA, the study results will be used for revising Flood Insurance Rate Maps for the area. They will be used for regulating potential future development so as to reduce or prevent possible flood damage to property and structures.

Please call the District's Project Manager, Richard P. Harris, P.E., at (602) 506-1501 for more information.

Sincerely,

Roy B. McDaniel

Roy B. McDaniel, P.E.
Project Engineer
Storm Water Management

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RBF CONSULTING

November 8, 2002

JN 45-100648

Bureau of Land Management
Arizona State Office
P.O. Box 45155
222 North Central Avenue
Phoenix, AZ 85004

Subject: Notification of Floodplain Delineation

To Whom It May Concern:

The Flood Control District of Maricopa County, under authority of the National Flood Insurance Act of 1968 (P.L. 90-448) as amended, and the Flood Disaster Act of 1973 (P.L. 93-234), has completed an approximate study of flood hazard areas in northern Maricopa County, Arizona, for five tributaries to the Agua Fria River. The study area surrounds is in the vicinity of Table Mesa Road, west of Interstate-17.

The purpose of this study was to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. Flood hazard zones will be used by Maricopa County to insure compliance to the floodplain management objectives of the National Flood Insurance Program. They will also be used by insurance agents as the basis for determining appropriate flood insurance premium rates applicable for buildings and their contents.

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Please call the District's Project Manager, Richard P. Harris, P.E., at (602) 506-1501 for more information.

Sincerely,

Roy B. McDaniel

Roy B. McDaniel, P.E.
Project Engineer
Storm Water Management

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RBF CONSULTING

November 8, 2002

JN 45-100648

Mr. Charles V. Wilder Jr.
5950 West Table Mesa Road
Phoenix, Arizona 85087-7060

Subject: Notification of Floodplain Delineation

Dear Mr. Wilder:

The Flood Control District of Maricopa County, under authority of the National Flood Insurance Act of 1968 (P.L. 90-448) as amended, and the Flood Disaster Act of 1973 (P.L. 93-234), has completed an approximate study of flood hazard areas in northern Maricopa County, Arizona, for five tributaries to the Agua Fria River. The study area surrounds is in the vicinity of Table Mesa Road, west of Interstate-17.

The purpose of this study was to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. Flood hazard zones will be used by Maricopa County to insure compliance to the floodplain management objectives of the National Flood Insurance Program. They will also be used by insurance agents as the basis for determining appropriate flood insurance premium rates applicable for buildings and their contents.

This announcement is intended to notify all interested persons of this study so that they may have an opportunity to bring any relevant facts and technical data concerning local flood hazards to the attention of the Flood Control District. The study will be available for review at the Flood Control District Office, located at 2801 West Durango Road, Phoenix, Arizona, beginning November 13.

The study results will be submitted to the Federal Emergency Management Agency (FEMA) for approval. Upon approval by FEMA, the study results will be used for revising Flood Insurance Rate Maps for the area. They will be used for regulating potential future development so as to reduce or prevent possible flood damage to property and structures.

Please call the District's Project Manager, Richard P. Harris, P.E., at (602) 506-1501 for more information.

Sincerely,

Roy B. McDaniel

Roy B. McDaniel, P.E.
Project Engineer
Storm Water Management

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B.5 Contract Documents

EXHIBIT A

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

SCOPE OF WORK

CONTRACT FCD 2000C020

UPPER AGUA FRIA WATERSHED
ZONE A FLOODPLAIN DELINEATION STUDY

EXHIBIT A

SCOPE OF WORK

CONTRACT FCD 2000C020

UPPER AGUA FRIA WATERSHED ZONE A FLOODPLAIN DELINEATION STUDY

GENERAL

The goal of this project is to delineate an estimated 50 miles of approximate Zone A 100-year floodplains in Watershed "UU" (a.k.a., Upper Agua Fria Watershed) east of Lake Pleasant within Maricopa County. The limits of Watershed "UU" are shown on Exhibit A.1.

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 topographic mapping, 4) perform field surveys as required, 5) develop the 100-year peak discharges, 6) delineate the Zone A floodplains, 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 judgement 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 delineations. 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 District Consultant Contracting Guidelines dated August 1, 2000.

The floodplain delineations will be phased according to the sub-watershed identification as identified in Exhibit A.1 and prioritization presented in Table 1, below.

Table 1: Sub-Watershed Prioritization

Sub-Watershed	Relative Priority	Miles of Delineation
06N 01E SEC 4 (EAST LAKE PLEASANT)	1	9
07N 02E SEC 7 (TABLE MESA RD AREA)	2	12
08N 02E SEC 28 (MOORE GULCH)	3	15
08N 02E SEC 21 (LITTLE SQUAW CREEK)	4	13
Total Area		49

The time frame for delineation of the Zone floodplains will be 180 days including 90 days for FCD review. Additional time, equal to 120 days will be allowed for FEMA review. All work must be completed including FEMA review within 300 days from the notice to proceed.

TASK 1 - COORDINATION

1.1 Within fourteen days of Notice to Proceed (NTP), 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 and obtain any necessary Rights of Entry for the study area. The District will furnish the consultant with a list of all the property owners to be notified. The consultant will furnish the District with a sample Right of Entry letter.

1.7 The consultant will meet with officials from the District and send a letter of notification to 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.

1.10 The Consultant will partake in the District's 6-hour HIS Training Course.

1.11 **(OPTIONAL)** The Consultant will work with the District to identify problems in WMS that are encountered during the services defined in this scope of work. The Consultant will contract with EMS-I to customize WMS for floodplain delineation and correct the identified problems. This work will only be undertaken through written authorization by the District's Project Manager based upon review and approval of specific tasks and costs.

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 **(OPTIONAL)** 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 A 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 format appropriate for use in future HEC-RAS models. This task is not authorized with the NTP and may be authorized in writing by the DISTRICT.

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)

e. FPXFCD (Floodplain Cross Sections)

TASK 5 - HYDROLOGY

5.1 The Consultant will develop hydrology using the Watershed Modeling System (WMS). The peak discharges for sub-watersheds will be developed using HEC-1 and will be verified using regression equations. The watersheds will cover the portion of Watershed "UU" located east of Lake Pleasant and the Agua Fria within Maricopa County, and that portion of the watershed within Yavapai County that drains into Maricopa County as shown in Exhibit A. Data needed for the hydrologic study will be provided by the District for the portion of the watershed within Maricopa County. Necessary hydrologic data for the portion of the watershed located within Yavapai County will be developed by the Consultant and reviewed and approved by the District. No sub-basin will have a drainage area smaller than ½ square mile. 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 the Flood Control 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

5.3.1 The findings of the hydrologic study will be presented in Section 3 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 does not 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 Boundary)

b. PRJDAT (Project Identification)

c. DRMPTH (Drainage Path)

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 study shall be based on the final results of the hydrologic study as directed by the District.

6.4 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. Final hydraulics section of the TDN.

6.5 Field Reconnaissance

6.5.1 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.

6.5.2 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.

6.5.3 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.

6.6 Cross Sections

6.6.1 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 include using WMS and USGS DEMs provided by the District, or field surveys possibly using GPS when the USGS maps and DEMs do not provide adequate information. In the majority of instances the channel centerline will be the centerline indicated on the USGS map, on the FEMA FIRM, or in the GIS data provided by the District.

6.6.2 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.

6.7 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.

6.8 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.

6.9 The Consultant shall fill out all the forms required by FEMA for the submittal of a Floodplain Delineation Study.

6.10 The consultant will provide work maps on monochrome USGS digital raster graphic quadrangle USGS 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 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 base maps depending on the terrain and the floodplain widths.

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, a north arrow, scale, section corners, current streets and highway names, State Plane Coordinate System, major drainage features, corporate boundaries, cross section lines, channel centerline, index map, the floodplain boundaries, and peak discharge and Section, Township, Range for each wash delineated.

6.11 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. CULVERT (culverts)

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. BRIDGES (Bridges)

i. PRJ (Project Boundary)

TASK 7 - DELIVERABLES

7.1 Both paper and electronic deliverables will be made at the completion of each task. 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 All topographic and related data for the District's Hydrologic Information System that isn't subject to change during FEMA's review should be submitted at this time.

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. All of the following products are considered deliverables for the FEMA submittal:

7.2.1 Two (2) complete sets of blackline topographic base maps with the 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: 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. 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.

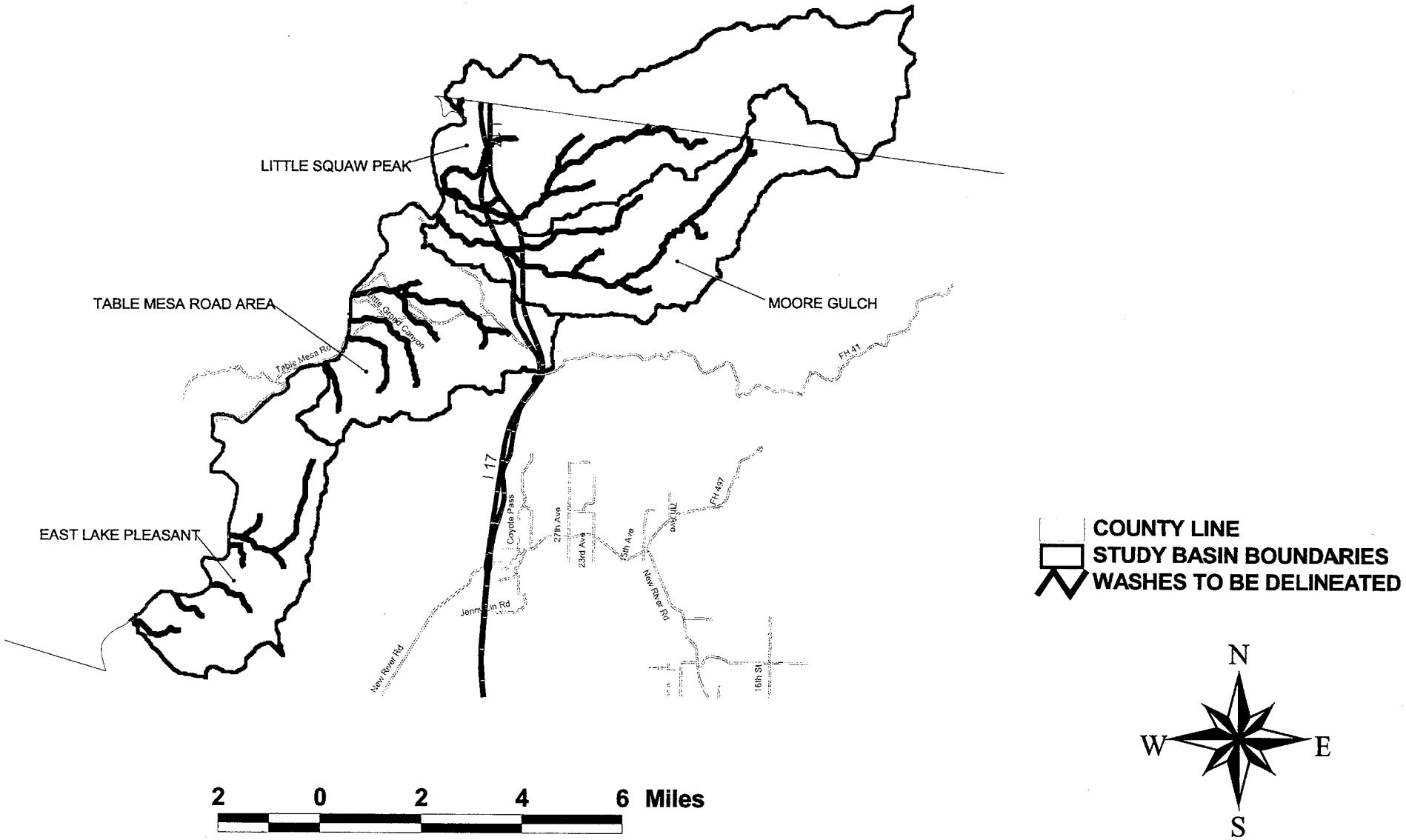
7.3.2 All remaining hydrologic and floodplain delineation data in conformance with the District's HIS Specifications.

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.

7.4 Separate submittals by subwatershed: The consultant will submit a separate TDN for each sub-watershed division established in Table 1 and shown in Exhibit A.1.

EXHIBIT A

FLOODPLAIN DELINEATION PHASING



B.6 FEMA Correspondence

C.1 Survey Field Notes for Aerial Mapping Control

Mapping was not performed as a part of this job. Existing elevation data in the form of a Digital Elevation Model (DEM) and breaklines provided by Maricopa County was used in this report. The DEM was produced from the Maricopa County Ortho-Photo project. A copy of the narrative from the survey report for that project follows. The information in the report appendix is provided on a CD at the end of this report.

Maricopa County Ortho-photo

GPS-Summary of Procedure

Final Report

RBF

CONSULTING

PLANNING

DESIGN

CONSTRUCTION

SURVEYOR'S CERTIFICATION

This survey was conducted under my direction during the months of November 2000 through March 2001. The information in this book is correct and accurate to the best of my knowledge and belief.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
29891
BRENT J.
SMITH
Date Signed 04/04/01
ARIZONA, U.S.A.

Brent J. Smith, R.L.S. AZ.#29891 Date

Maricopa County Ortho-photo
Summary of Procedure
Report

Procedure Outline:

- I **Control** - set control throughout project
- II **Observation** - collected data from ground stations
- III **Compilation** - interpret the raw data for usable output
- IV **Translation** - translate the output to format required for implementation

Procedure Specifics:

I. Control - Aerial targets were set throughout the project for reference to facilitate the orthographic correction of the photos. Most of the points were set on existing GDACS points to give reference to existing data. The location of non-GDACS points were established through RTK GPS or static GPS observation.

II. Observation- During the flight there were two GPS units on the ground collecting the satellite data for the duration of the flight days. One unit on a central BASE station, and the other unit location ranging between 5 other stations based on flight area that day. The observation days were in December 2000,on the 16th, 17th, 18th, 27th, 28th, and the 30th. The observation days were in January 2001,on the 4th. The observation days in March were on the 13th, 14th and 15th.

III. Compilation - The data collected by the two ground units and the airborne unit were sent out to Fotoflight for processing. The information came from Fotoflight in latitude and longitude and elevation in meters.

IV. Translation - Photo centers were converted to NAD 83 Arizona State Plane coordinates in International feet.

Appendix - Table of Contents

Appendix A:

GPS Observation Logs (including location maps)

Day 1 : 12/16/00 Observation logs for 1HD1 and 4HT3.
Day 2 : 12/17/00 Observation logs for 1HD1 and 4HT3.
Day 3 : 12/18/00 Observation logs for 1HD1 and 3GI1.
Day 4 : 12/27/00 Observation logs for 1HD1 and 3GI1.
Day 5 : 12/28/00 Observation logs for 1HD1 and 3GI1.
Day 6 : 12/30/00 Observation logs for 1HD1 and 3GI1.
Day 7 : 01/04/01 Observation logs for 1HD1 and 1LM2.
Day 8 : 03/13/01 Observation logs for 1HD1 and 1FN1.
Day 9 : 03/14/01 Observation logs for 1HD1 and 1FN1.
Day 10: 03/15/01 Observation logs for 1HD1 and 1FN1.

Appendix B:

Data on the location of the center of each photograph taken and separated by the days of observation. Files with the extension ".lat", contain the Latitude, Longitude and Elevation as prepared by Fotoflight. Files with the extension ".xls" have the Arizona State plane coordinates in NAD 83.

Day 1 : 121600.xls and 121600.lat
Day 2 : 121700.xls and 121700.lat
Day 3 : 121800.xls and 121800.lat
Day 4 : 122700.xls and 122700.lat
Day 5 : 122800.xls and 122800.lat
Day 6 : 123000.xls and 123000.lat
Day 7 : 010401.xls and 010401.lat
Day 8 : 031301.xls and 031301.lat
Day 9 : 031401.xls and 031401.lat
Day 10: 031501.xls and 031501.lat

NOTE: On the attached CD, the raw data files (.raw & .dat) files are also included.

Appendix C:

Complete listing of panel points used in this project.
(filename panels.xls)

Appendix D:

Complete listing of GDACS check points (filename orthochecks.xls) including the standard deviations. (filename results_1.wb3)

C.2 Survey Field Notes for Hydrologic Modeling

Field reconnaissance notes for sub-basin boundary verification and estimation of physical parameters is included in Appendix E. Additional survey was not required for this study because Approximate methods are being used to delineate Zone A Floodplains. Therefore, there are no survey field notes.

C.3 Survey Field Notes for Hydraulic Modeling

Field survey was performed to set elevation reference monuments and to survey hydraulic structures. The survey was conducted by RBF Consulting under the supervision of Brent J. Smith, R.L.S. The following pages are copies of the field notes.

Surveyor's Certificate

This survey was conducted under my direction during the months of March 2002 and June 2002. The information in this book is correct and accurate to the best of my knowledge and belief.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
29891
BRENT J.
SMITH
Date Signed 07/01/02
ARIZONA, U.S.A.

Brent Smith, RLS

07/01/02
Date

SURVEY SUMMARY

The scope of this project was to set 37 elevation reference marks (ERM's) along the upper Agua Fria river and its tributaries and perform a structure survey of all pipes, bridges, and culverts affecting the area. RBF Consulting performed this work under the direction of Brent Smith, RLS between March and June of 2002.

All work was referenced to the North American Datum 1983 (NAD83) epoch 1992. All elevations were referenced to North American Vertical Datum 1988 (NAVD88). Control monuments were recovered from the Maricopa county Department of Transportation GDACS network and the National Geodetic Survey (NGS).

Horizontal control

In the area encompassed by this project we recovered 4 GDACS control monuments with coordinates published by the Maricopa County Department of Transportation (MCDOT). These points were observed by MCDOT between 1998 and 2000. This was a part of their Geodetic Densification and Cadastral Survey (GDACS) project. The horizontal positions of these monuments have been accepted by the National Geodetic Survey (NGS) and given a horizontal order of B. The published values are related to NAD83 (1992)

Vertical control

The same monuments that were used for horizontal control have a vertical component provided by MCDOT. The elevations were established by determining an ellipsoidal height by GPS observation and referencing this to NAVD88. The orthometric height was then determined using a high-resolution geoid model (geoid 99) with precise GPS observation and processing techniques. The NGS publishes these results as Third Order Class II ellipsoidal heights. Since this is not given a vertical order additional vertical control was used to verify vertical tolerance of minimum third accuracy order. Measurements were made to two additional NGS benchmarks to verify vertical control.

Equipment

All GPS work was preformed using Trimble 4000 series receivers (4000ssi, 4700, 4800). Compact L1/L2 antennas with ground planes were used where external antennas were needed. All antennas used collect L1/L2 and p-code. These antennas are designed to help eliminate multipath and unwanted noise from the observation data. Trimmark II radios were used for RTK work. Trimble Geomatics Office version 1.5 software was used to process field data. This

allowed us to analyze the quality of both the field measurements and the network. The structures were located with the use of a Geodimeter 600 robotic total station theodolite using conventional survey methods.

Outline of survey procedures

Structure surveys

The structures were mapped using the geodimeter 600 from control points established using GPS RTK methods. This ensured all of the structures would relate to the project control network. An as built sketch was made of the structure and photos were taken. Please reference the Structure Survey Book for this project.

Elevation reference monument (ERM) surveys

The ERM's were set in locations determined by the Maricopa County Flood Control District. The locations and elevations were then determined though GPS static survey methods. At each monument three photos were taken and a sketch map was made to depict the monument and a route to its location. Please reference the ERM Survey Book for this project.

Static methods

Where static survey methods were used we designed survey procedures to minimize errors and give us confidence in our results. Fixed height tripods or bipods were used for all observations to eliminate antenna height errors. One GPS "base" receiver was set up to collect data over a control point. A second "rover" receiver was then taken to each ERM where it collected data for 15 minutes. The base receiver was then moved to another control point and each of the ERMs were observed a second time for another 15 minutes. The use of these independent measurements confirmed the quality of our fieldwork and provided data for a stronger final adjustment. Observation logs were filled out for each session. These logs included the height of the antenna, the start and end time of the session, the receiver serial number, and the name of the field personnel. The data was then processed with the use of Trimble Geomatics Office software so that we could analyze the quality of both the fieldwork and the data the receiver collected.

RTK methods

Where RTK survey methods were used we chose a field procedure that would minimize human error and inaccurate data associated with RTK GPS measurements. A base station receiver was set up on a fixed height tripod on a

control point. A radio link was then set up to broadcast its location to a second (rover) receiver. The rover would then gain initialization "on the fly". This means that it has determined it's differential position from the base receiver. The rover receivers were set up on fixed height poles with bipods. A 90 second measurement was taken on another control point to verify that the setup is correct and that the RTK results are consistent with our static measurements. Each point located with RTK was then measured for ninety seconds. The receiver was then forced to physically loose lock with the satellites and then re-initialize at least 40ft. from where it gained initialization the first time. This forces it to use a different set of data to solve for its position. The monument was then measured for another ninety seconds. The results of the two measurements were then compared for quality assurance.

RBF CONSULTING

July 8, 2003

JN 45-100648

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009
Subject: **Upper Agua Fria Watershed Zone A Flood Plain Delineation Study**

Elevation Reference Monuments for this study were surveyed using Static GPS Methods from Maricopa County Department of Transportation Monuments 1PD5, NR22 and 1NF2. Positions and elevations submitted are NAD 1983/92 and NAVD 1988 based on the above referenced monuments.

Accuracy of the horizontal positions is Third Order Class I, (FGCC 1984) relative accuracy of 1 part in 10,000. Accuracy of the elevations is Third Order, (FGCC 1984) relative accuracy of 2.0mm x square root of distance in kilometers between points.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
29891
BRENT J
SMITH
Date Signed 07/08/03
ARIZONA, U.S.A.

Brent J. Smith, RLS 29891

45-100648.002 Upper Agua Fria ERMs
NAD 83/NAVD 88
RBF Consulting 6/11/2002

Watershed 2

Station	NORTHING	EASTING	ELEVATION	DESCRIPTION
UAF25	1087246.13	616338.7354	1768.49	SET FCDMC BRASS CAP AT LAT. N 33°59'18" LONG W. 112°11'34"
UAF26	1088754.872	621128.6931	1822.13	SET FCDMC BRASS CAP AT LAT. N 33°59'33" LONG W. 112°10'37"
UAF27	1089160.347	623262.3468	1888.25	SET FCDMC BRASS CAP AT LAT. N 33°59'37" LONG W. 112°10'11"
UAF28	1088053.021	630045.3256	2001.70	SET FCDMC BRASS CAP AT LAT. N 33°59'26" LONG W. 112°08'51"
UAF29	1086824.302	618067.1075	1820.02	SET FCDMC BRASS CAP AT LAT. N 33°59'14" LONG W. 112°11'13"
UAF30	1086800.104	625971.4413	1943.78	SET FCDMC BRASS CAP AT LAT. N 33°59'13" LONG W. 112°09'39"
UAF31	1080806.249	614567.9439	1792.26	SET FCDMC BRASS CAP AT LAT. N 33°58'14" LONG W. 112°11'54"
UAF32	1083153.460	616269.5391	1758.96	SET FCDMC BRASS CAP AT LAT. N 33°58'40" LONG W. 112°11'34"
UAF33	1083245.303	619067.2601	1868.94	SET FCDMC BRASS CAP AT LAT. N 33°58'39" LONG W. 112°11'01"
UAF34	1084224.011	620767.8055	1900.62	SET FCDMC BRASS CAP AT LAT. N 33°58'48" LONG W. 112°10'40"
UAF35	1086033.413	631044.236	2013.24	SET FCDMC BRASS CAP AT LAT. N 33°59'06" LONG W. 112°08'40"
UAF36	1083849.549	633103.2629	2112.76	SET FCDMC BRASS CAP AT LAT. N 33°58'45" LONG W. 112°08'15"
UAF37	1082459.221	635196.0445	2177.78	SET FCDMC BRASS CAP AT LAT. N 33°58'32" LONG W. 112°07'48"

45-100648.002 Upper Agua Fria ERMs
Adjusted positions and ellipsoid heights

Watershed 2

Station	Latitude	Longitude	Ellip Ht	Geoid Ht
UAF25	33-59-17.948032	112-11-33.630225	1674.6844	-93.8052
UAF26	33-59-32.998322	112-10-36.786762	1728.5025	-93.6298
UAF27	33-59-37.062650	112-10-11.456603	1794.6946	-93.5557
UAF28	33-59-26.266068	112-08-50.862300	1908.3138	-93.3878
UAF29	33-59-13.820368	112-11-13.089642	1726.2397	-93.7796
UAF30	33-59-13.777252	112-09-39.212608	1850.2216	-93.5602
UAF31	33-58-14.189170	112-11-54.451147	1698.1916	-94.0674
UAF32	33-58-37.456490	112-11-34.321079	1665.0055	-93.9521
UAF33	33-58-38.438436	112-11-01.100573	1775.0611	-93.8776
UAF34	33-58-48.164381	112-10-40.935904	1806.824	-93.7991
UAF35	33-59-06.307667	112-08-38.944933	1919.8128	-93.4275
UAF36	33-58-44.746653	112-08-14.435472	2019.3273	-93.4371
UAF37	33-58-31.035620	112-07-49.548270	2084.3691	-93.4153

45-100648.002 Upper Agua Fria ERMs
Station Coordinate Error Ellipses
Confidence Region = 95%

Watershed 2

Station	Semi-Major	Semi-Minor	Azimuth of	Elev
UAF25	0.04651	0.04443	131-33	0.0577
UAF26	0.04723	0.04217	0-54	0.06985
UAF27	0.04817	0.04103	174-25	0.06406
UAF28	0.06144	0.05286	153-07	0.0797
UAF29	0.04592	0.04291	124-03	0.06257
UAF30	0.05151	0.04488	0-58	0.07885
UAF31	0.04291	0.04165	106-48	0.05791
UAF32	0.04575	0.04474	75-41	0.0566
UAF33	0.04326	0.04139	57-25	0.05002
UAF34	0.04548	0.04218	161-23	0.04912
UAF35	0.04836	0.04386	146-24	0.06779
UAF36	0.04682	0.04515	153-21	0.07312
UAF37	0.05361	0.04984	157-35	0.10018

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MULTIPLE OBSERVATION GPS LOG SHEET

Job No.	Date	Day	Job Name
45-100648	5-14-02	134	UPPER AGUA FRIA

Observer	Equip. No.	Antenna Type	Antenna Meas. Technique
WILLIS/WASHICKO		Compact L1L2 w/GP | wo/GP | L1L2 Geo w/GP | 4000 | Other	Edge of GP | Base | Phase Center | Other

Station No.	Name	Start Time	Stop Time	H.I.(m)	Description
File Name / Monument Location / Target Offset / Notes					
UAF 37	B.M.	8:47AM	9:08AM	5.90	2½" BRASS CAP UAF 37
UAF 37 134 1 (UAF134)	/ SW COR. SEC. 2 .50 MILE± IN FROM TABLE MESA RD.				/ NEW WAY PT. 38 N 33-58-32 W 112-07-48
UAF36	B.M	9.42 AM	9:57 AM	5.90	2½" BRASS CAP UAF 36
AF36 1342	/ ELY SIDE SEC. 3 1 MILE FROM TABLE MESA UP A SMALL HILL 200'± FROM DIRT RD.				/ NEW WAY PT 40 N 33-58-15 W 112-08-15
UAF35	B.M.	10:15 AM	10:31 AM	5.90	2½" BRASS CAP UAF 35
AF351343	/ 1.5 MILES± FROM TABLE MESA RD.				/ NEW WAY PT #41 N 33-59-06 W 112-08-40
UAF28	B.M	10:50 AM	11:05 AM	5.90	2½" BRASS CAP UAF 28
AF281344	/ 2.0 MILES N'LY TABLE MESA RD.				/ NEW WAY PT #42 N33-59-26 W 112-08-51
UAF30	B.M.	11:28 AM	11:43 AM	5.90	2½" BRASS CAP UAF 30
AF301345	/ 750' NRTH OF END OF SIDE DIRT RD.				/ NEW WAY PT. #102 N 33-59.13 W 112-09-39
UAF26	BM	12:25 pm	12:40 pm	5.90	2½" BRASS CAP UAF26
AF261346	/ SW'LY OF ℄ SEC. 32 800'±				NEW WAY PT #104 N33-59-33 W 112-10-37
UAF27	BM	1:20 pm	1:35 pm	5.90	2½ BRASS CAP UAF27 WAY PT #106 N33-59-37 W 112-10-11
AF271347	/ 375' S'LY OF DIRT RD. NEAR ELY ¼ COR. SEC 32				(DID NOT FIND ¼ COR. JUST APPROX.
UAF34	BM	2:31 PM	2:46 PM	5.90	2½" BRASS CAP UAF 34
AF341347	/ 400'± W'LY OF DIRT RD.				/ NEW WAY PT. #107 N 33-58-48 W 112-10-40

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MULTIPLE OBSERVATION GPS LOG SHEET

Job No.	Date	Day	Job Name
45-100648	5-14-02	134	UPPER AGUA FRIA

Observer	Equip. No.	Antenna Type	Antenna Meas. Technique
PAUL	1022	Compact L1L2 w/GP | wo/GP | L1L2 Geo w/GP | 4800 | Other	Edge of GP | Base | Phase Center | Other

Station No.	Name	Start Time	Stop Time	H.I.(m)	Description
1PD5	GDACS			2	BASE

File Name / Monument Location / Target Offset / Notes

1PD5	GDACS	7:43 AM 14:43 UTC	3:25 pm	2	BASE
1PD5134B					(6.562 F)

"CONTAMINATED FILE?"

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MULTIPLE OBSERVATION GPS LOG SHEET

Job No.	Date	Day	Job Name
45100648	5-15-02	135	AGUA FRIA

Observer	Equip. No.	Antenna Type	Antenna Meas. Technique
KLEIN	4800	Compact L1L2 w/GP | wo/GP | L1L2 Geo w/GP (4800) Other	Edge of GP | Base | Phase Center | Other

This Unit is the: ☐ Base ☑ Rover | RTK File Name:

Station No.	Name	Start Time	Stop Time	H.I.(m)	Description
UAF 29	BM.	8:02 AM	8:17 AM	5.90 FT.	2½" BRASS DISC UAF 29
AF291351 / 600' SOUTH OFF OF ROAD DUE SOUTH					/ NEW WAY PT # 108 N33-59-14 W112-11-13
UAF 25	B.M.	9:00 AM	9:15 AM	5.90 F	2½" BRASS DISC UAF 25
AF251352 / SW COR OF MAIN PROP. LITTLE GRAND CANYON RANCH					/ NEW WAY PT # 109 N33-59-18 W112-11-34
UAF 33	BM	9:40 AM	9:55 AM	5.90 FT	2½ BRASS DISC UAF 33
AF331353 / .45 MILES± FROM SPLIT OF DIRT RD'S 40'± ELY OF ℄					/ NEW WAY PT # 110 N33-58-39 W112-11-01
UAF 32	B.M.	10:22 AM	10:38 AM	5.90 FT	2½" BRASS DISC UAF 32
AF321354 /					/ NEW WAY PT # 111 N33-58-40 W112-11-34
UAF 31	BM	11:17 A.M	11:34 AM	5.90 FT	2½" BRASS DISC UAF 31
AF311355 / UPPER ARM PLEASANT LAKE IS DUE NORTH 1000'±					/ NEW WAY PT # 112 N33-58-14 W112-11-54
UAF 15	BM	12:28 pm	12:43 pm	5.90 FT	NEW WAY PT # 113 N34-00-16 W112-08-35
AF151356 / I 17 SOUTH IS DUE EAST 800'±					/ 2½" BRASS CAP U.A.F 15
UAF 16	B.M.	1:23 pm	1:39 pm	5.90 FT	2½" BRASS CAP UAF 16
AF161358 / 50'± WEST OF NLY BRIDGE ABUT I 17 NORTHBOUND OVER MOORE GULCH / MON IS UP .30'±					/ NEW WAY PT # 114 N34-00-00 W112-08-03
UAF 21	B.M	2:01 pm	2:16 pm	5.90 FT	2½ BRASS CAP UAF 21
AF211359 / 1 MILE± EAST FROM I 17 NORTHBOUND BRIDGE					/ NEW WAY PT # 123 N33-59-48 W112-07-04
NOTE SESSION 7 WAS ABORTED					
UAF 22	B.M.	2:27 pm	2:42 pm	5.90 FT	2½" BRASS DISC UAF 22
F2213510 / ½ MILE FURTHER EAST OF UAF 21 ALONG SAME ROCKY ROAD					/ NEW WAY PT # 151 N33-59-41 W112-06-31
UAF 23	B.M.	2:56 pm	3:11 pm	5.90 FT	2½" BRASS DISC. UAF 23
F2313511 / 2 MILES EAST OF I-17 ALONG ROCKY ROAD THROUGH MOORE GULCH					/ NEW WAY PT # 152 N33-59-42 W112-06-03

"CONTOMINATED FILE?"

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MULTIPLE OBSERVATION GPS LOG SHEET

Job No.	Date	Day	Job Name
45-100648	5-17-2002	135	UPPER AGUA FRIA

Observer	Equip. No.	Antenna Type	Antenna Meas. Technique
KLEIN	1022	Compact L1L2 w/GP | wo/GP | L1L2 Geo w/GP | 4800 | Other	Edge of GP | Base | Phase Center | Other

This Unit is the: ☑ Base ☐ Rover | RTK File Name:

Station No.	Name	Start Time	Stop Time	H.I.(m)	Description
File Name / Monument Location / Target Offset / Notes					
1PD5135B	GDACS	13:43 UTC		2.0m 6.562 FT.	BASE

"GOOD SESSIONS"

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MULTIPLE OBSERVATION GPS LOG SHEET

Job No.	Date	Day	Job Name
100648	5-17-02	137	UPPER AGUA FRIA

Observer	Equip. No.	Antenna Type	Antenna Meas. Technique
WASHCKO	(UNIT TO IRVINE) 3982	Compact L1L2 w/GP | wo/GP | L1L2 Geo w/GP | 4800 | Other	Base of GP | Base | Phase Center | Other

This Unit is the: ☒ Base ☐ Rover | RTK File Name: N/A

Station No. / File Name / ~~Monument Location~~ / ~~Target Offset~~ / ~~Notes~~	Name	Start Time	Stop Time	5.906 H.I.(m)	Description
UAF29 ✓	UAF29	8:19 A.M	8:34	5.906	2½" BRASS CAP STAMPED UAF 29
AF291371					
UAF25 ✓	UAF 25	8:46 A.M	9:01	5.906	2½" BRASS CAP STAMPED UAF25
AF251372					
UAF33 ✓	UAF33	9:21	9:36	5.906	2½" BRASS CAP STAMPED UAF33
AF331373					
UAF32 ✓	UAF32	9:59	10:15	5.906	2½" BRASS CAP STAMPED UAF32
AF321374					
UAF31 ✓	UAF31	10:39	10:57	5.906	2½" BRASS CAP STAMPED UAF 31
AF311375					
UAF15	UAF15	11:34	11:50	5.906	2½" BRASS CAP STAMPED UAF 15
AF151376					
UAF16	UAF16	12:13	12:29	5.906	2½" BRASS CAP STAMPED UAF16
AF151377					
UAF17 ✓	UAF17	12:38	12:53	5.906	2½" BRASS CAP STAMPED UAF17
AF171378					
UAF21 ✓	UAF21	1:02	1:18	5.906	2½" BRASS CAP STAMPED UAF21
AF211379					
UAF22 ✓	UAF22	1:35	1:50	5.906	2½" BRASS CAP STAMPED UAF22
F2213710					
UAF23 ✓	UAF23	1:56	2:11	5.906	2½" BRASS CAP STAMPED UAF23
F2313711					

DO NOT MOUNT

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MULTIPLE OBSERVATION GPS LOG SHEET

Job No.	Date	Day	Job Name
45-100648	5-21-2002	141	UPPER AGUA FRIA

Observer	Equip. No.	Antenna Type	Antenna Meas. Technique
KLEIN, HAYNES	3702	Compact L1L2 w/GP | wo/GP | L1L2 Geo w/GP | 4800 | Other	Edge of GP | Base | Phase Center | Other

This Unit is the: ☐ Base ☑ Rover | RTK File Name:

Station No.	Name	Start Time	Stop Time	H.I.(m)	Description
File Name / Monument Location / Target Offset / Notes					
UAF 6	BM	8:27 AM	8:42AM	5.90FT	2½" BRASS DISC UAF 6 UP.30'
UAF61411	OBSERVED W/EDGE OF G.P. ANT NOT BOTTOM OF MOUNT				NEW WAY PT #172 N34-01-24 W 112-09-44
UAF 1	BM	11:01 AM	11:17AM	5.90FT	2½" BRASS DISC - UAF1 UP.10'
UAF11412	SHOT WITH BOTTOM ANT. MOUNT				NEW WAY PT # 174 N34-02-09 W 112-08-02
UAF 7	B.M.	12:17 PM	12:32PM	5.90FT	2½" BRASS DISC UAF7 FLUSH
UAF71413	@ 6MIN MARK RECIEVER WENT DOWN BUT CAME BACK UP				NEW WAY PT #175 N34-01-22 W112-09-01
UAF 37	B.M.	12:56pm	1:11pm	5.90FT	2½" BRASS DISC FLUSH STAMPED UAF 37
AF371415	ALL MONS ARE SET IN AN 24" ALUM. PIPE (TYP.)				WAY PT # 38
(SESSION 4 BAT. ON ROVER DIED)					
UAF 36	BM	1:18 PM	1:33pm	5.90FT	2½" BRASS DISC UP.10'± STAMPED UAF 36
AF361416					WAY PT # 40
UAF 35		1:40 PM	1:55pm	5.90FT	2½" BRASS DISC UP.10'± STAMPED UAF 35
AF351417					WAY PT # 41
UAF 28	B.M.	2:02 PM	2:17 PM	5.90FT	2½" BRASS DISC UP.10'± STAMPED UAF 28
AF281418					WAY PT # 42
UAF 27	B.M.	2:27 PM	2:42PM	5.90FT	2½ BRASS DISC UP.10'± STAMPED UAF 27
AF271419					WAY PT #106
UAF 26	B.M.	3:02 PM	3:17PM	5.90FT	2½" BRASS DISC UP.20'± STAMPED UAF 26
F261410					WAY PT #104
UAF 30	B.M	3:37 PM	3:52PM	5.90FT	2½" BRASS DISC - UP.10'± STAMPED UAF 30
F301411					WAY PT #102

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RBF CONSULTING

MULTIPLE OBSERVATION GPS LOG SHEET

Job No.	Date	Day	Job Name
45-100648	5-22-2002	142	UPPER AGUA FRIA

Observer	Equip. No.	Antenna Type	Antenna Meas. Technique
KLEIN, HAYNES	3702	Compact L1L2 w/GP | wo/GP | L1L2 Geo w/GP (4800) Other	Edge of GP (Base) Phase Center | Other

This Unit is the: ☐ Base ☑ Rover | RTK File Name:

Station No.	Name	Start Time	Stop Time	H.I.(m)	Description
File Name / Monument Location / Target Offset / Notes					
UAF 34	B.M.	7:42 AM	7:57 AM	5.90 FT	2 1/2" BRASS DISC STAMPED UAF 34
~~AF341422~~	~~FILE NOT FD~~ at 142341.dat				WAY PT #107
UAF 33	BM	8:20 AM	8:35 AM	5.90 FT	2 1/2" BRASS DISC STAMPED UAF 33
AF331422					WAY PT # 110
UAF 32	B.M.	8:48 AM	9:03 AM	5.90 FT	2 1/2" BRASS DISC UP 10'± STAMPED UAF 32
AF321423					WAY PT # 111
UAF 31	BM	9:23 AM	9:38 AM	5.90 FT	2 1/2" BRASS DISC UP 10'± STAMPED UAF 31
AF311424					WAY PT # 112
UAF 29	BM	10:02 AM	10:17 AM	5.90 FT	2 1/2" BRASS DISC UP 10'± STAMPED U.A.F 29
AF291425					WAY PT # 108
UAF 25	B.M.	10:32 AM	10:47 AM	5.90 FT	2 1/2" BRASS DISC UP 20'± STAMPED UAF 25
AF251426					WAY PT # 109
UAF 14	BM	11:13 AM	11:18 AM	5.90 FT	2 1/2" BRASS DISC UP 10'± STAMPED UAF 14
AF141427					WAY PT
UAF 13	BM	11:35 AM	11:50 AM	5.90 FT	2 1/2" BRASS DISC UP 10'± STAMPED UAF 13
AF131428					WAY PT 164
UAF 9	BM	11:59 AM	12:14 PM	5.90 FT	2 1/2" ALC CAP 1 521 UP 10'± 1917 4 528
UAF01429					WAY PT -
~~UAF 6~~	~~BM~~	~~12:28 PM~~	~~VOID~~	~~5.90 FT~~	~~2 1/2" BRASS DISC UP 40'± STAMPED UAF 6~~
~~AF61 4210~~	~~"WIND GUST DISTURBED SET UP"~~				~~WAY PT~~
UAF 6	BM	12:41 PM	12:56 PM	5.90 FT	2 1/2" BRASS DISC UP 40'± STAMPED UAF 6
AF6142 11					WAY PT -
UAF 1	BM	2:05 PM	2:20 PM	5.90 FT	2 1/2" BRASS DISC UP 16'± STAMPED UAF 1
AF114212					WAY PT # 174
UAF 7	BM	2:52 PM	3:07 PM	5.90 FT	2 1/2" BRASS DISC STAMPED UAF 7
AF714213					WAY PT # 175

~~EST~~ 2.5

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JOB No: 45-100648

CLIENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICEO

DATE: 5-15-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

FILE NAME: ~~4PD51353~~

POINT RANGE: _____

PURPOSE OF SURVEY:

(T) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(S) SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

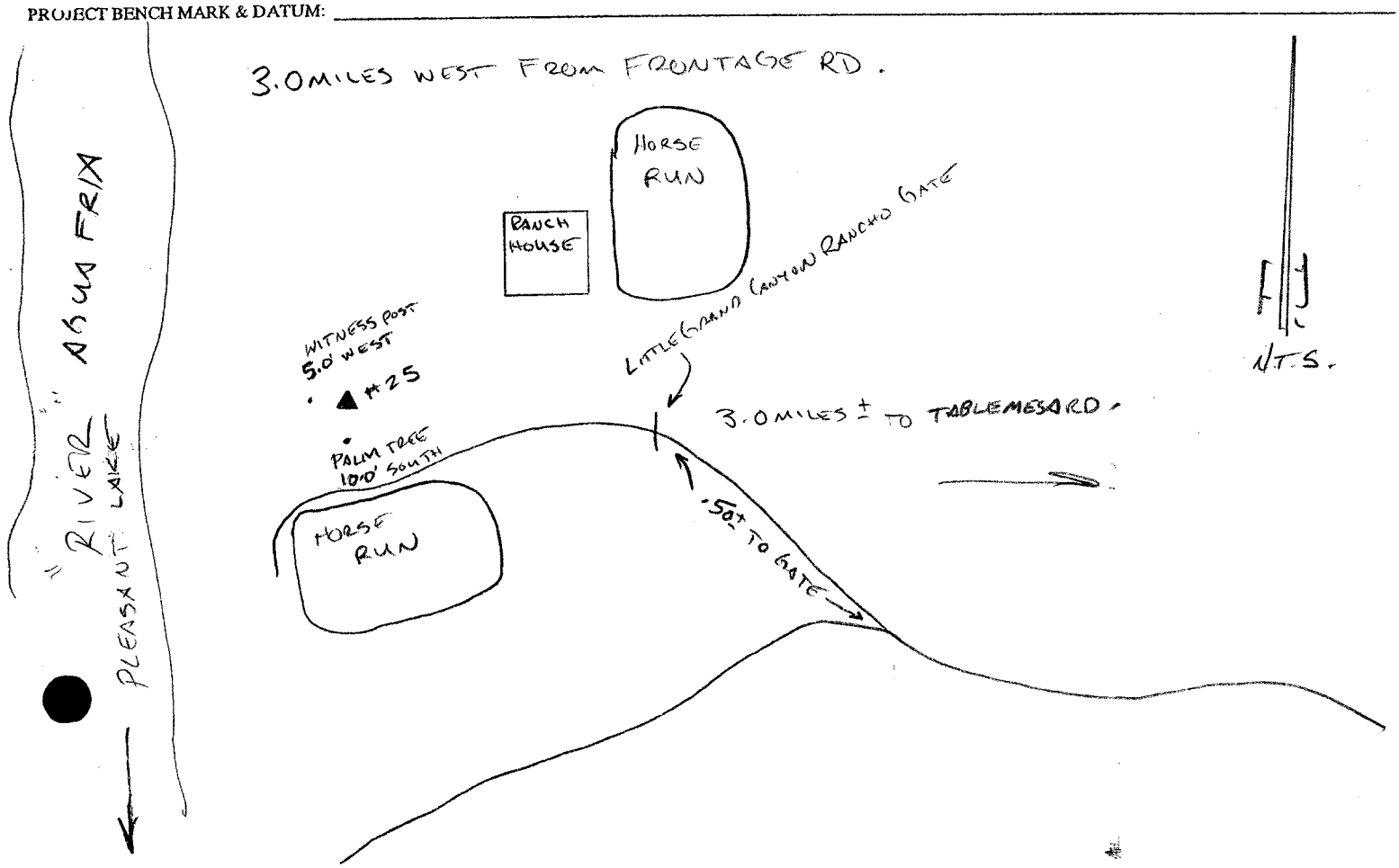
(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

(G) GIS

DESCRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

BASE OF HORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC ~~WAY PT. #109~~ N 33-59-18 W 112-11-34

PROJECT BENCH MARK & DATUM: _____



BOOK_____ PAGE_____

JOB No: 45-100648

CLIENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICKO

DATE: 5-14-2002

RBF CONSULTING

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

FILE NAME: ~~IPDS1340~~

POINT RANGE: _____

PURPOSE OF SURVEY:

(T) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(S) SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

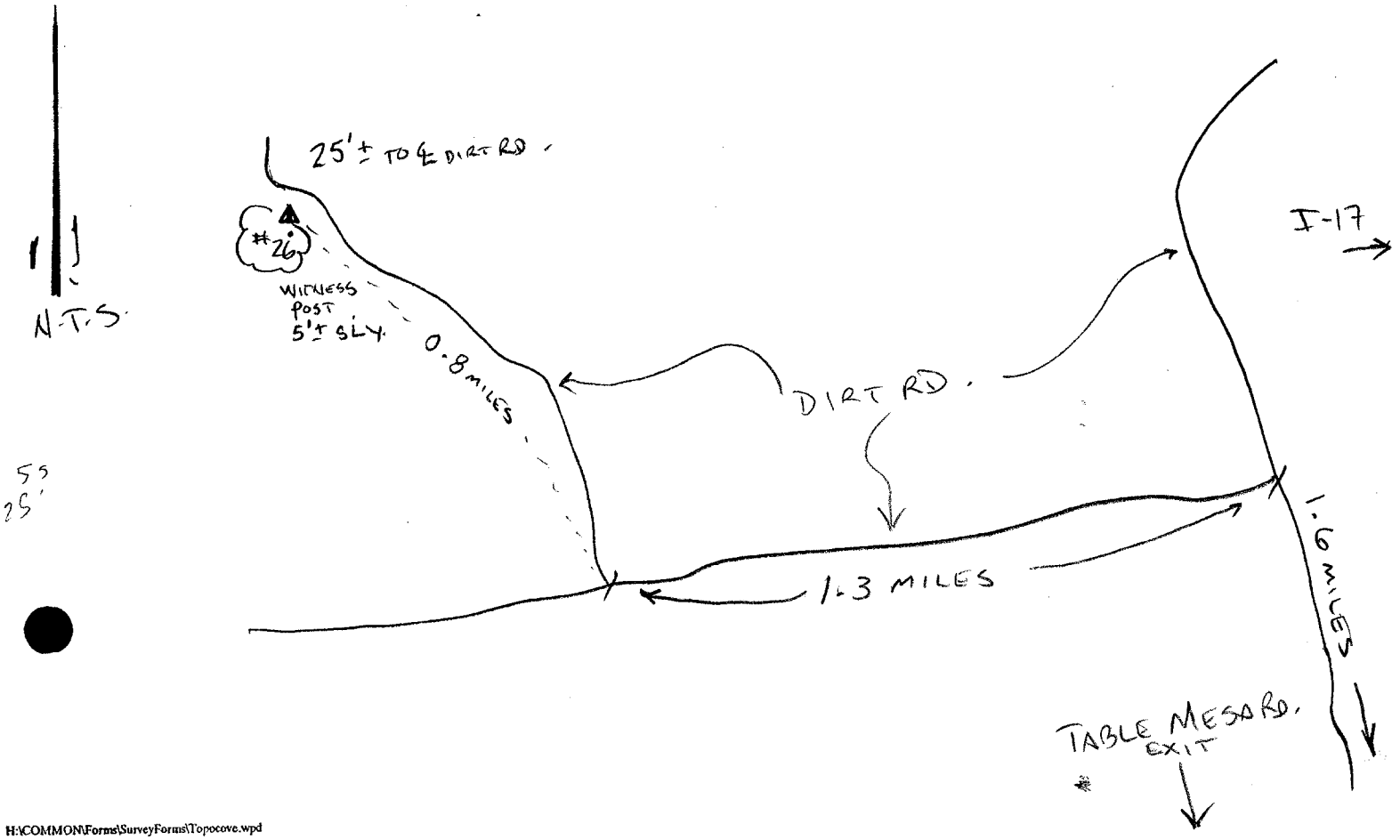
(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

(G) GIS

DESCRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

BASIS OF HORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC ~~WAY PT #104~~ N 33-59-33 W 112-10-37

PROJECT BENCH MARK & DATUM: _____



BOOK_____ PAGE _____ 2

JOB No: 45-100648

CLIENT: MARICOPA CO FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICKO

DATE: 5-14-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

FILE NAME: TP051348

POINT RANGE: _____

PURPOSE OF SURVEY:

(T) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

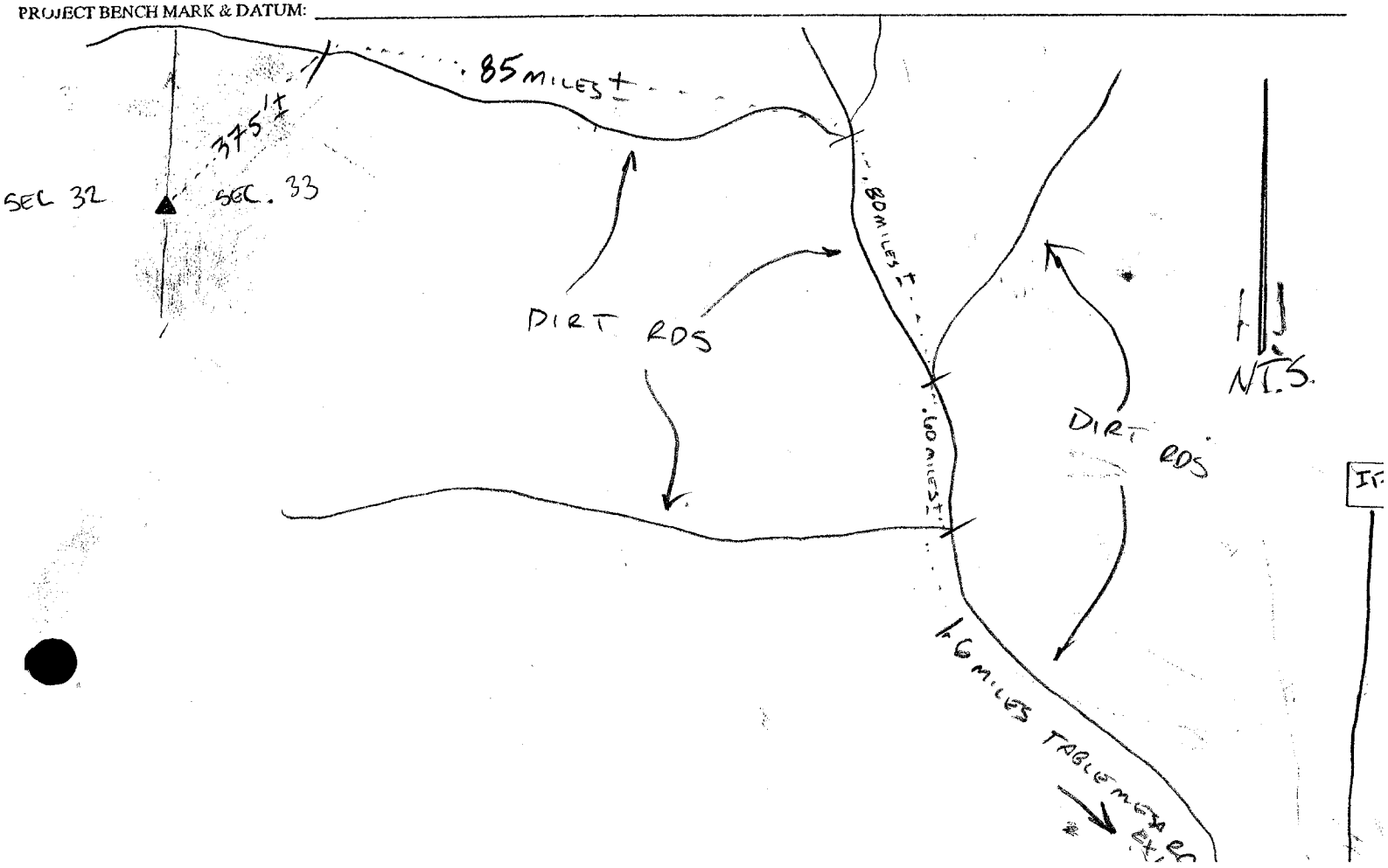
(S) SUBDRAIN LOCATION

(G) GIS

DESCRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

BASIS OF HORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC ~~WAY PT. #106~~ N33-59-37 W 112-10-11

PROJECT BENCH MARK & DATUM: _____



BOOK_____ PAGE_____

JOB No: 45-1006448

CLIENT: MARICOPA Co. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICKO

DATE: 5-14-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

FILE NAME: 1PD51348

POINT RANGE: _____

PURPOSE OF SURVEY:

(T) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(S) SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

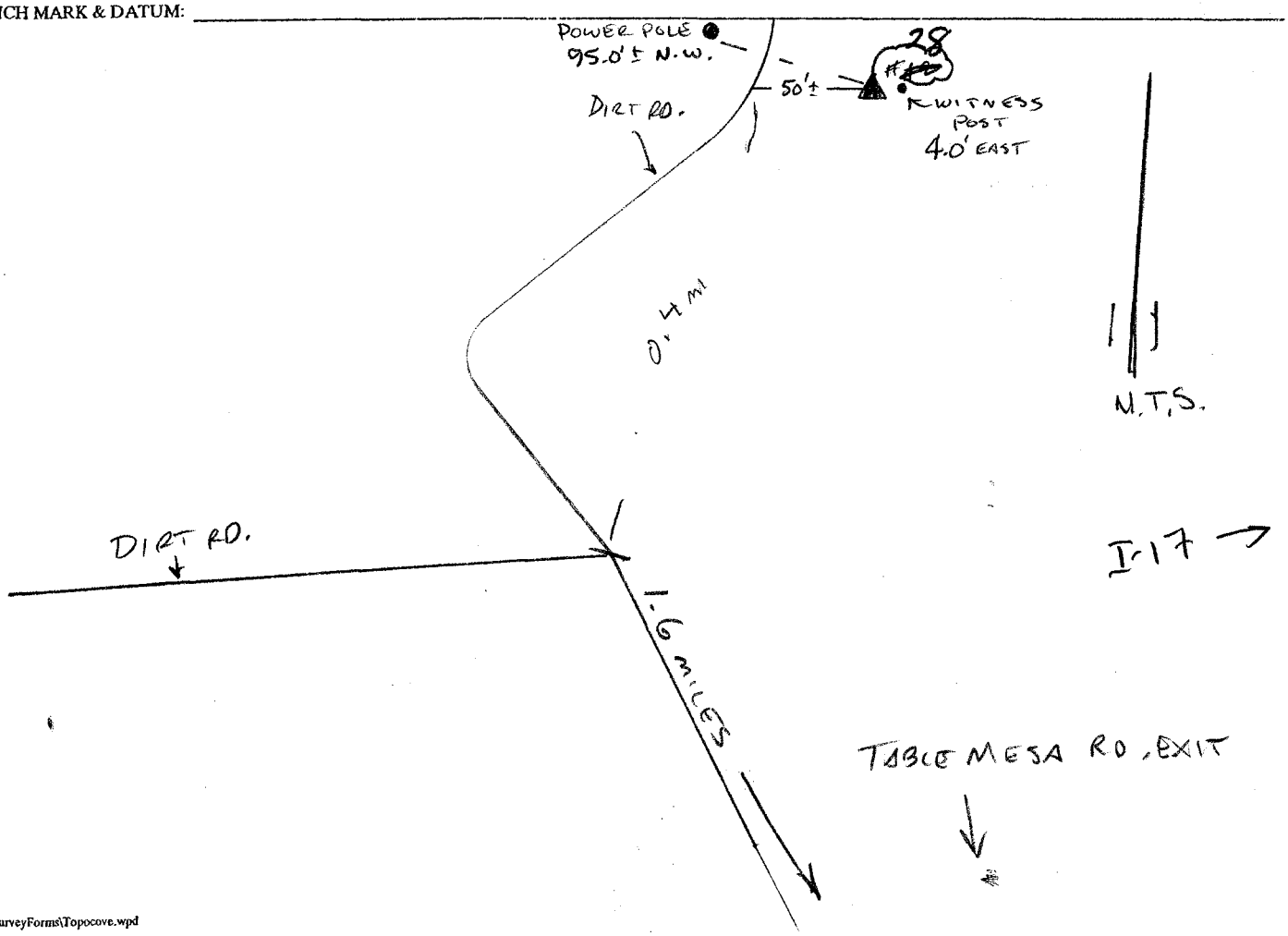
(G) GIS

DESCRIPTION: SETTING FLOOD CONTROL BENCHMARKS (U.A.F.)

☐ IMPERIAL
☐ METRIC

HORIZONTAL CONTROL: ~~WAY PT. 42~~ N 33-59-26 W 112-08-51

PROJECT BENCH MARK & DATUM: _____



~~109~~ 29

BOOK_____ PAGE_____

JOB No: 45-100648

CLIENT: MARICOPA CO FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICKO

DATE: 5-15-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

LE NAME: ~~1PDS135B~~

POINT RANGE:

JRPOSE OF SURVEY:

(T) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

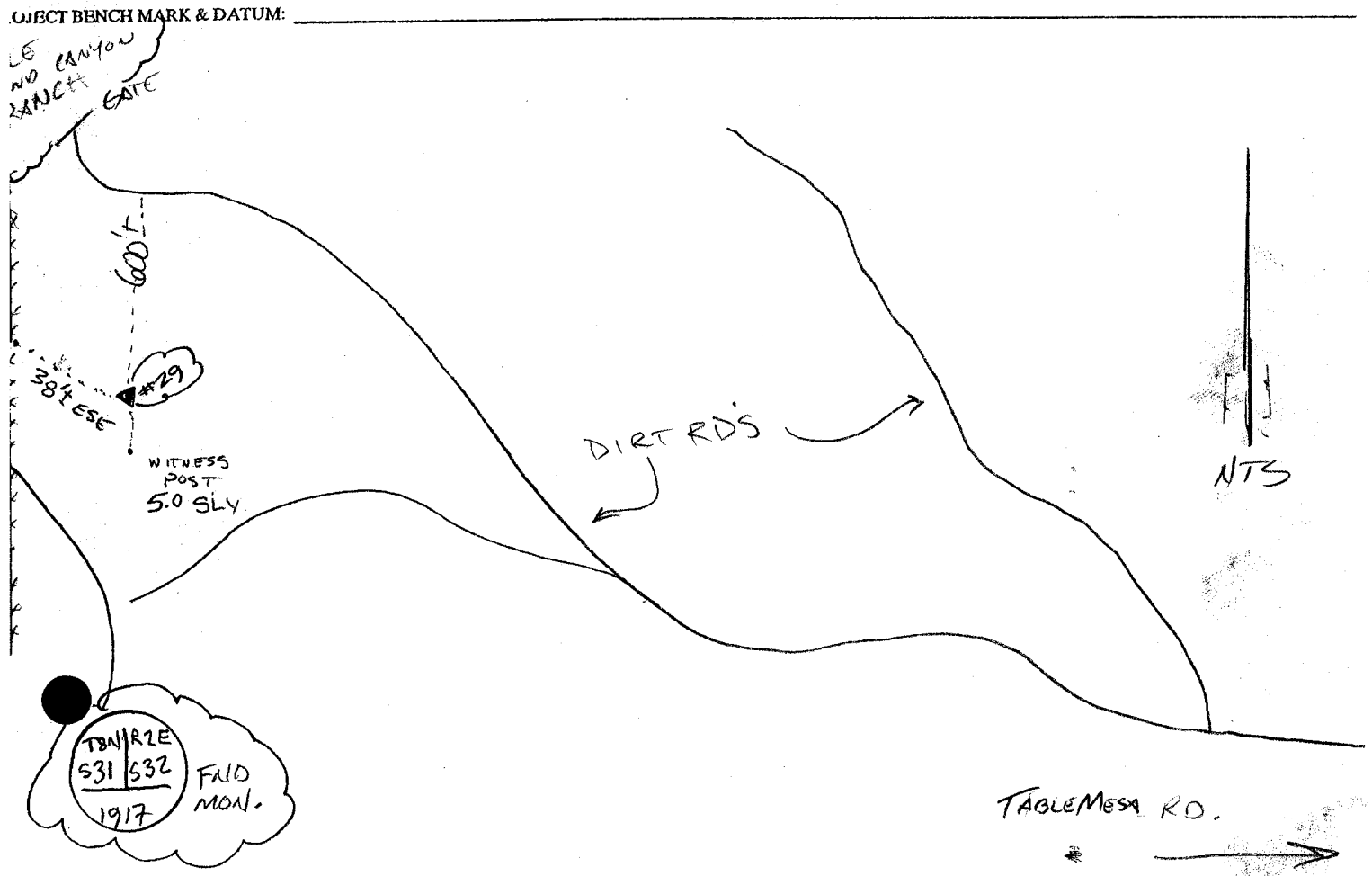
(S) SUBDRAIN LOCATION

(G) GIS

ESCRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

ORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC ~~WAY PT # 108~~ N/33-59-14 W/112-11-13

OJECT BENCH MARK & DATUM:



BOOK_____ PAGE ~~102~~ 30

JOB No: 45-100648

CLIENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICKO

DATE: 5-14-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

FILE NAME: ~~1RD5134B~~

POINT RANGE: _____

PURPOSE OF SURVEY:

(D) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(F) SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

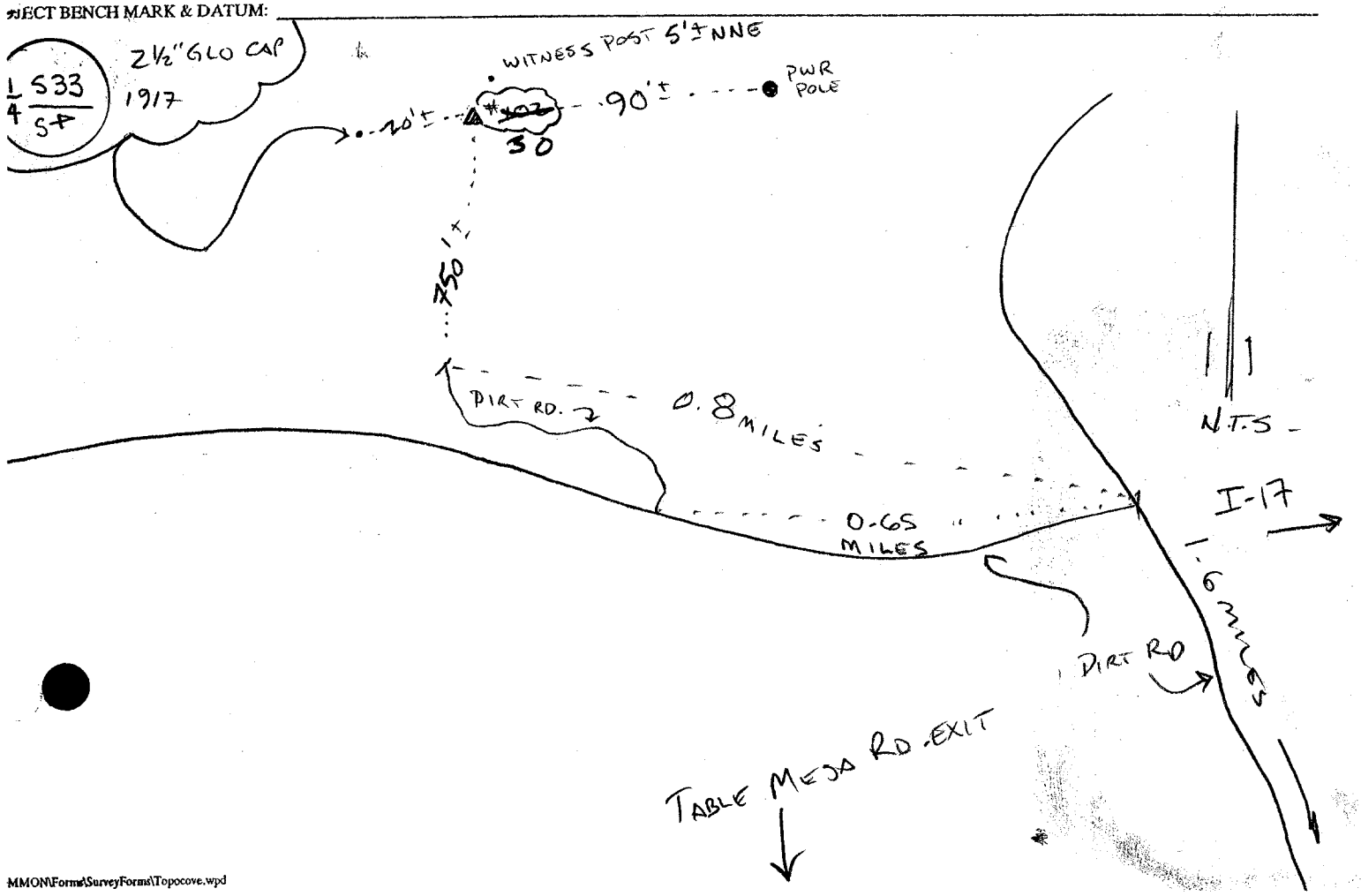
(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

(G) GIS

DESCRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

HORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC ~~WAY PT-#102~~ N33-59-13 W112-09-39

PROJECT BENCH MARK & DATUM: _____



BOOK_____ PAGE ~~42~~ 31

JOB No: 45-100648

LIENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

ARTY CHIEF: KLEIN

REW: WILLIS, WASHICKO

ATE: 5-15-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

E NAME: 1PD5135B

POINT RANGE: _____

POSE OF SURVEY:

) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

) SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

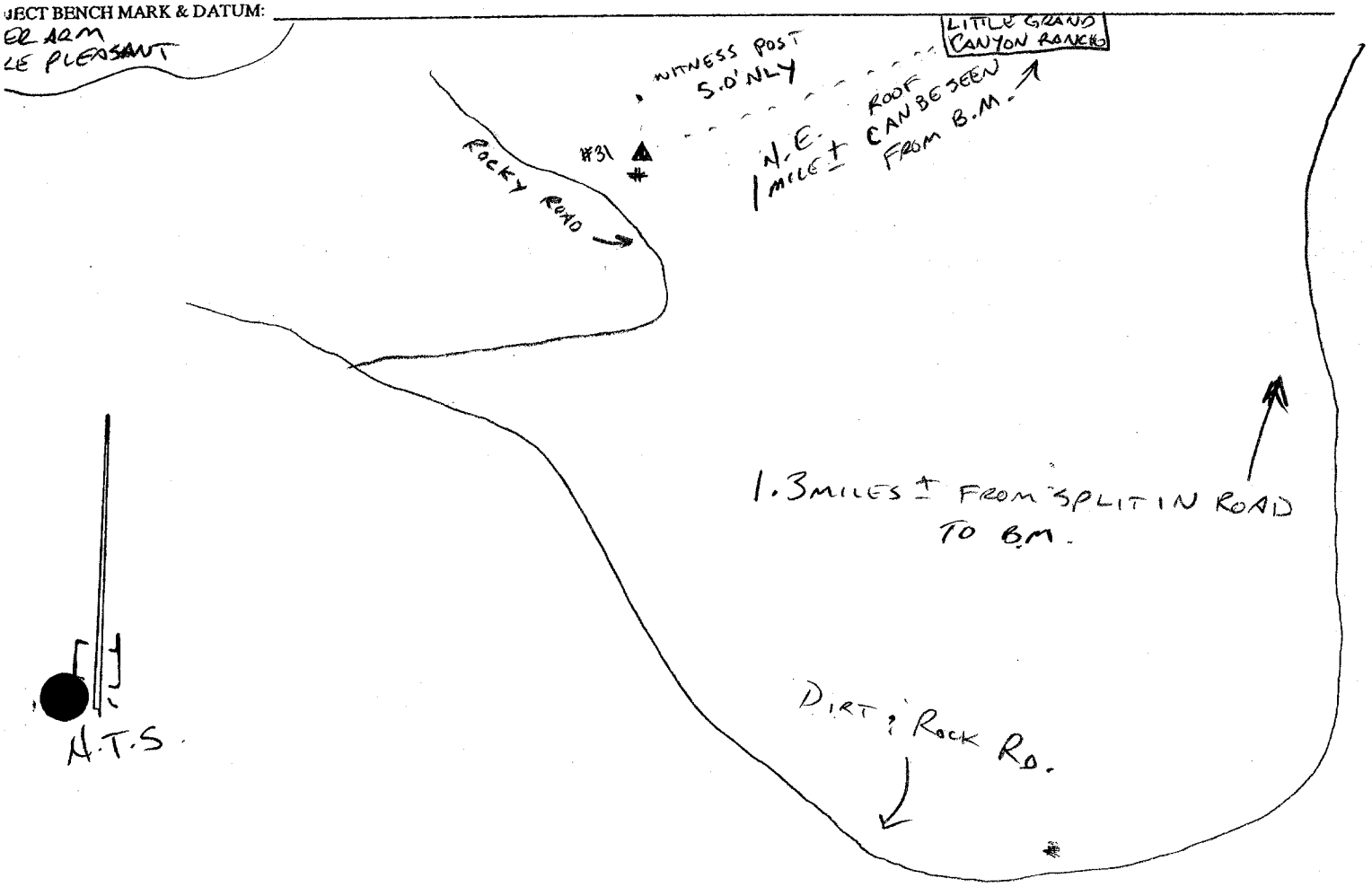
(G) GIS

CRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

IZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC WAY PT # ~~#2~~ N33-58-14 W112-11-54

JECT BENCH MARK & DATUM:

ER ARM
LE PLEASANT



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BOOK_____ PAGE _____ #32

JOB No: 45-100648

IENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

RTY CHIEF: KLEIN

EW: WILLIS, WASAICKO

TE: 5-15-2002

RBF CONSULTING

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

NAME: ~~4PD5135B~~

POINT RANGE: _____

'OSE OF SURVEY:

EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

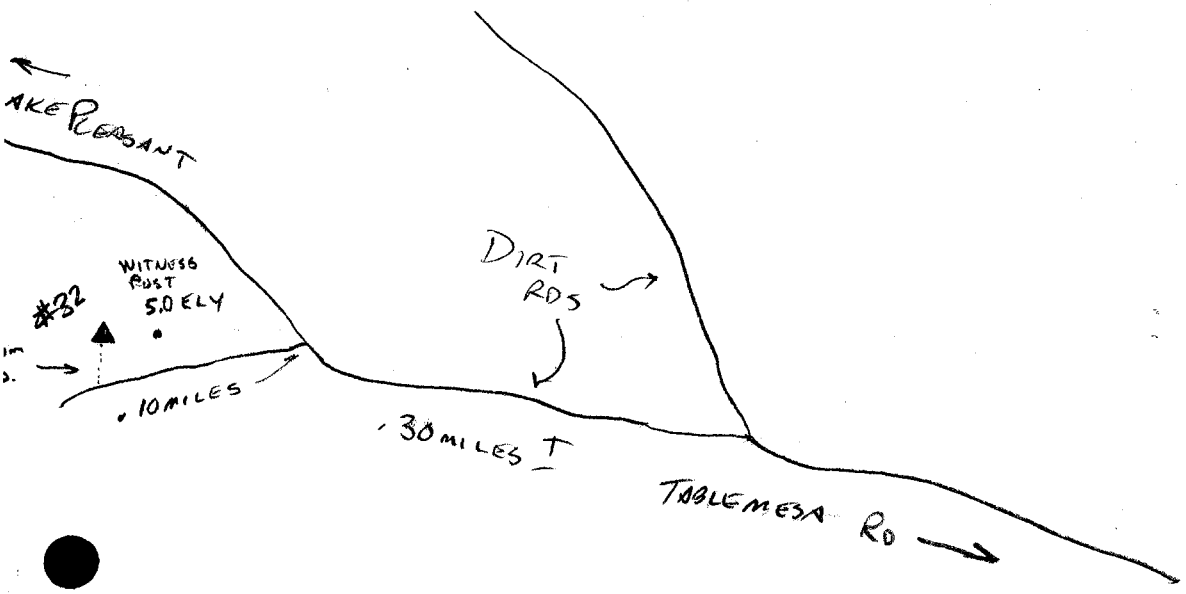
(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

(G) GIS

RIPTION: SETTING FLOOD CONTROL BENCHMARKS (U.A.F.)

OF HORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC WAS ~~PT. #111~~ N 33-58-40 W 112-11-34

ECT BENCH MARK & DATUM: _____



N.T.S.

~~17~~ 33

BOOK_____ PAGE_____

JOB No: 45-100648

CLIENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICKO

DATE: 5-15-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

FILE NAME: ~~1 PDS735B~~

POINT RANGE: _____

PURPOSE OF SURVEY:

(C) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(D) SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

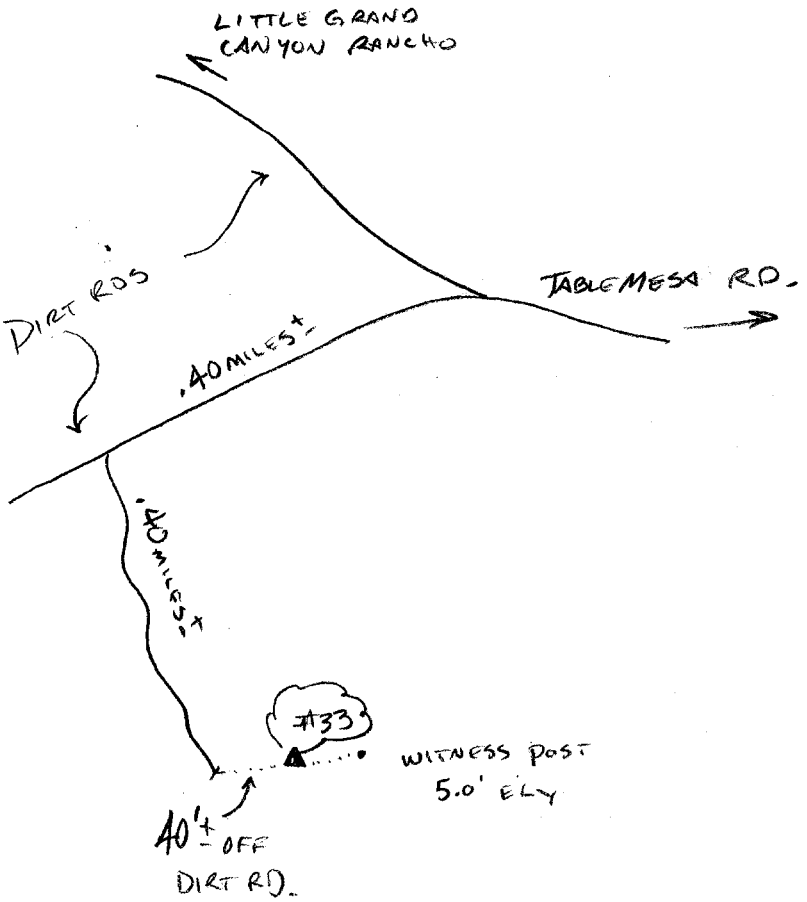
(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

(G) GIS

DESCRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

HORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC WAY ~~PT # 110~~ N 33-58.39 W 112-11-01

PROJECT BENCH MARK & DATUM: _____



BOOK_____ PAGE ~~107~~ 34

JOB No: 45-100648

CLIENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

PARTY CHIEF: KLEIN

CREW: WILLIS, WASHICKO

DATE: 5-14-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

FILE NAME: ~~1PD51345~~

POINT RANGE: A

PURPOSE OF SURVEY:

(C) EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

(D) SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

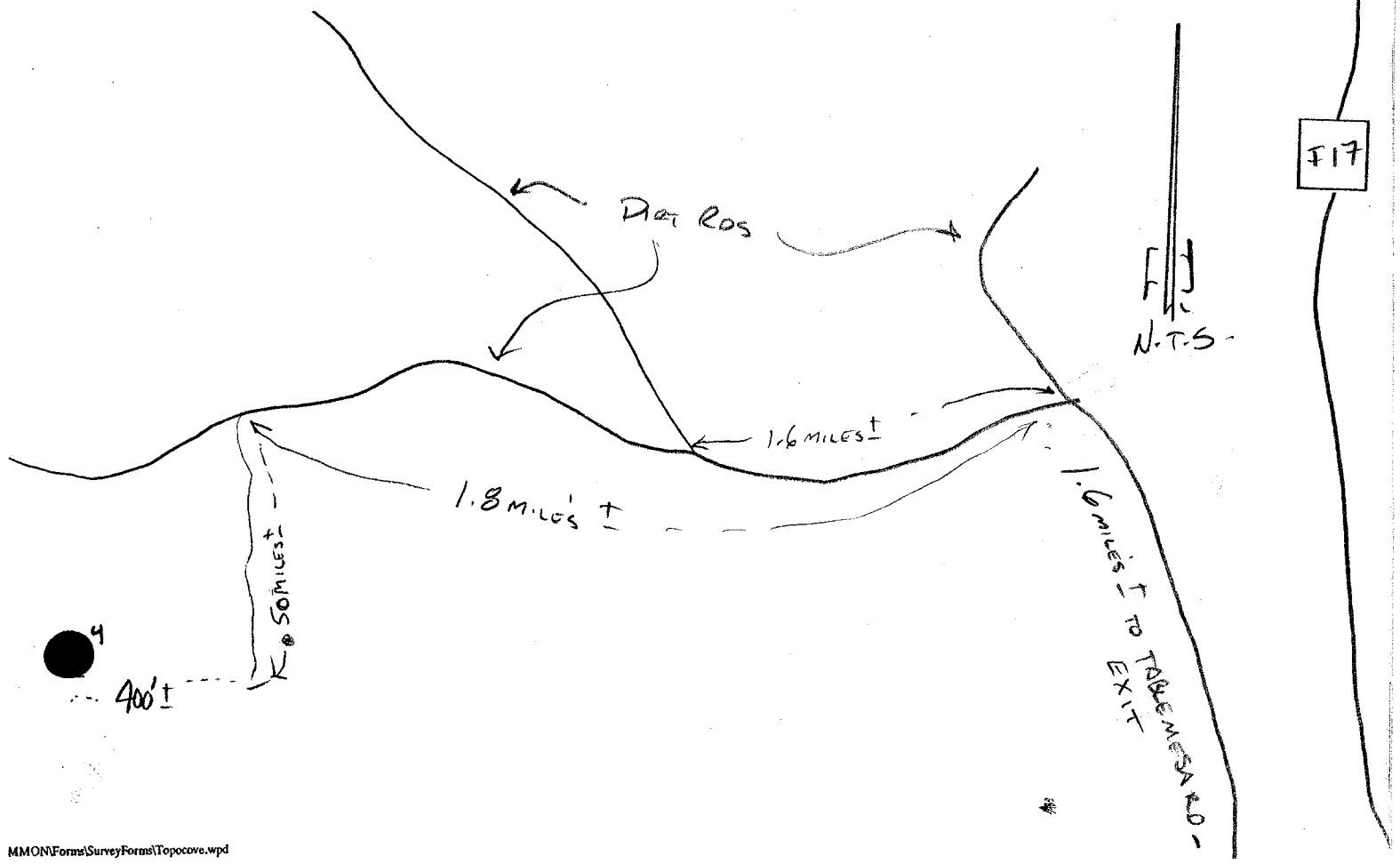
(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

(G) GIS

DESCRIPTION: SETTING FLOOD CONTROL BENCH MARKS (U.A.F.)

HORIZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC ~~WAYPT # 107~~ / 33-58-48 W 112-10-40

PROJECT BENCH MARK & DATUM:



F17

BOOK_____ PAGE_____

JOB No: 45-100648

IENT: MARICOPA CO. FLOOD CONTROL DIST.

TOPOGRAPHY COVER SHEET

RTY CHIEF: KLEIN

EW: WILLIS, WASHICKO

TE: 5-14-2002

RBF CONSULTING
PLANNING DESIGN CONSTRUCTION
16605 N 28th Avenue Suite 100 Phoenix Arizona 85053
(602) 467-2200 Fax (602) 467-2201

NAME: ~~4PD5134B~~

POINT RANGE: _____

POSE OF SURVEY:

EARTH QUANTITY TOPO
- ☐ ALLUVIAL REMOVAL
- ☐ WET ALLUVIAL REMOVAL
- ☐ BUTTRESS/KEYWAY REMOVAL
- ☐ LAND SLIDE REMOVAL
- ☐ OVER-EXCAVATION
- ☐ STOCK PILE

SUBDRAIN LOCATION

(A) AS-CONSTRUCTED TOPO
- ☐ ROUGH GRADE VERIFICATION
- ☐ PRECISE GRADE VERIFICATION
- ☐ IMPROVEMENT VERIFICATION

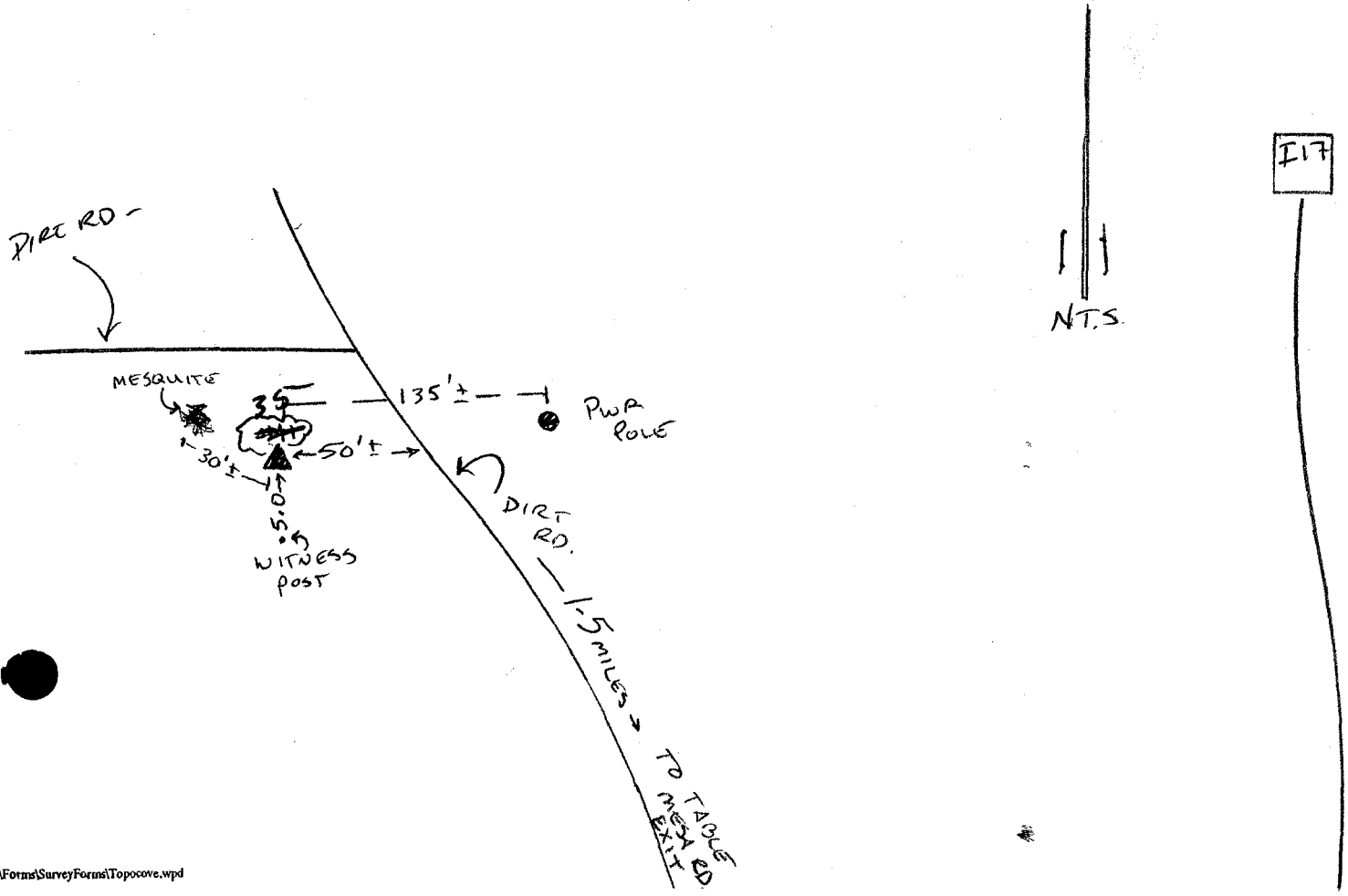
(E) EXISTING SITE TOPO
- ☐ AERIAL PROFILE CHECK
- ☐ FOR DESIGN

(G) GIS

RIPTION: SETTING FLOOD CONTROL BENCH MARK (U.A.F.)

F ZONTAL CONTROL: ☐ IMPERIAL ☐ METRIC ~~WAY PT. 41~~ N 35-59-06 W 112-08-40

ECT BENCH MARK & DATUM: _____



D.1 Precipitation Data

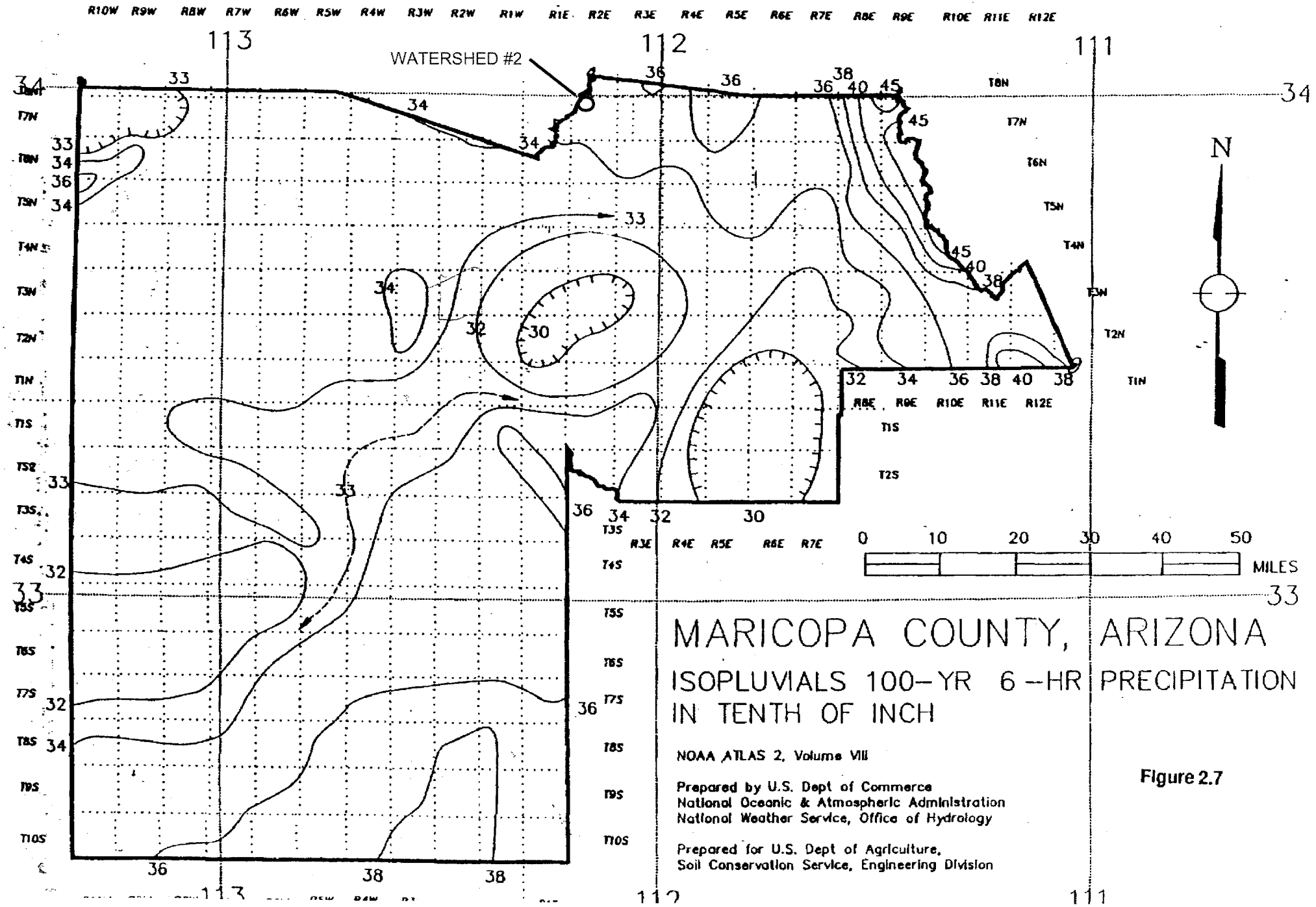
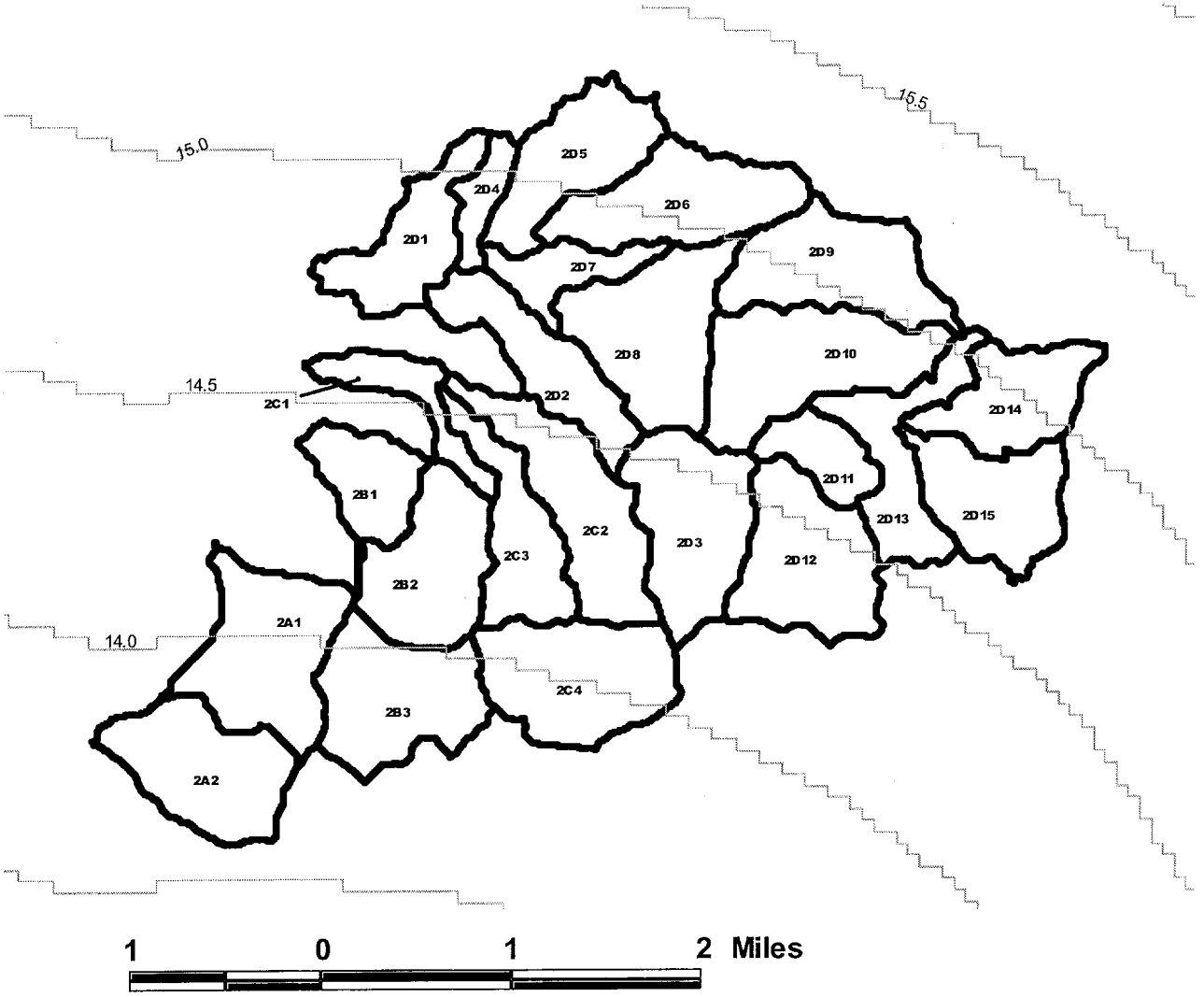
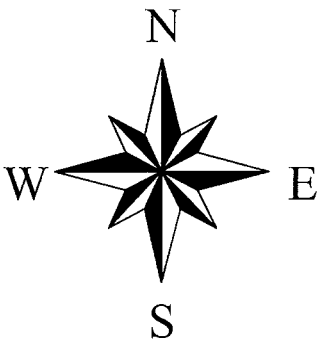

WATERSHED #2
N
0 10 20 30 40 50
MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.7

AVERAGE ANNUAL RAINFALL





Contours of Average Annual Rainfall
Sub-Basin Boundaries

D.2 Physical Parameter Calculations

NMIN Calculations

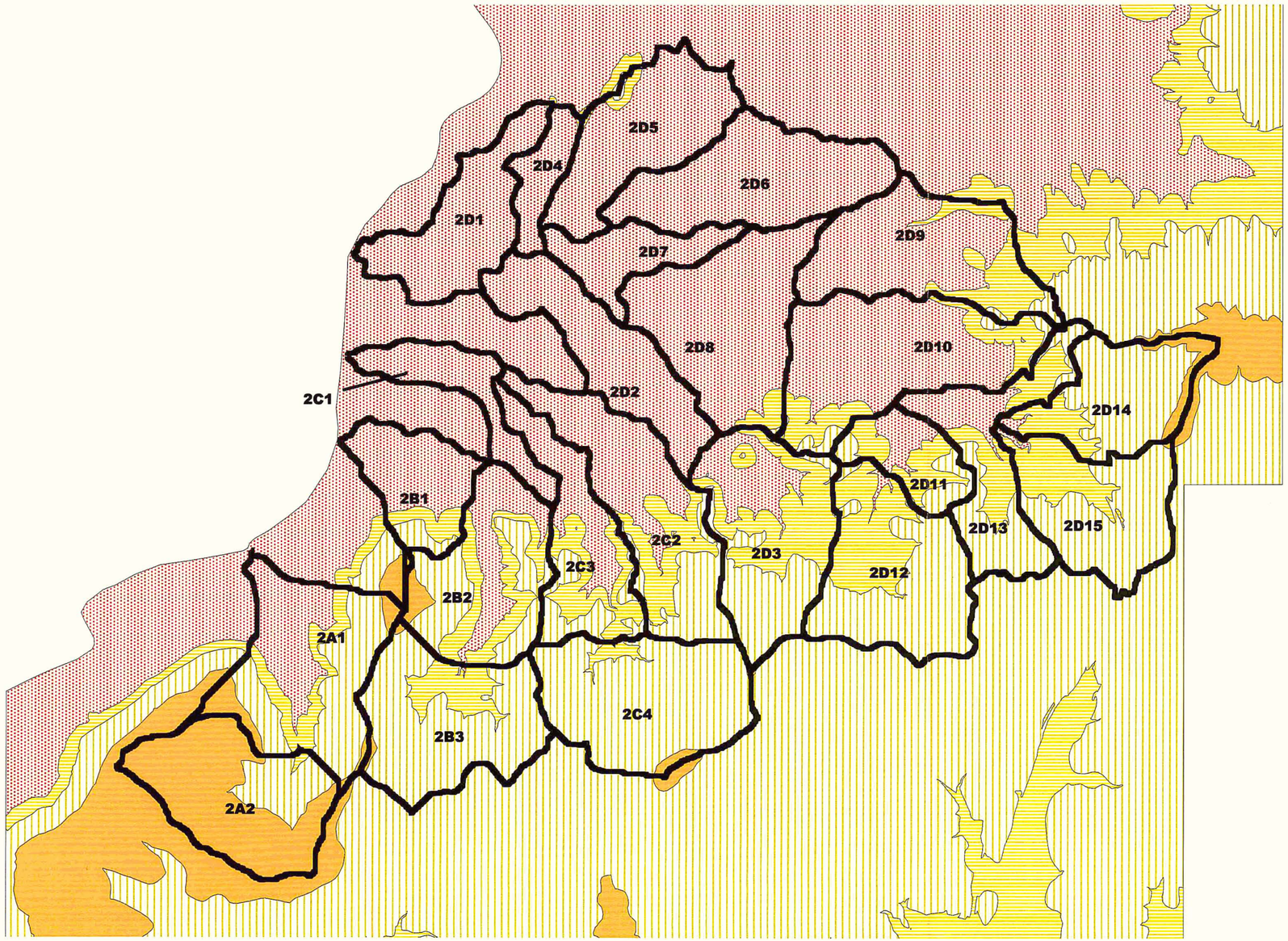
Sub Basin	Area	IA	DTHETA	PSIF	XKSAT	RTIMP	T_C	R	$0.10T_C$	$0.15T_C$	$0.25T_C$
2A1	0.5744	0.150	0.343	7.105	0.114	22.800	0.471	0.305	3	4	7
2A2	0.5000	0.150	0.196	10.967	0.280	9.700	0.388	0.217	2	3	6
2B1	0.2699	0.150	0.390	5.737	0.189	33.600	0.429	0.357	3	4	6
2B2	0.4775	0.150	0.350	4.535	0.344	27.500	0.475	0.329	3	4	7
2B3	0.5225	0.150	0.368	5.181	0.257	21.600	0.396	0.206	2	4	6
2C1	0.1970	0.150	0.370	5.220	0.231	3.000	0.679	0.925	4	6	10
2C2	0.5345	0.150	0.350	4.591	0.325	14.800	0.733	0.731	4	7	11
2C3	0.3696	0.150	0.350	4.336	0.385	24.100	0.650	0.701	4	6	10
2C4	0.5624	0.150	0.350	4.491	0.369	26.500	0.417	0.215	3	4	6
2D1	0.3569	0.150	0.383	6.339	0.148	11.227	0.550	0.482	3	5	8
2D2	0.3902	0.150	0.397	5.932	0.170	9.300	0.771	0.808	5	7	12
2D3	0.5354	0.150	0.354	4.936	0.278	17.600	0.513	0.357	3	5	8
2D4	0.1235	0.150	0.390	5.720	0.187	25.800	0.392	0.400	2	4	6
2D5	0.4188	0.150	0.350	4.644	0.302	9.300	0.846	0.776	5	8	13
2D6	0.5000	0.150	0.350	4.559	0.320	0.000	1.042	0.995	6	9	16
2D7	0.1990	0.150	0.392	6.165	0.157	0.000	0.767	0.924	5	7	12
2D8	0.5759	0.150	0.397	6.058	0.164	8.300	0.592	0.354	4	5	9
2D9	0.5211	0.144	0.363	6.339	0.150	9.500	0.738	0.645	4	7	11
2D10	0.6188	0.147	0.382	5.798	0.181	8.600	0.683	0.504	4	6	10
2D11	0.1971	0.150	0.380	5.465	0.218	0.000	0.367	0.269	2	3	6
2D12	0.5322	0.150	0.380	5.421	0.227	11.900	0.467	0.285	3	4	7
2D13	0.3812	0.143	0.366	5.664	0.205	20.800	0.525	0.453	3	5	8
2D14	0.3677	0.138	0.343	5.305	0.242	27.400	0.508	0.438	3	5	8
2D15	0.4242	0.138	0.339	5.181	0.256	35.300	0.563	0.436	3	5	8
									6	4	6

TRY NMIN = 6 MINUTES
GIVES LOWER PEAK FLOWS

TRY NMIN= 4 MINUTES
GIVES LOWER PEAK FLOWS

USE NMIN = 5 MINUTES

VEGETATIVE COVER BASED ON ELEVATION



LEGEND

Sub-Basin Boundaries

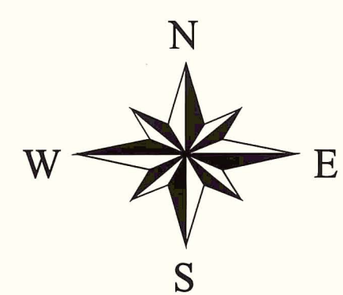
VEGETATIVE COVER

- 20
- 25
- 30
- 35

The percent vegetative cover has been calculated basend on recommendations by the FCDMC.

The following table lists the % and elevation ranges:

Elevation	% Vegetative Cover
3000+	40%
2600-3000	35%
2200-2600	30%
2100-2200	25%
<2100	20%



```
1, "Recreational Open Space, 20% Vegetative Cover", 0.100000, 0.00,
20.00, "normal"
2, "Recreational Open Space, 25% Vegetative Cover", 0.100000, 0.00,
25.00, "normal"
3, "Recreational Open Space, 30% Vegetative Cover", 0.100000, 0.00,
30.00, "normal"
4, "Transportation, 20% Vegetative Cover", 0.100000, 80.00, 20.00,
"normal"
5, "Transportation, 25% Vegetative Cover", 0.100000, 80.00, 25.00,
"normal"
6, "Transportation, 30% Vegetative Cover", 0.100000, 80.00, 30.00,
"normal"
7, "Vacant, 20% Vegetative Cover", 0.150000, 0.00, 20.00, "dry"
8, "Vacant, 25% Vegetative Cover", 0.150000, 0.00, 25.00, "dry"
9, "Vacant, 30% Vegetative Cover", 0.150000, 0.00, 30.00, "dry"
10, "Vacant, 35% Vegetative Cover", 0.150000, 0.00, 35.00, "dry"
11, "Water", 0.000000, 0.00, 0.00, "wet"
12, "Water", 0.000000, 0.00, 0.00, "wet"
13, "Water", 0.000000, 0.00, 0.00, "wet"
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1, "Agualt fine sandy loam", 0.250000, 0.00, 100.00
2, "Agualt loam", 0.250000, 0.00, 100.00
3, "Alluvial land", 1.200000, 0.00, 100.00
4, "Antho sandy loam, 0 to 1 percent slopes", 0.400000, 0.00, 100.00
5, "Antho sandy loam, 1 to 3 percent slopes", 0.400000, 0.00, 100.00
6, "Antho gravelly sandy loam, 1 to 3 percent slopes", 0.400000, 0.00,
100.00
7, "Avondale clay loam", 0.040000, 0.00, 100.00
8, "Carrizo gravelly loamy sand", 1.200000, 0.00, 100.00
9, "Carrizo fine sandy loam", 0.250000, 0.00, 100.00
10, "Cashion clay", 0.010000, 0.00, 100.00
11, "Cavelt gravelly loam, 1 to 5 percent slopes", 0.400000, 0.00, 100.00
12, "Contine clay loam", 0.040000, 0.00, 100.00
13, "Estrella loam", 0.250000, 0.00, 100.00
14, "Gravel pit", 0.000000, 0.00, 100.00
15, "Gilman fine sandy loam", 0.250000, 0.00, 100.00
16, "Gilman loam", 0.250000, 0.00, 100.00
17, "Glenbar clay loam", 0.040000, 0.00, 100.00
18, "Gravelly alluvial land", 1.200000, 0.00, 100.00
19, "Laveen loam, 0 to 1 percent slopes", 0.250000, 0.00, 100.00
20, "Laveen loam, 1 to 3 percent slopes", 0.250000, 0.00, 100.00
21, "Laveen clay loam, 0 to 1 percent slopes", 0.040000, 0.00, 100.00
22, "Mohall sandy loam", 0.400000, 0.00, 100.00
23, "Mohall loam", 0.250000, 0.00, 100.00
24, "Pimer clay loam", 0.040000, 0.00, 100.00
25, "Pinal gravelly loam, 0 to 1 percent slopes", 0.400000, 0.00, 100.00
26, "Pinal gravelly loam, 1 to 3 percent slopes", 0.400000, 0.00, 100.00
27, "Pinal loam, moderately deep variant", 0.250000, 0.00, 100.00
28, "Pinamt very gravelly loam, 0 to 1 percent slopes", 0.400000, 0.00,
100.00
29, "Pinamt very gravelly loam, 3 to 5 percent slopes", 0.400000, 0.00,
100.00
30, "Rillito gravelly loam, 0 to 1 percent slopes", 0.400000, 0.00,
100.00
31, "Rillito gravelly loam, 1 to 3 percent slopes", 0.400000, 0.00,
100.00
32, "Rock land", 0.250000, 65.00, 100.00
33, "Rough broken land", 0.400000, 20.00, 100.00
34, "Tremant gravelly loam, 1 to 3 percent slopes", 0.100000, 0.00,
100.00
35, "Trix clay loam", 0.040000, 0.00, 100.00
36, "Valencia sandy loam", 0.400000, 0.00, 100.00
37, "Vecont clay", 0.010000, 0.00, 100.00
38, "Vint loamy fine sand", 1.200000, 0.00, 100.00
39, "Lakes, ponds, reservoirs - perennial", 0.000000, 0.00, 100.00
40, "Antho sandy loams", 0.410000, 0.00, 100.00
41, "Antho gravelly sandy loams", 0.410000, 0.00, 100.00
42, "Antho-Carrizo-Maripo complex", 0.580000, 0.00, 100.00
43, "Antho-Carrizo-Maripo complex, low precipitation", 0.580000, 0.00,
100.00
44, "Anthony sandy loam", 0.430000, 0.00, 100.00
45, "Anthony-Arizo complex", 0.620000, 0.00, 100.00
46, "Anthony-Arizo complex, low precipitation", 0.620000, 0.00, 100.00
47, "Arizo cobbly sandy loam", 0.960000, 0.00, 100.00
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48, "Beeline-Cipriano complex, 3 to 45 percent slopes", 0.270000, 0.00, 100.00
49, "Brios-Carrizo complex, 1 to 5 percent slopes", 0.940000, 0.00, 100.00
50, "Brios-Carrizo complex, low precipitation, 1 to 5 percent slopes", 0.940000, 0.00, 100.00
51, "Carefree cobbly clay loam, 1 to 8 percent slopes", 0.010000, 0.00, 100.00
52, "Carefree-Beardsley complex", 0.010000, 0.00, 100.00
53, "Carrizo very gravelly sand", 1.040000, 0.00, 100.00
54, "Carrizo-Gunsight complex, 1 to 5 percent slopes", 0.540000, 0.00, 100.00
55, "Cellar-Rock outcrop complex, 10 to 70 percent slopes", 0.440000, 15.00, 100.00
56, "Cellar-Rock outcrop complex, low precipitation, 10 to 70 percent slopes", 0.440000, 15.00, 100.00
57, "Cherioni-Rock outcrop complex, 5 to 60 percent slopes", 0.330000, 15.00, 100.00
58, "Chuckawalla-Gunsight complex, 1 to 8 percent slopes", 0.190000, 0.00, 100.00
59, "Chuckawalla-Gunsight complex, low precipitation, 1 to 8 percent slopes", 0.190000, 0.00, 100.00
60, "Cipriano very gravelly loam", 0.380000, 0.00, 100.00
61, "Contine clay loam", 0.040000, 0.00, 100.00
62, "Contine clay", 0.010000, 0.00, 100.00
63, "continental clay loam, 0 to 3 percent slopes", 0.020000, 0.00, 100.00
64, "Continental clay, 0 to 3 percent slopes", 0.020000, 0.00, 100.00
65, "Continental cobbly clay loam, 1 to 8 percent slopes", 0.010000, 0.00, 100.00
66, "Continental-Mohave complex, 1 to 7 percent slopes", 0.010000, 0.00, 100.00
67, "Continental-Ohaco complex", 0.020000, 0.00, 100.00
68, "Denure-Momoli-Carrizo complex", 0.340000, 0.00, 100.00
69, "Denure-Momoli-Carrizo complex, low precipitation", 0.340000, 0.00, 100.00
70, "Dixaleta-Rock outcrop complex, 25 to 65 percent slopes", 0.330000, 35.00, 100.00
71, "Dixaleta-Rock outcrop complex, low precipitation, 25 to 65 percent slopes", 0.330000, 35.00, 100.00
72, "Eba very gravelly loam, 1 to 8 percent slopes", 0.230000, 0.00, 100.00
73, "Eba very gravelly loam, 8 to 20 percent slopes", 0.230000, 0.00, 100.00
74, "Eba very gravelly loam, low precipitation, 8 to 20 percent slopes", 0.230000, 0.00, 100.00
75, "Eba-Continental complex, 1 to 8 percent slopes", 0.070000, 0.00, 100.00
76, "Eba-Continental-Cave association, 3 to 20 percent slopes", 0.130000, 0.00, 100.00
77, "Eba-Continental-Cave association, low precipitation, 3 to 20 percent", 0.130000, 0.00, 100.00
78, "Eba-Nickel-Cave association, 3 to 25 percent slopes", 0.290000, 0.00, 100.00

79, "Eba-Pinaleno complex, 3 to 20 percent slopes", 0.170000, 0.00, 100.00
80, "Eba-Pinaleno complex, 20 to 40 percent slopes", 0.170000, 0.00, 100.00
81, "Eba-Pinaleno complex, low precipitation, 3 to 20 percent slopes", 0.170000, 0.00, 100.00
82, "Eba-Pinaleno complex, low precipitation, 20 to 40 percent slopes", 0.170000, 0.00, 100.00
83, "Ebon very gravelly loam, 1 to 8 percent slopes", 0.030000, 0.00, 100.00
84, "Ebon very gravelly loam, 8 to 20 percent slopes", 0.030000, 0.00, 100.00
85, "Ebon-Contine complex, 1 to 8 percent", 0.030000, 0.00, 100.00
86, "Ebon-Gunsight-Cipriano association, 3 to 25 percent slopes", 0.110000, 0.00, 100.00
87, "Ebon-Pinamt complex, 3 to 20 percent slopes", 0.060000, 0.00, 100.00
88, "Ebon-Pinamt complex, 20 to 40 percent slopes", 0.060000, 0.00, 100.00
89, "Estrella loams", 0.260000, 0.00, 100.00
90, "Gachado-Lomitas complex, 8 to 25 percent slopes", 0.240000, 0.00, 100.00
91, "Gachado-Lomitas-Rock outcrop complex, 7 to 55 percent slopes", 0.160000, 20.00, 100.00
92, "Gadsden clay", 0.020000, 0.00, 100.00
93, "Gila fine sandy loams", 0.290000, 0.00, 100.00
94, "Gilman loams", 0.270000, 0.00, 100.00
95, "Gilman loams, low precipitation", 0.270000, 0.00, 100.00
96, "Gilman clay loam", 0.060000, 0.00, 100.00
97, "Gilman-Momoli-Denure complex", 0.340000, 0.00, 100.00
98, "Gilman-Momoli-Denure complex, low precipitation", 0.340000, 0.00, 100.00
99, "Glenbar loams", 0.260000, 0.00, 100.00
100, "Gran-Wickenburg complex, 1 to 10 percent slopes", 0.150000, 0.00, 100.00
101, "Gran-Wickenburg complex, low precipitation, 1 to 10 percent slopes", 0.150000, 0.00, 100.00
102, "Gran-Wickenburg-Rock outcrop complex, 1 to 7 percent slopes", 0.140000, 25.00, 100.00
103, "Gran-Wickenburg-Rock outcrop complex, low precipitation, 10 to 65 percent slopes", 0.140000, 25.00, 100.00
104, "Greyeagle-Continental-Nickel association, 1 to 40 percent slopes", 0.190000, 0.00, 100.00
105, "Greyeagle-Suncity Variant complex, 1 to 7 percent slopes", 0.230000, 0.00, 100.00
106, "Guest clay", 0.010000, 0.00, 100.00
107, "Gunsight-Cipriano complex, 1 to 7 percent slopes", 0.630000, 0.00, 100.00
108, "Gunsight-Cipriano complex, low precipitation, 1 to 7 percent slopes", 0.630000, 0.00, 100.00
109, "Gunsight-Rillito complex, 1 to 25 percent slopes", 0.360000, 0.00, 100.00
110, "Gunsight-Rillito complex, low precipitation, 1 to 40 percent slopes", 0.360000, 0.00, 100.00
111, "Lehmans-Rock outcrop complex, 8 to 65 percent slopes", 0.090000,

30.00, 100.00
112, "Lehmans-Rock outcrop complex, low precipitation, 8 to 65 percent slopes", 0.090000, 30.00, 100.00
113, "Luke-Cipriano association, 1 to 15 percent slopes", 0.080000, 0.00, 100.00
114, "Mohall loam", 0.230000, 0.00, 100.00
115, "Mohall loam, calcareous solum", 0.230000, 0.00, 100.00
116, "Mohall clay loam", 0.050000, 0.00, 100.00
117, "Mohall clay loam, calcareous solum", 0.050000, 0.00, 100.00
118, "Mohall clay", 0.020000, 0.00, 100.00
119, "Mohall-Tremant complex, 1 to 8 percent slopes", 0.080000, 0.00, 100.00
120, "Mohall-Tremant complex, low precipitation, 1 to 8 percent slopes", 0.080000, 0.00, 100.00
121, "Mohave sandy loam", 0.040000, 0.00, 100.00
122, "Mohave loam", 0.040000, 0.00, 100.00
123, "Mohave loam, calcareous solum", 0.050000, 0.00, 100.00
124, "Mohave clay loam", 0.040000, 0.00, 100.00
125, "Mohave clay loam, calcareous solum", 0.050000, 0.00, 100.00
126, "Mohave complex", 0.040000, 0.00, 100.00
127, "Mohave-Guest complex", 0.020000, 0.00, 100.00
128, "Mohave-Tres Hermanos complex, 1 to 8 percent slopes", 0.060000, 0.00, 100.00
129, "Momoli gravelly sandy loam, 1 to 5 percent slopes", 0.390000, 0.00, 100.00
130, "Momoli-Carrizo complex", 0.930000, 0.00, 100.00
131, "Momoli-Carrizo complex, low precipitation", 0.930000, 0.00, 100.00
132, "Nickel-Cave complex, 8 to 30 percent slopes", 0.330000, 0.00, 100.00
133, "Nickel-Cave complex, low precipitation, 8 to 30 percent slopes", 0.330000, 0.00, 100.00
134, "Ohaco gravelly loam", 0.040000, 0.00, 100.00
135, "Pinaleno-Tres Hermanos complex, 1 to 10 percent slopes", 0.070000, 0.00, 100.00
136, "Pinaleno-Tres Hermanos complex, low precipitation, 1 to 10 percent slopes", 0.070000, 0.00, 100.00
137, "Pinamt-Tremant complex, 1 to 10 percent slopes", 0.370000, 0.00, 100.00
138, "Pinamt-Tremant complex, low precipitation, 1 to 10 percent slopes", 0.370000, 0.00, 100.00
139, "Quilotosa-Vaiva-Rock outcrop complex, 20 to 65 percent slopes", 0.400000, 20.00, 100.00
140, "Rillito loam, 0 to 3 percent slopes", 0.280000, 0.00, 100.00
141, "Rillito gravelly loam, 1 to 8 percent slopes", 0.400000, 0.00, 100.00
142, "Rock outcrop-Gachado complex, 5 to 55 percent slopes", 0.100000, 65.00, 100.00
143, "Rock outcrop-Lehmans complex, 15 to 65 percent slopes", 0.140000, 60.00, 100.00
144, "Rock outcrop-Lehmans complex, low precipitation, 15 to 65 percent slopes", 0.140000, 60.00, 100.00
145, "Sal-Cipriano complex, 1 to 10 percent slopes", 0.180000, 0.00, 100.00
146, "Sal-Cipriano complex, low precipitation, 1 to 10 percent slopes",

0.180000, 0.00, 100.00
147, "Schenco-Rock outcrop complex, 3 to 25 percent slopes", 0.310000, 30.00, 100.00
148, "Schenco-Rock outcrop complex, 25 to 60 percent slopes", 0.350000, 35.00, 100.00
149, "Suncity-Cipriano complex, 1 to 7 percent slopes", 0.130000, 0.00, 100.00
150, "Torriorthents, 15 to 40 percent slopes", 0.400000, 0.00, 100.00
151, "Tremant gravelly sandy loams", 0.390000, 0.00, 100.00
152, "Tremant gravelly loams", 0.390000, 0.00, 100.00
153, "Tremant gravelly loams, low precipitation", 0.390000, 0.00, 100.00
154, "Tremant-Antho complex, 1 to 5 percent slopes", 0.390000, 0.00, 100.00
155, "Tremant-Gunsight-Rillito complex, 1 to 5 percent slopes", 0.230000, 0.00, 100.00
156, "Tremant-Gunsight-Rillito complex, low precipitation, 1 to 5 percent slopes", 0.230000, 0.00, 100.00
157, "Tremant-Rillito complex", 0.420000, 0.00, 100.00
158, "Tremant-Suncity complex, 1 to 8 percent slopes", 0.140000, 0.00, 100.00
159, "Tres Hermanos gravelly sandy loams", 0.060000, 0.00, 100.00
160, "Tres Hermanos-Anthony complex, 1 to 5 percent slopes", 0.120000, 0.00, 100.00
161, "Vado gravelly sandy loam, 1 to 5 percent slopes", 0.330000, 0.00, 100.00
162, "Vaiva very gravelly loam, 1 to 20 percent slopes", 0.370000, 0.00, 100.00
163, "Valencia sandy loams", 0.390000, 0.00, 100.00
164, "Vint loamy fine sand", 0.430000, 0.00, 100.00
165, "Lakes, ponds, reservoirs - perennial", 0.000000, 0.00, 100.00
166, "Antho-Carrizo complex, 0 to 3 percent slopes", 0.400000, 0.00, 100.00
167, "Antho-Tremant complex, 1 to 5 percent slopes", 0.380000, 0.00, 100.00
168, "Antho association", 0.400000, 0.00, 100.00
169, "Antho-Valencia association", 0.390000, 0.00, 100.00
170, "Agualt loam", 0.260000, 0.00, 100.00
171, "Anthosandy loam, 0 to 1 percent slopes", 0.380000, 0.00, 100.00
172, "Antho sandy loam, 1 to 3 percent slopes", 0.390000, 0.00, 100.00
173, "Antho sandy loam, saline-alkali", 0.390000, 0.00, 100.00
174, "Antho gravelly sandy loam, 0 to 1 percent slopes", 0.400000, 0.00, 100.00
175, "Antho gravelly sandy loam, 1 to 3 percent slopes", 0.400000, 0.00, 100.00
176, "Antho-Brios sandy loams", 0.390000, 0.00, 100.00
177, "Antho-Carrizo complex, 0 to 1 percent slopes", 0.380000, 0.00, 100.00
178, "Antho-Carrizo complex, 1 to 3 percent slopes", 0.400000, 0.00, 100.00
179, "Antho-Tremant-Mohall complex, 1 to 5 percent slopes", 0.270000, 0.00, 100.00
180, "Avonda clay loam", 0.050000, 0.00, 100.00
181, "Avondale clay loam", 0.040000, 0.00, 100.00
182, "Avondale clay loam, saline-alkali", 0.040000, 0.00, 100.00

183, "Beardsley loam", 0.240000, 0.00, 100.00
184, "Borrow pit", 0.000000, 0.00, 100.00
185, "Brios loamy sand", 1.050000, 0.00, 100.00
186, "Brios sandy loam", 0.390000, 0.00, 100.00
187, "Brios loam", 0.250000, 0.00, 100.00
188, "Calciorthids and Torriorthents, eroded", 0.380000, 0.00, 100.00
189, "Carrizo and Brios soils", 0.500000, 0.00, 100.00
190, "Cherioni-Rock outcrop complex", 0.290000, 20.00, 100.00
191, "Coolidge-Laveen association", 0.390000, 0.00, 100.00
192, "Carrizo gravelly sandy loam", 0.400000, 0.00, 100.00
193, "Carrizo-Ebon complex, 3 to 12 percent slopes", 0.190000, 0.00, 100.00
194, "Casa Grande Sandy loam", 0.240000, 0.00, 100.00
195, "Casa Grande loam", 0.240000, 0.00, 100.00
196, "Casa Grande complex", 0.300000, 0.00, 100.00
197, "Casa Grande-Leveen complex, alkali", 0.260000, 0.00, 100.00
198, "Cashion clay, saline-alkali", 0.010000, 0.00, 100.00
199, "Coolidge sandy loam", 0.400000, 0.00, 100.00
200, "Coolidge gravelly sandy loam, 1 to 3 percent slopes", 0.400000, 0.00, 100.00
201, "Coolidge-Tremant complex", 0.190000, 0.00, 100.00
202, "Dune land", 1.200000, 0.00, 100.00
203, "Ebon-Pinamt complex, 0 to 10 percent slopes", 0.120000, 0.00, 100.00
204, "Ebon gravelly loam, 0 to 8 percent slopes", 0.100000, 0.00, 100.00
205, "Estrella loam", 0.250000, 0.00, 100.00
206, "Estrella loam, saline-alkali", 0.250000, 0.00, 100.00
207, "Gachado-Rock outcrop complex", 0.100000, 40.00, 100.00
208, "Gilman complex, saline-alkali", 0.250000, 0.00, 100.00
209, "Gilman-Antho association", 0.290000, 0.00, 100.00
210, "Gilman-Laveen association", 0.250000, 0.00, 100.00
211, "Gravel pit", 0.000000, 0.00, 100.00
212, "Gunsight-Pinal complex, 1 to 10 percent slopes", 0.350000, 0.00, 100.00
213, "Gunsight-Rillito complex, 0 to 10 percent slopes", 0.260000, 0.00, 100.00
214, "Gadsden clay loam", 0.040000, 0.00, 100.00
215, "Gadsden clay", 0.010000, 0.00, 100.00
216, "Gadsden clay, saline-alkali", 0.010000, 0.00, 100.00
217, "Gilman fine sandy loam", 0.260000, 0.00, 100.00
218, "Gilman fine sandy loam, saline-alkali", 0.240000, 0.00, 100.00
219, "Gilman loan, 0 to 1 percent slopes", 0.250000, 0.00, 100.00
220, "Gilman loam, 1 to 3 percent slopes", 0.260000, 0.00, 100.00
221, "Gilman loam, saline-alkali", 0.240000, 0.00, 100.00
222, "Gilman,Antho and Glenbar soils, severely eroded", 0.190000, 0.00, 100.00
223, "Gilman loam, clayey subsoil variant, moderately saline", 0.240000, 0.00, 100.00
224, "Glenbar loam", 0.230000, 0.00, 100.00
225, "Glenbar loam, saline-alkali", 0.230000, 0.00, 100.00
226, "Glenbar clay loam", 0.040000, 0.00, 100.00
227, "Glenbar clay loam, saline-alkali", 0.040000, 0.00, 100.00
228, "Glenbar clay", 0.010000, 0.00, 100.00
229, "Gunsight-Rillito complex, 0 to 1 percent slopes", 0.230000, 0.00,

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100.00
230, "Gunsight-Rillito complex, 1 to 3 percent slopes", 0.240000, 0.00,
100.00
231, "Harqua complex, 0 to 3 percent slopes", 0.070000, 0.00, 100.00
232, "Harqua complex, 3 to 8 percent slopes", 0.050000, 0.00, 100.00
233, "Harqua-Gunsight complex, 0 to 5 percent slopes", 0.140000, 0.00,
100.00
234, "Harqua-Laveen complex", 0.150000, 0.00, 100.00
235, "Harqua-Rillito complex, 1 to 3 percent slopes", 0.120000, 0.00,
100.00
236, "Man-made levee", 0.000000, 0.00, 100.00
237, "La Palma very fine sandy loam", 0.260000, 0.00, 100.00
238, "Laveen sandy loam", 0.400000, 0.00, 100.00
239, "Laveen loam, 0 to 1 percent slopes", 0.250000, 0.00, 100.00
240, "Laveen loam, 1 to 3 percent slopes", 0.250000, 0.00, 100.00
241, "Laveen loam, saline-alkali", 0.250000, 0.00, 100.00
242, "Laveen clay loam", 0.040000, 0.00, 100.00
243, "Laveen-Antho complex, saline-alkali", 0.330000, 0.00, 100.00
244, "Waste stabilization pond", 0.000000, 0.00, 100.00
245, "Mohall-Tremant complex, 0 to 3 percent slopes", 0.150000, 0.00,
100.00
246, "Mohall-Laveen association", 0.150000, 0.00, 100.00
247, "Maripo sandy loam", 0.400000, 0.00, 100.00
248, "Mohall sandy loam", 0.390000, 0.00, 100.00
249, "Mohall loam", 0.250000, 0.00, 100.00
250, "Mohall clay loam", 0.050000, 0.00, 100.00
251, "Mohall clay", 0.010000, 0.00, 100.00
252, "Perryville-Rillito complex, 0 to 3 percent slopes", 0.280000, 0.00,
100.00
253, "Pinal gravelly loam", 0.400000, 0.00, 100.00
254, "Pinal-Suncity complex, 0 to 3 percent slopes", 0.380000, 0.00,
100.00
255, "Pinamt-Tremant complex, 1 to 10 percent slopes", 0.200000, 0.00,
100.00
256, "Perryville sandy loam", 0.400000, 0.00, 100.00
257, "Perryville loam, saline-alkali", 0.380000, 0.00, 100.00
258, "Perryville gravelly loam, 0 to 1 percent slopes", 0.370000, 0.00,
100.00
259, "Perryville gravelly loam, 1 to 3 percent slopes", 0.380000, 0.00,
100.00
260, "Pinal loam, 0 to 1 percent slopes", 0.250000, 0.00, 100.00
261, "Pinal loam, 1 to 3 percent slopes", 0.260000, 0.00, 100.00
262, "Pinal-La Palma loams, 1 to 3 percent slopes", 0.250000, 0.00,
100.00
263, "Rock outcrop-Cherioni complex", 0.400000, 65.00, 100.00
264, "Rillito sandy loam, 0 to 1 percent slopes", 0.390000, 0.00, 100.00
265, "Rillito sandy loam, 1 to 3 percent slopes", 0.390000, 0.00, 100.00
266, "Rillito loam, 0 to 1 percent slopes", 0.260000, 0.00, 100.00
267, "Rillito loam, 1 to 3 percent slopes", 0.250000, 0.00, 100.00
268, "Rillito-Harqua complex, 1 to 3 percent slopes", 0.230000, 0.00,
100.00
269, "Rillito-Perryville complex, 5 to 20 percent slopes", 0.290000,
0.00, 100.00
270, "Torrifluvents", 0.400000, 0.00, 100.00
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271, "Torripsamments and Torrifluvents, frequently flooded", 1.200000, 0.00, 100.00
272, "Tremant complex, 0 to 3 percent slopes", 0.120000, 0.00, 100.00
273, "Tremant-Rillito complex, 0 to 5 percent slopes", 0.140000, 0.00, 100.00
274, "Toltec loam", 0.250000, 0.00, 100.00
275, "Torriorthents", 0.400000, 0.00, 100.00
276, "Tremant loam", 0.250000, 0.00, 100.00
277, "Tremant gravelly loam, 0 to 1 percent slopes", 0.370000, 0.00, 100.00
278, "Tremant gravelly loam 1 to 3 percent slopes", 0.360000, 0.00, 100.00
279, "Tremant clay loam", 0.040000, 0.00, 100.00
280, "Tremant gravelly clay loam", 0.040000, 0.00, 100.00
281, "Tremant-Rillito complex, 0 to 1 percent slopes", 0.110000, 0.00, 100.00
282, "Tremant-Rillito complex, 1 to 3 percent slopes", 0.130000, 0.00, 100.00
283, "Trix clay loam", 0.040000, 0.00, 100.00
284, "Tucson loam", 0.250000, 0.00, 100.00
285, "Tucson clay loam", 0.050000, 0.00, 100.00
286, "Valencia sandy loam", 0.390000, 0.00, 100.00
287, "Valencia sandy loam, saline-alkali", 0.390000, 0.00, 100.00
288, "Valencia gravelly sandy loam", 0.390000, 0.00, 100.00
289, "Vecont loam", 0.250000, 0.00, 100.00
290, "Vecont clay", 0.010000, 0.00, 100.00
291, "Vint loamy fine sand", 0.910000, 0.00, 100.00
292, "Vint fine sandy loam", 0.270000, 0.00, 100.00
293, "Vint loam", 0.260000, 0.00, 100.00
294, "Vint clay loam", 0.040000, 0.00, 100.00
295, "Vint-Carrizo complex", 0.630000, 0.00, 100.00
296, "Lakes, ponds, reservoirs - perennial", 0.000000, 0.00, 100.00
297, "Wintersburg complex", 0.030000, 0.00, 100.00
298, "Agualt and Ripley soils", 0.000000, 0.00, 100.00
299, "Agualt and Ripley soils, saline-sodic", 0.000000, 0.00, 100.00
300, "Ajo-Gunsight-Pompeii complex, 3 to 25 percent slopes", 0.660000, 0.00, 100.00
301, "Akela-Rock outcrop complex, 15 to 65 percent slopes", 0.000000, 0.00, 100.00
302, "Carrizo-Dateland complex, 0 to 3 percent slopes", 0.820000, 0.00, 100.00
303, "Carrizo-Momoli complex, 0 to 3 percent slopes", 1.200000, 0.00, 100.00
304, "Cherioni very cobbly fine sandy loam, 3 to 10 percent slopes", 0.400000, 0.00, 100.00
305, "Cherioni-Coolidge complex, 1 to 15 percent slopes", 0.000000, 0.00, 100.00
306, "Cipriano-Hyder-Rock outcrop complex, 15 to 65 percent slopes", 0.590000, 15.00, 100.00
307, "Cipriano-Momoli complex, 1 to 7 percent slopes", 0.500000, 0.00, 100.00
308, "Coolidge complex, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
309, "Cuerda-Why-Lagunita complex", 0.350000, 0.00, 100.00
310, "Dateland very fine sandy loam", 0.000000, 0.00, 100.00

311, "Dateland-Cuerda complex, 0 to 3 percent slopes", 0.250000, 0.00, 100.00
312, "Dateland-Denure fine sandy loams, saline-sodic, 0 to 3 percent slopes", 0.280000, 0.00, 100.00
313, "Denure sandy loam", 0.000000, 0.00, 100.00
314, "Denure gravelly fine sandy loam, 1 to 3 percent slopes", 0.560000, 0.00, 100.00
315, "Denure-Carrizo, bench, gravelly fine sandy loams", 0.000000, 0.00, 100.00
316, "Denure-Cavelt complex, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
317, "Denure-Coolidge complex, 1 to 3 percent slopes", 0.500000, 0.00, 100.00
318, "Denure-Rillito-Why complex, 1 to 5 percent slopes", 0.400000, 0.00, 100.00
319, "Denure-Why complex, 1 to 5 percent slopes", 0.000000, 0.00, 100.00
320, "Dumps-Pits association", 0.000000, 0.00, 100.00
321, "Gadsden clay loam, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
322, "Gadsden and Kofa silty clay loams, saline-sodic", 0.000000, 0.00, 100.00
323, "Garzona-Rock outcrop-Winkel complex, 15 to 65 percent slopes", 0.000000, 0.00, 100.00
324, "Gilman very fine sandy loam", 0.000000, 0.00, 100.00
325, "Gilman very fine sandy loam, saline-sodic", 0.000000, 0.00, 100.00
326, "Glenbar silty clay loam", 0.000000, 0.00, 100.00
327, "Glenbar silty clay loam, saline-sodic", 0.000000, 0.00, 100.00
328, "Growler-Momoli complex, 1 to 3 percent slopes", 0.840000, 0.00, 100.00
329, "Growler-Wellton complex, 1 to 3 percent slopes", 0.490000, 0.00, 100.00
330, "Gunsight-Ajolito extremely gravelly sandy loams, 1 to 15 percent slopes", 1.200000, 0.00, 100.00
331, "Gunsight-Chuckawalla complex, 1 to 15 percent slopes", 0.840000, 0.00, 100.00
332, "Gunsight-Cipriano complex, 1 to 15 percent slopes", 0.910000, 0.00, 100.00
333, "Gunsight-Pinamt complex, 1 to 15 percent slopes", 0.840000, 0.00, 100.00
334, "Gunsight-Rillito-Carrizo complex, 1 to 15 percent slopes", 0.800000, 0.00, 100.00
335, "Harqua fine sandy loam, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
336, "Harqua-Cavelt complex, 1 to 10 percent slopes", 0.000000, 0.00, 100.00
337, "Hyder-Gachado-Gunsight extremely gravelly sandy loams, 1 to 25 percent slopes", 0.400000, 15.00, 100.00
338, "Indio silt loam", 0.000000, 0.00, 100.00
339, "Indio silt loam, saline-sodic", 0.000000, 0.00, 100.00
340, "Lagunita-Vint complex", 0.000000, 0.00, 100.00
341, "Mohall fine sandy loam", 0.000000, 0.00, 100.00
342, "Mohall loam", 0.280000, 0.00, 100.00
343, "Mohall loam, occasionally flooded", 0.000000, 0.00, 100.00
344, "Mohall clay loam", 0.000000, 0.00, 100.00
345, "Mohall complex, 0 to 3 percent slopes", 0.000000, 0.00, 100.00

346, "Momoli-Carrizo extremely gravelly sandy loams, 1 to 10 percent slopes", 1.200000, 0.00, 100.00
347, "Momoli-Carrizo, bench, very gravelly sandy loams, 1 to 3 percent slopes", 1.200000, 0.00, 100.00
348, "Momoli-Comobabi association, 5 to 15 percent slopes", 0.480000, 0.00, 100.00
349, "Pits", 0.000000, 0.00, 100.00
350, "Quilotosa-Momoli-Carrizo complex, 1 to 15 percent slopes", 1.200000, 15.00, 100.00
351, "Quilotosa-Rock outcrop complex, 15 to 55 percent slopes", 0.970000, 26.00, 100.00
352, "Riverwash", 0.000000, 0.00, 100.00
353, "Rock outcrop-Hyder complex. 25 to 65 percent slopes", 0.000000, 0.00, 100.00
354, "Rositas-Denure loamy fine sands, 1 to 10 percent slopes", 0.000000, 0.00, 100.00
355, "Schenco-Laposa-Rock outcrop complex, 10 to 55 percent slopes", 0.630000, 19.00, 100.00
356, "Tremant gravelly fine sandy loam", 0.000000, 0.00, 100.00
357, "Tucson loam", 0.250000, 0.00, 100.00
358, "Vaiva-Quilotosa extremely gravelly sandy loams, 3 to 25 percent slopes", 0.000000, 0.00, 100.00
359, "Vaiva-Quilotosa extremely stony sandy loams, 25 to 55 percent slopes", 0.000000, 0.00, 100.00
360, "Vint very fine sandy loam", 0.000000, 0.00, 100.00
361, "Wellton loam", 0.160000, 0.00, 100.00
362, "Wellton complex", 0.000000, 0.00, 100.00
363, "Why gravelly fine sandy loam", 0.000000, 0.00, 100.00
364, "Why-Carrizo complex, 0 to 3 percent slopes", 0.440000, 0.00, 100.00
365, "Man-made levee", 0.000000, 0.00, 100.00
366, "Mountain", 0.020000, 10.00, 100.00
367, "Valley", 0.250000, 0.00, 100.00
368, "Lakes, ponds, reservoirs - perennial", 0.000000, 0.00, 100.00
369, "Brios gravelly loamy sand,3 to 5 percent slopes", 0.000000, 0.00, 100.00
370, "Brios very fine sandy loam,0 to 2 percent slopes", 0.000000, 0.00, 100.00
371, "Carrizo-Momoli complex, 1 to 3 percent slopes", 0.000000, 0.00, 100.00
372, "Carrizo-Pinamt complex, 1 to 5 percent slopes", 0.000000, 0.00, 100.00
373, "Carrizo very gravelly coarse sand, 0 to 1 percent slopes", 0.000000, 0.00, 100.00
374, "Casa Grande clay loam, 0 to 1 percent slopes", 0.000000, 0.00, 100.00
375, "Casa Grande complex, 0 to 5 percent slopes", 0.000000, 0.00, 100.00
376, "Casa Grande fine sandy loam, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
377, "Cavelt-Carrizo-Gunsight complex, 1 to 10 percent slopes", 0.000000, 0.00, 100.00
378, "Chuckwalla-Gunsight complex, 1 to 5 percent slopes", 0.000000, 0.00, 100.00
379, "Cristobal-Gunsight complex, 3 to 15 percent slopes", 0.000000, 0.00, 100.00

380, "Dateland-Cuerda complex, saline-sodic, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
381, "Denure-Pahaka complex, 1 to 3 percent slopes", 0.000000, 0.00, 100.00
382, "Denure-Pahaka complex, 3 to 5 percent slopes", 0.000000, 0.00, 100.00
383, "Gadsden, Glenbar and Vint soils, saline-sodic, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
384, "Gadsden silty clay loam, saline-sodic, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
385, "Glenbar silt loam, saline-sodic, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
386, "Indio silt loam, saline-sodic, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
387, "Indio-Vint complex, saline-sodic, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
388, "Kamato complex, 0 to 5 percent slopes", 0.000000, 0.00, 100.00
389, "Kamato loam, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
390, "Lagunita silt loam, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
391, "Laveen fine sandy loam, saline-sodic, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
392, "Momoli cobbly sandy loam, 5 to 15 percent slopes", 0.000000, 0.00, 100.00
393, "Pompeii-Lomitas-Rock outcrop complex, 15 to 65 percent slopes", 0.000000, 0.00, 100.00
394, "Quilotosa-Momoli-Vaiva complex, 1 to 15 percent slopes", 0.000000, 0.00, 100.00
395, "Quilotosa-Rock outcrop-Vaiva complex, 20 to 65 percent slopes", 0.000000, 0.00, 100.00
396, "Redun-Shontik complex, 1 to 3 percent slopes", 0.000000, 0.00, 100.00
397, "Rillito-Gunsight complex, 3 to 15 percent slopes", 0.000000, 0.00, 100.00
398, "Rositas-Casa Grande-Slickspots complex, 1 to 15 percent slopes", 0.000000, 0.00, 100.00
399, "Rositas loamy fine sand, sodic, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
400, "Shontik-Redun complex, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
401, "Talai silt loam, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
402, "Trix loam, saline-sodic, 0 to 1 percent slopes", 0.000000, 0.00, 100.00
403, "Vint-Yahana complex, saline-sodic, 0 to 10 percent slopes", 0.000000, 0.00, 100.00
404, "Why-Brios complex, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
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407, "Ajo-pinamt, deep, complex, 3 to 15 percent slopes", 0.000000, 0.00, 100.00
408, "Anklam-cellar-rock outcrop complex, 15 to 55 percent slopes", 0.000000, 0.00, 100.00
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0.00, 100.00
410, "Arizo-riverwash complex, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
411, "Baboquivari-combate complex, 1 to 8 percent slopes", 0.000000, 0.00, 100.00
412, "Bucklebar-hayhook-tubac complex, 0 to 3 percent slopes", 0.000000, 0.00, 100.00
413, "Caralampi-selevin-kimrose complex, 5 to 50 percent slopes", 0.000000, 0.00, 100.00
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417, "Chiricahua-lampshire complex, 15 to 45 percent slopes", 0.000000, 0.00, 100.00
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429, "Gachado-lomitas-rock outcrop complex, 15 to 45 percent slopes", 0.000000, 0.00, 100.00
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432, "Ginland silty clay, 0 to 1 percent slopes", 0.000000, 0.00, 100.00
433, "Glenbar loam, 0 to 1 percent slopes", 0.000000, 0.00, 100.00
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436, "Glendale-pajarito complex, 1 to 3 percent slopes", 0.000000, 0.00, 100.00
437, "Grabe-vado complex, 1 to 5 percent slopes", 0.000000, 0.00, 100.00
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452, "Oracle-romero-rock outcrop complex, 5 to 35 percent slopes", 0.000000, 0.00, 100.00
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457, "Quilotosa-rock outcrop-vaiva complex, 15 to 45 percent slopes", 0.000000, 0.00, 100.00
458, "Romero-lampshire-rock outcrop complex, 15 to 65 percent slopes", 0.000000, 0.00, 100.00
459, "Romero-rock outcrop complex, 10 to 40 percent slopes", 0.000000, 0.00, 100.00
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461, "Sasco loam, 0 to 1 percent slopes", 0.000000, 0.00, 100.00
462, "Soledad-topawa complex, 1 to 5 percent slopes", 0.000000, 0.00, 100.00
463, "Tatai silt loam, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
464, "Tubac complex, 0 to 2 percent slopes", 0.000000, 0.00, 100.00
465, "Tucson-mohall-valencia complex, 1 to 3 percent slopes", 0.000000, 0.00, 100.00
466, "Vado-agustin complex, 1 to 8 percent slopes", 0.000000, 0.00, 100.00
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468, "Wintersburg loam, 0 to 1 percent slopes", 0.000000, 0.00, 100.00
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470, "Dam", 0.000000, 0.00, 100.00
471, "Sandy Clay Loam", 0.120000, 0.00, 100.00

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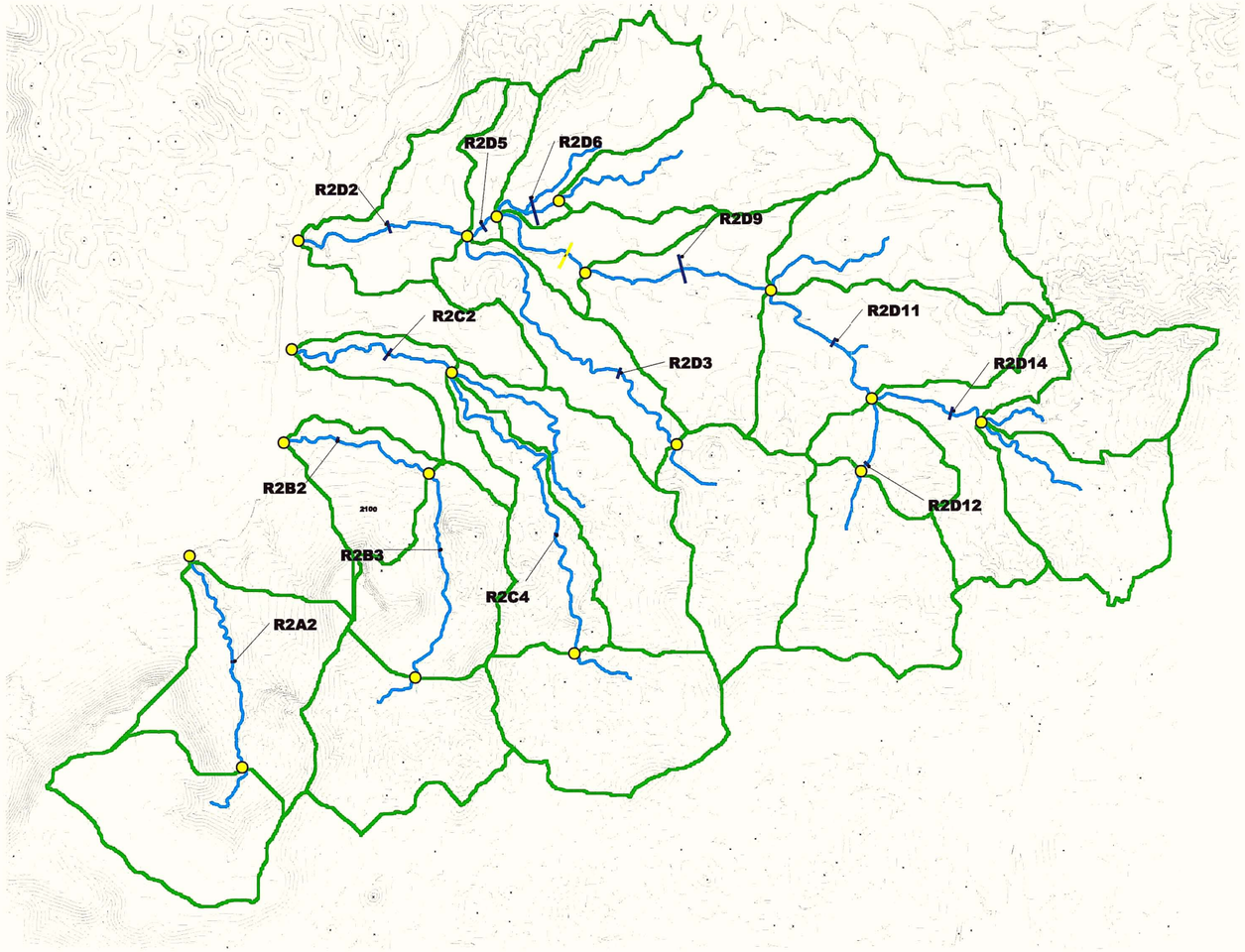
D.3 Hydrograph Routing Data



3000 0 3000 Feet

LEGEND

- SUB-BASIN OUTLETS
- SUB-BASIN BOUNDARIES
- WASHES
- CROSS SECTION FOR NORMAL DEPTH

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

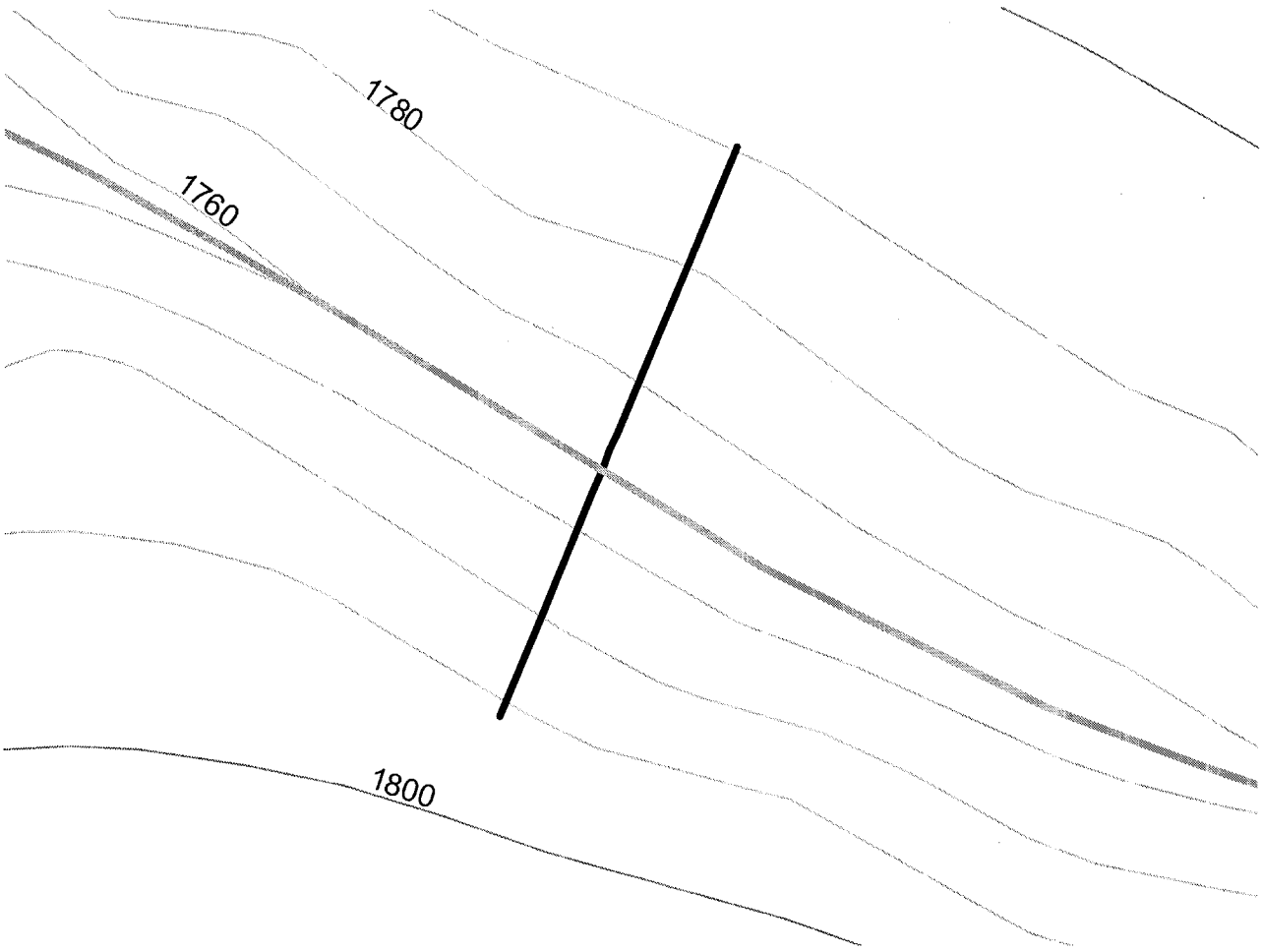
UPPER AGUA FRIA WATERSHED
ZONE A FLOODPLAIN DELINEATION STUDY
WATERSHED #2 (TABLE MESA ROAD AREA)
NORMAL DEPTH CROSS SECTION LOCATIONS

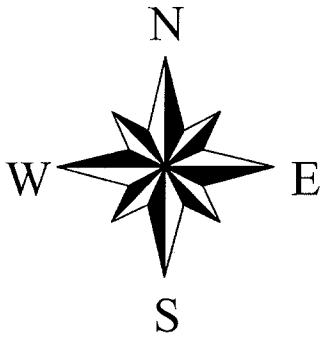
RBF CONSULTING
PLANNING ■ DESIGN ■ CONSTRUCTION
16605 NORTH 28th AVENUE, SUITE 100
PHOENIX, ARIZONA 85053-7569
602.467.2200 • FAX 602.467.2201 • www.RBF.com

NSTPS CALCULATIONS

REACH	LENGTH	SLOPE	VELOCITY	TIME	NSTPS
R2A2	6185	0.06943	14.79	6.97	1
R2B2	4313	0.03623	11.20	6.42	1
R2B3	5922	0.03857	11.08	8.91	2
R2C2	5066	0.02543	6.47	13.06	3
R2C4	9869	0.03165	10.63	15.48	3
R2D2	4867	0.01574	10.17	7.98	2
R2D3	9665	0.01992	7.44	21.65	4
R2D5	965	0.01254	7.20	2.23	0
R2D6	2035	0.02060	2.96	11.48	2
R2D8	3199	0.01614	5.83	9.15	2
R2D9	5102	0.01206	8.91	9.55	2
R2D11	4525	0.01753	9.01	8.37	2
R2D12	1971	0.02704	10.28	3.19	1
R2D14	3306	0.01785	9.50	5.80	1

ROUTING REACH R2B2

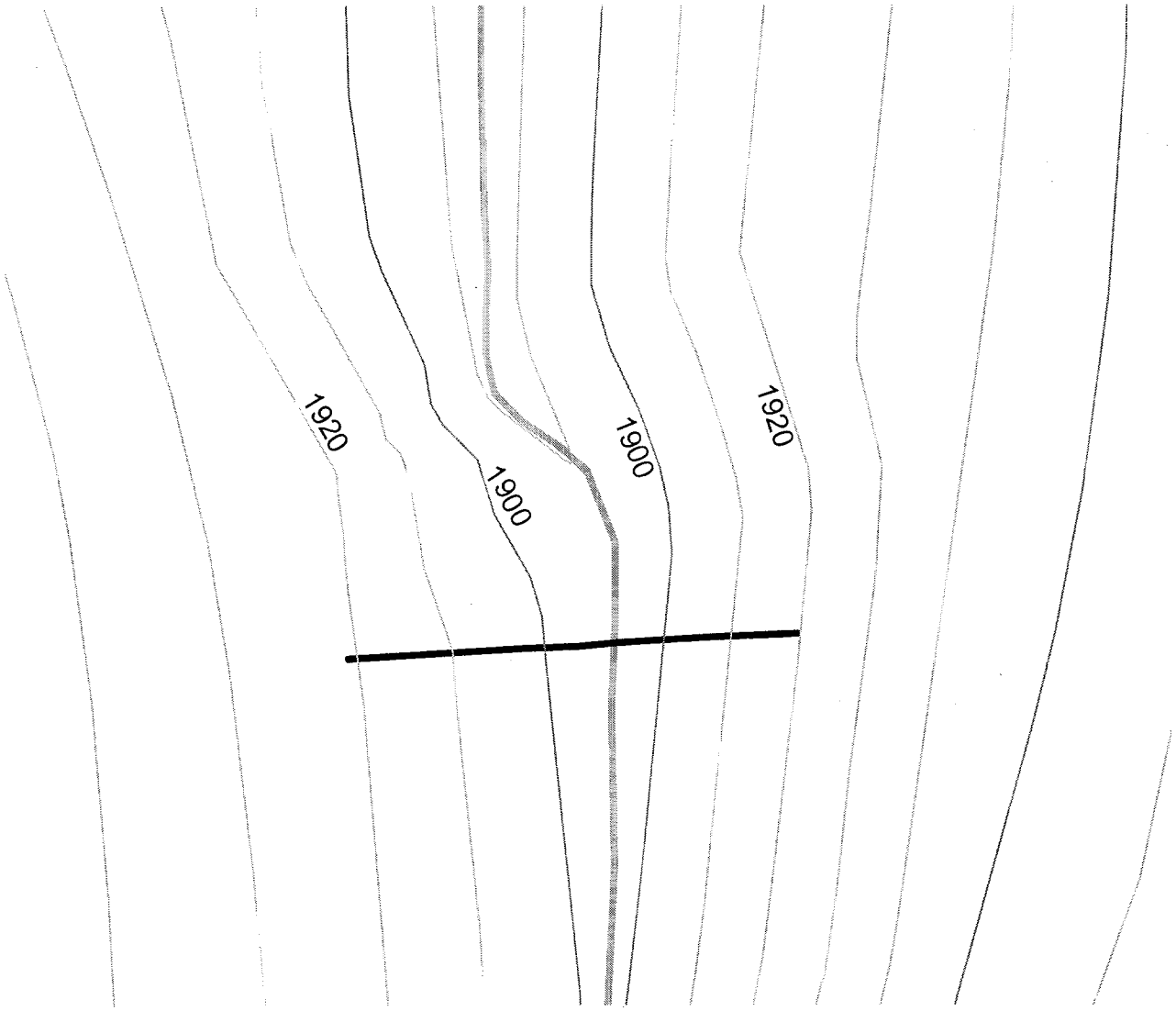


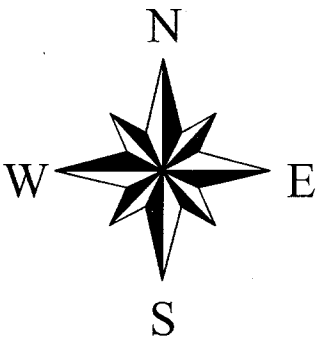


FLOW LINE
NORMAL DEPTH CROSS SECTION

40 0 40 80 Feet

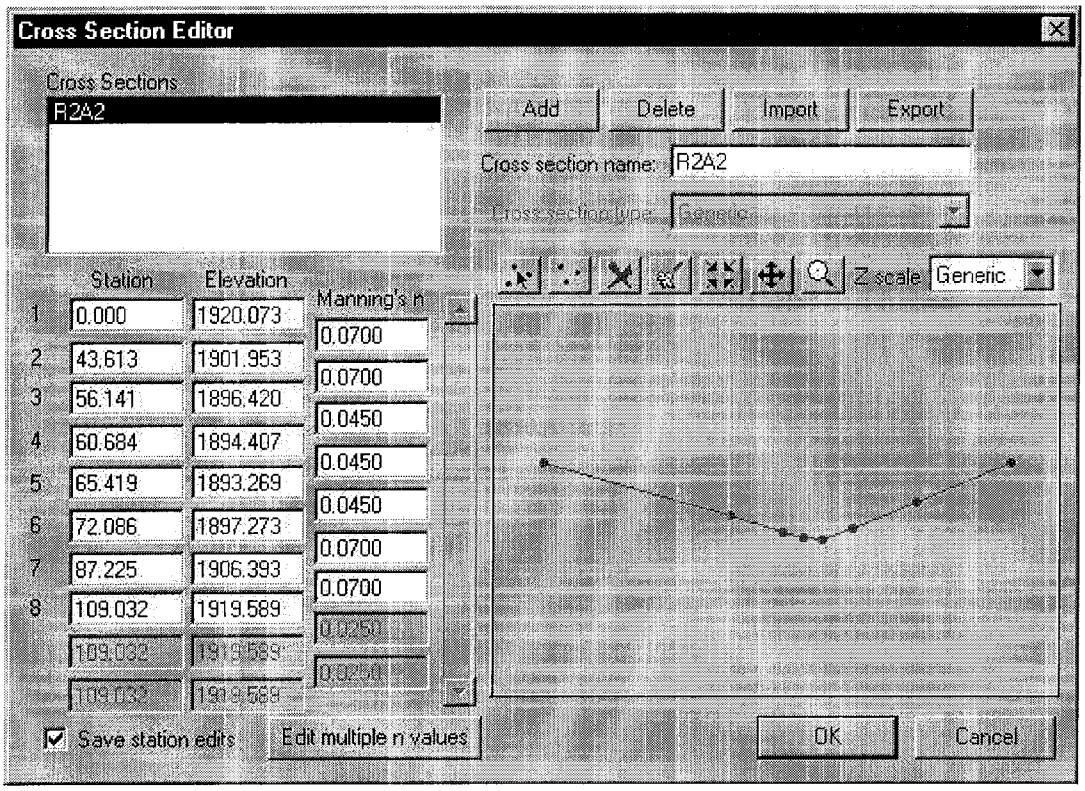
ROUTING REACH R2A2





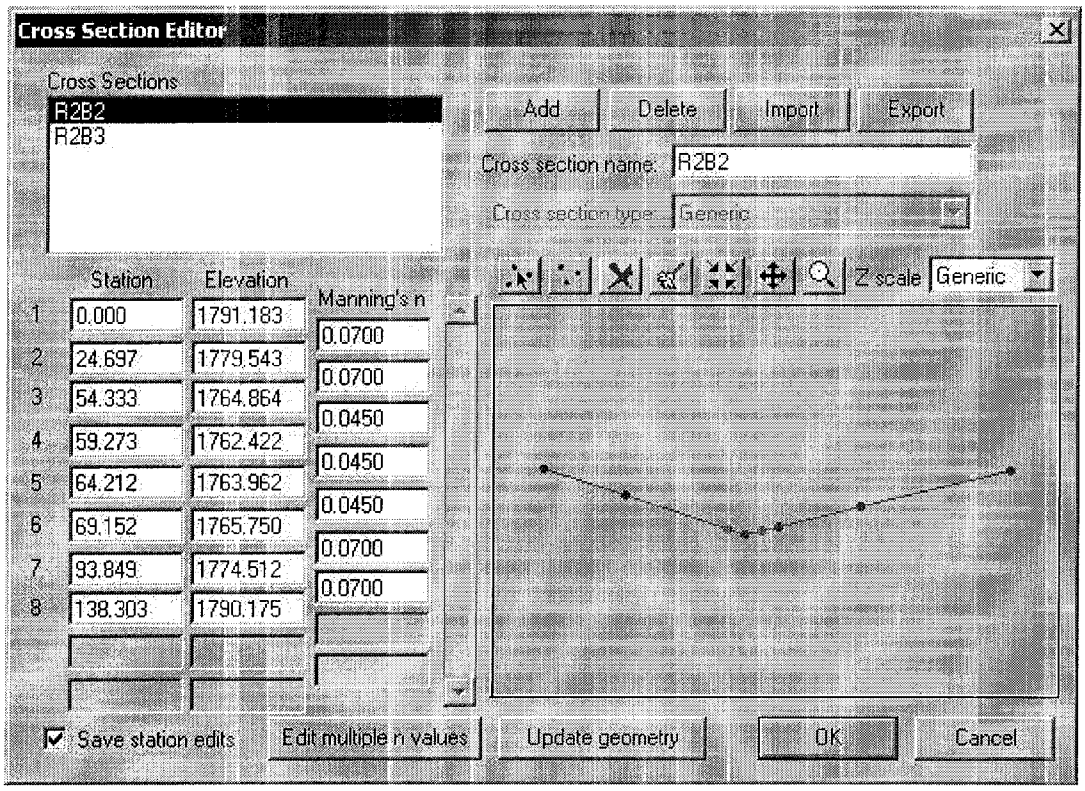
NORMAL DEPTH CROSS SECTION - R2A2
FLOW LINE

40 0 40 Feet



Calculated Values

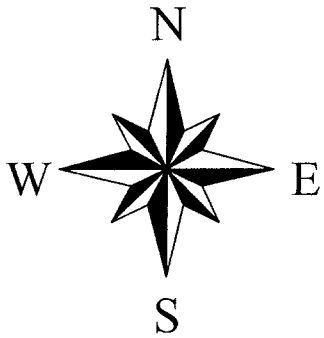
Flow	1304.000 cfs
Depth	6.222 ft
Area of Flow	88.186 sq ft
Wetted Perimeter	29.515 ft
Average Velocity	14.787 fps
Top Width (T)	26.580 ft
Froude Number	1.431
Critical Depth	7.242 ft
Critical Velocity	11.115 fps
Critical Slope	0.03475
Slope:	0.06943



Calculated Values

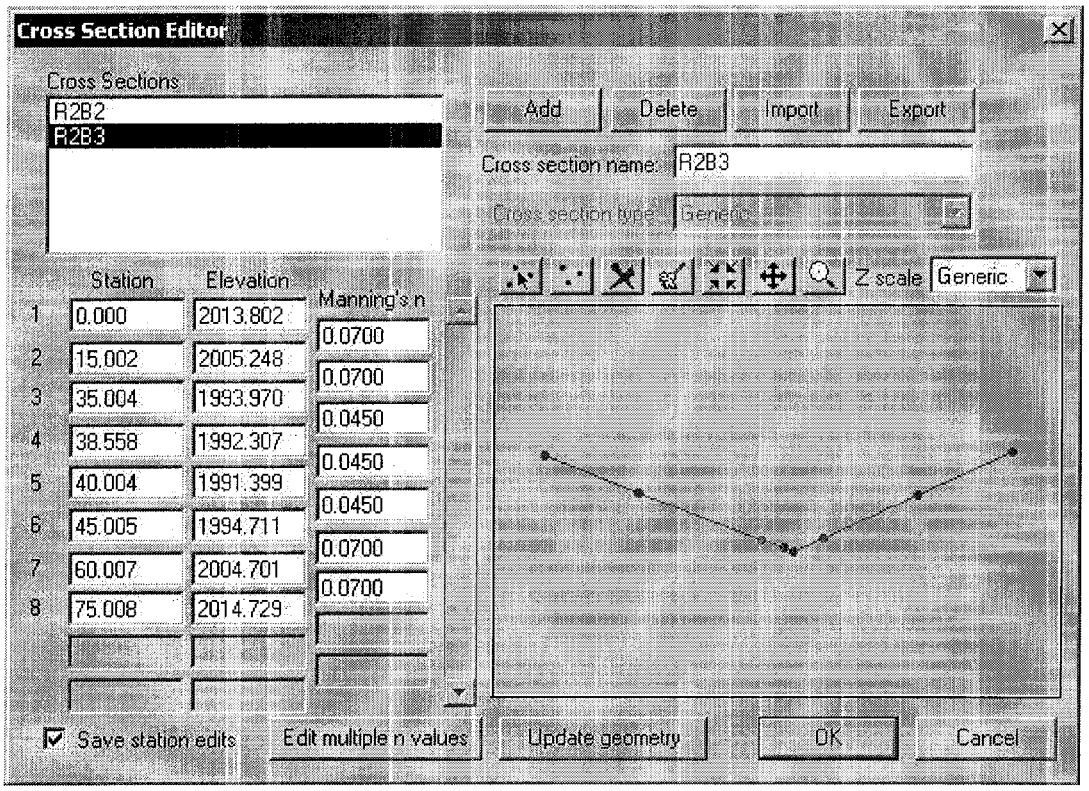
Flow: 1735.000 cfs
Depth: 7.904 ft
Area of Flow: 154.875 sq ft
Wetted Perimeter: 41.926 ft
Average Velocity: 11.203 fps
Top Width (T): 38.741 ft
Froude Number: 0.987
Critical Depth: 7.863 ft
Critical Velocity: 11.317 fps
Critical Slope: 0.03716
Manning's Roughness: 0.06050
Slope: 0.03623

ROUTING REACH 2B3



FLOW LINE
NORMAL DEPTH CROSS SECTION

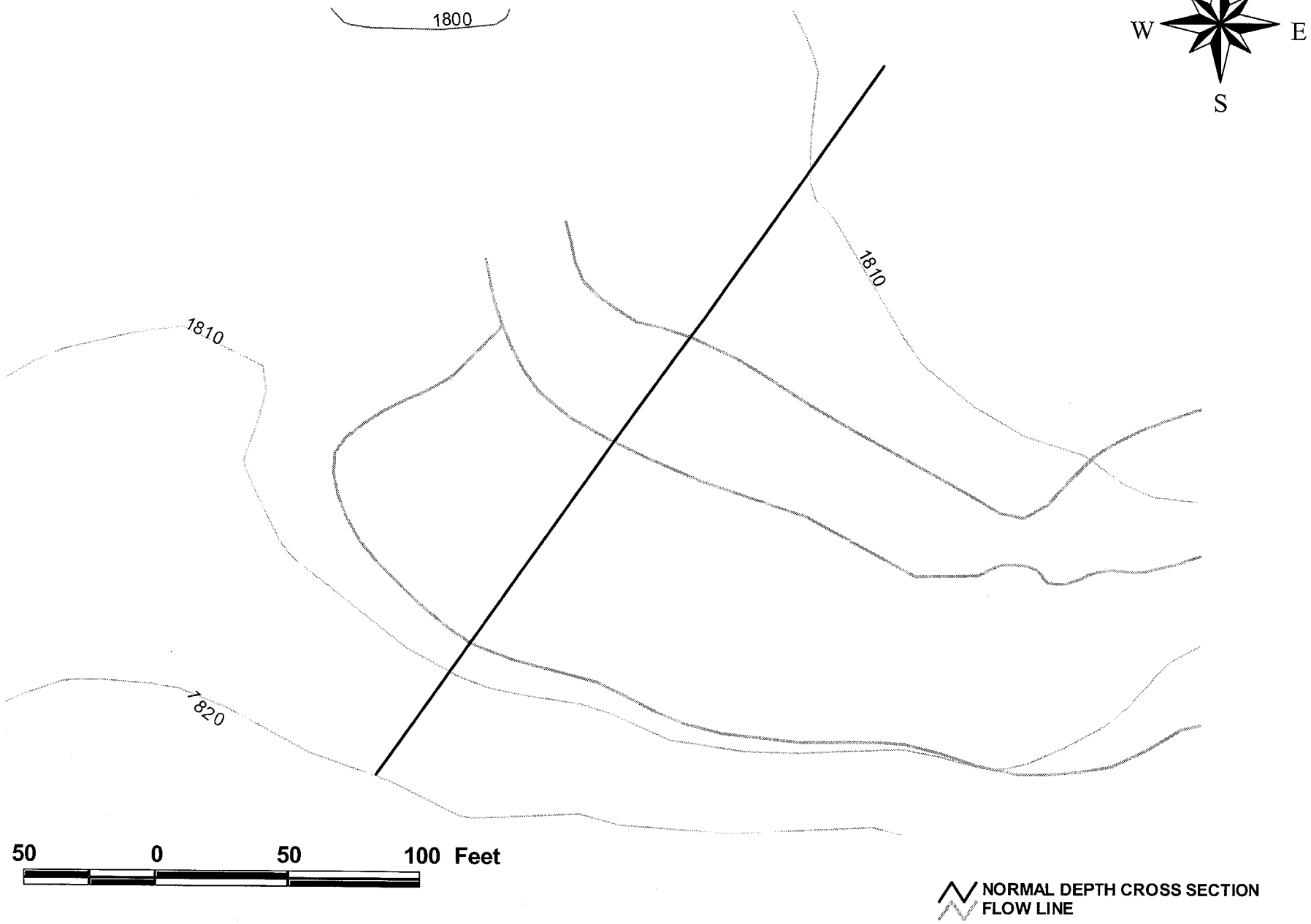
40 0 40 80 Feet

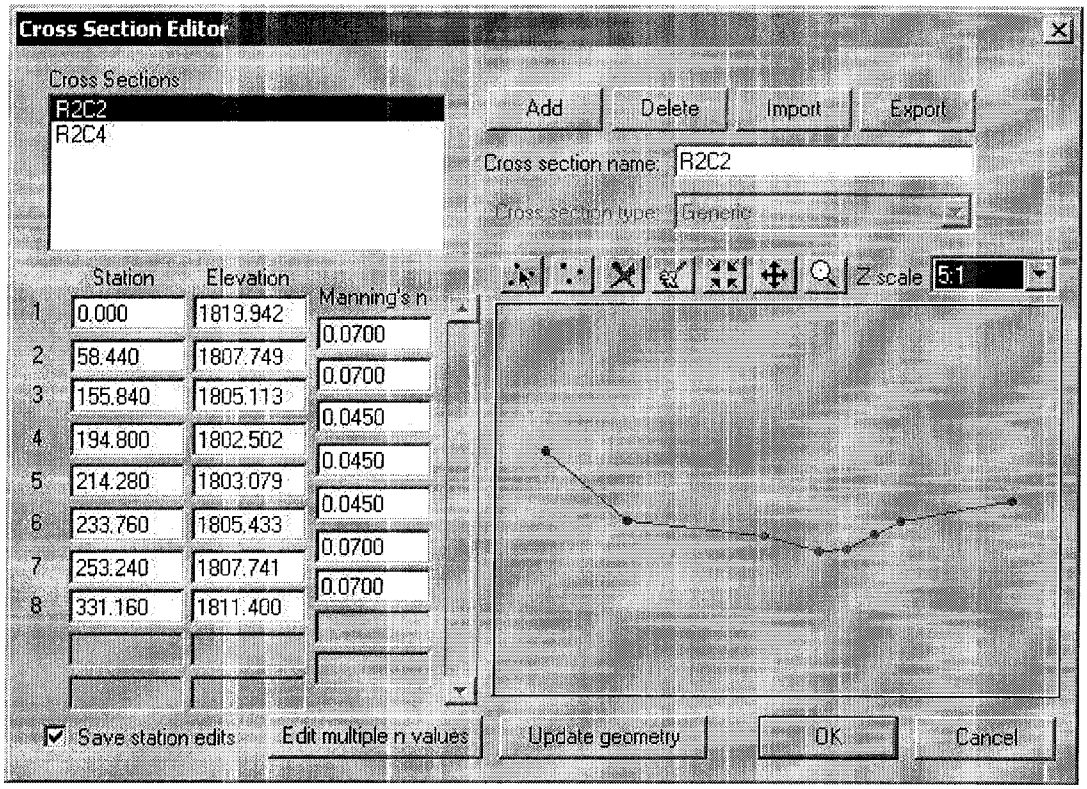


Calculated Values

Flow: 1215.000 cfs
Depth: 8.080 ft
Area of Flow: 109.690 sq ft
Wetted Perimeter: 31.451 ft
Average Velocity: 11.077 fps
Top Width (T): 26.934 ft
Froude Number: 0.967
Critical Depth: 7.973 ft
Critical Velocity: 11.375 fps
Critical Slope: 0.04124
Manning's Roughness: 0.06076
Slope: 0.03857

ROUTING REACH R2C2

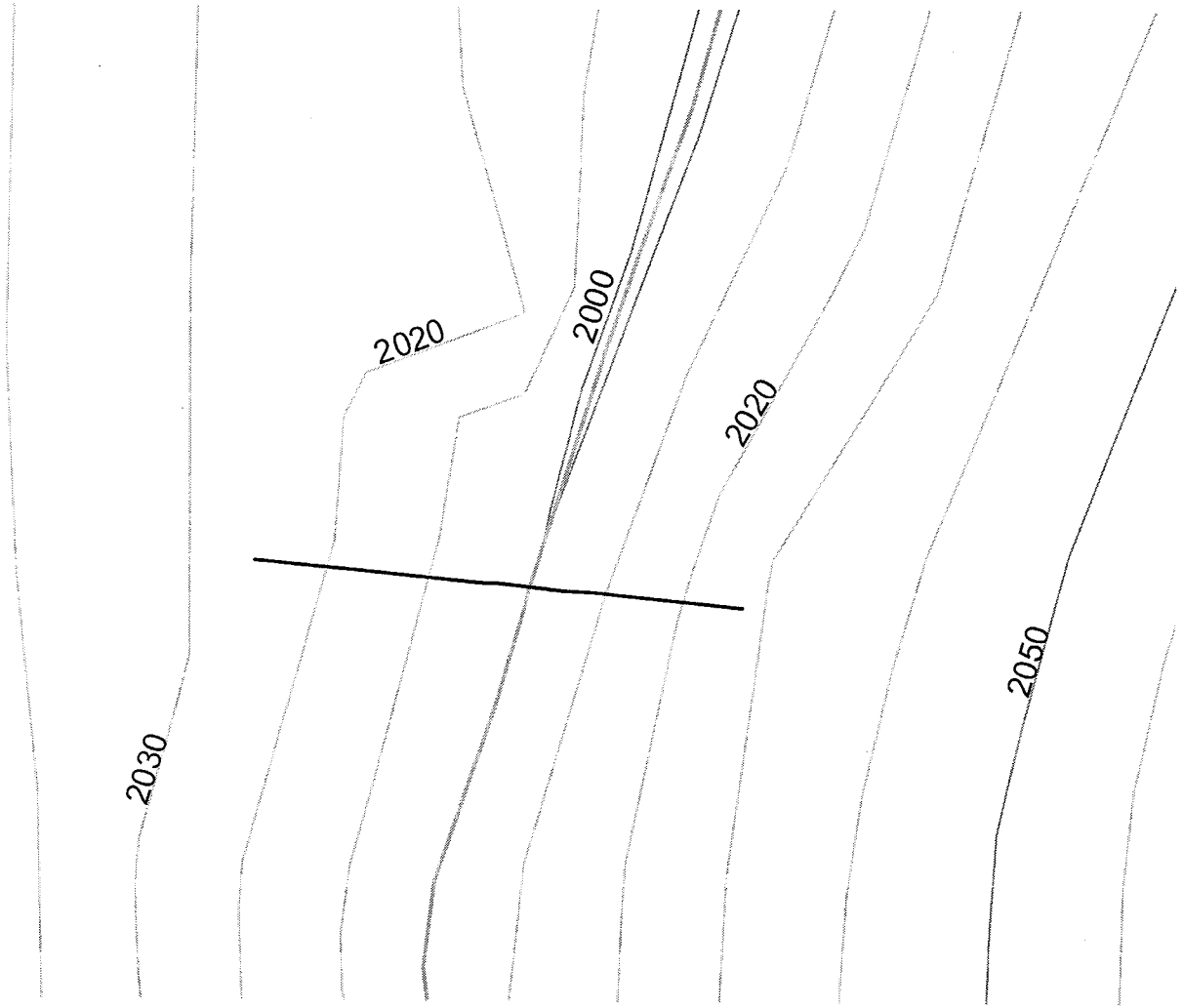




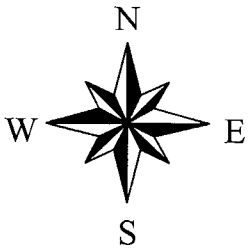
Calculated Values

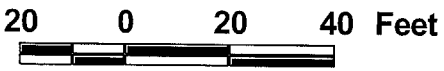
Flow: 1619.000 cfs
Depth: 3.919 ft
Area of Flow: 250.410 sq ft
Wetted Perimeter: 134.880 ft
Average Velocity: 6.465 fps
Top Width (T): 134.567 ft
Froude Number: 0.835
Critical Depth: 3.643 ft
Critical Velocity: 7.532 fps
Critical Slope: 0.03517
Manning's Roughness: 0.05551
Slope: 0.02543

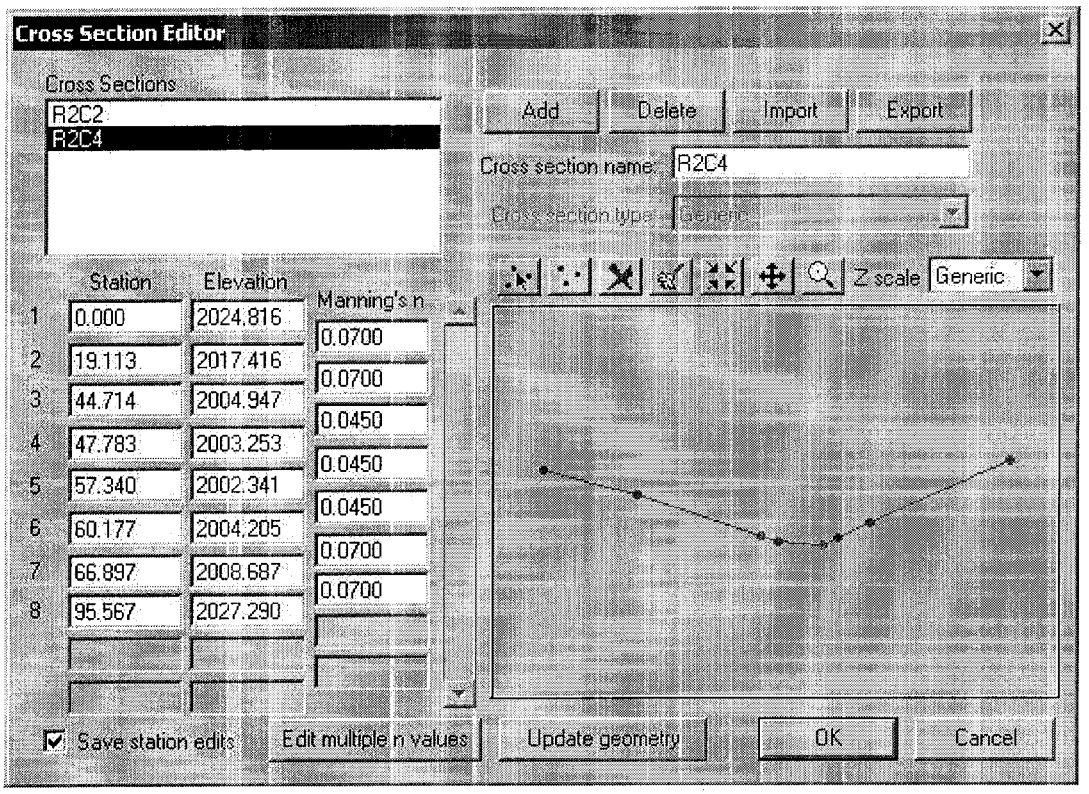
ROUTING REACH R2C4



NORMAL DEPTH CROSS SECTION
FLOW LINE



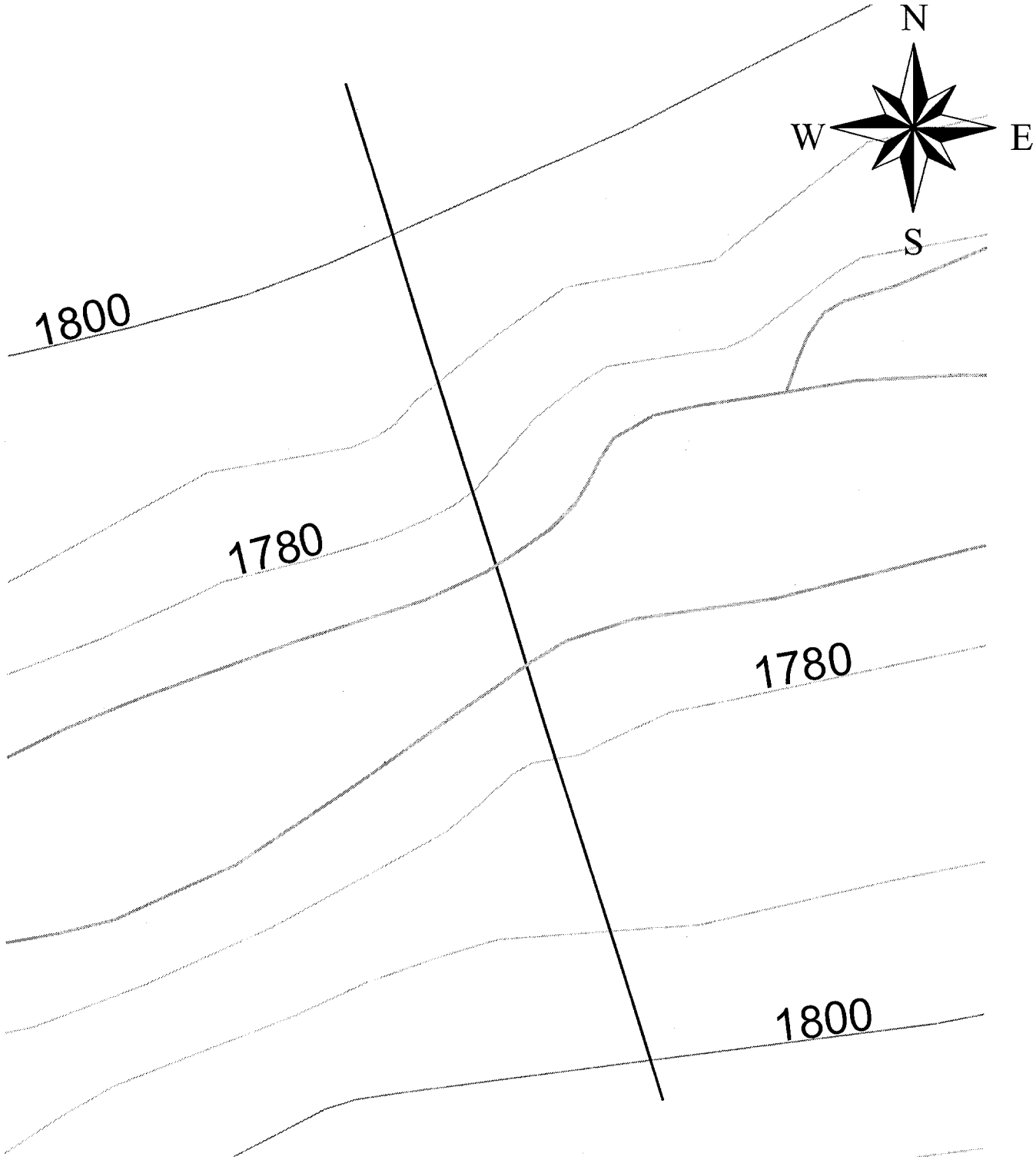




Calculated Values

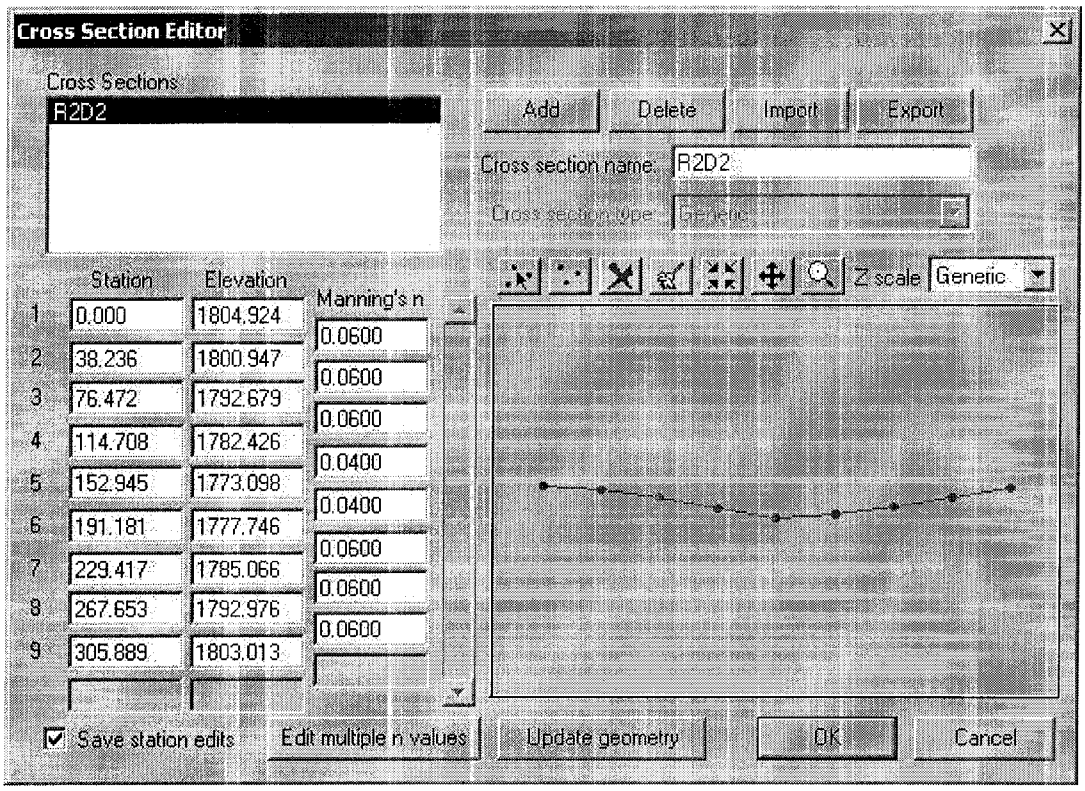
Flow: 1249.000 cfs
Depth: 6.426 ft
Area of Flow: 117.552 sq ft
Wetted Perimeter: 33.450 ft
Average Velocity: 10.625 fps
Top Width (T): 30.150 ft
Froude Number: 0.948
Critical Depth: 6.265 ft
Critical Velocity: 11.079 fps
Critical Slope: 0.03513
Manning's Roughness: 0.05767
Slope: 0.03165

ROUTING REACH R2D2



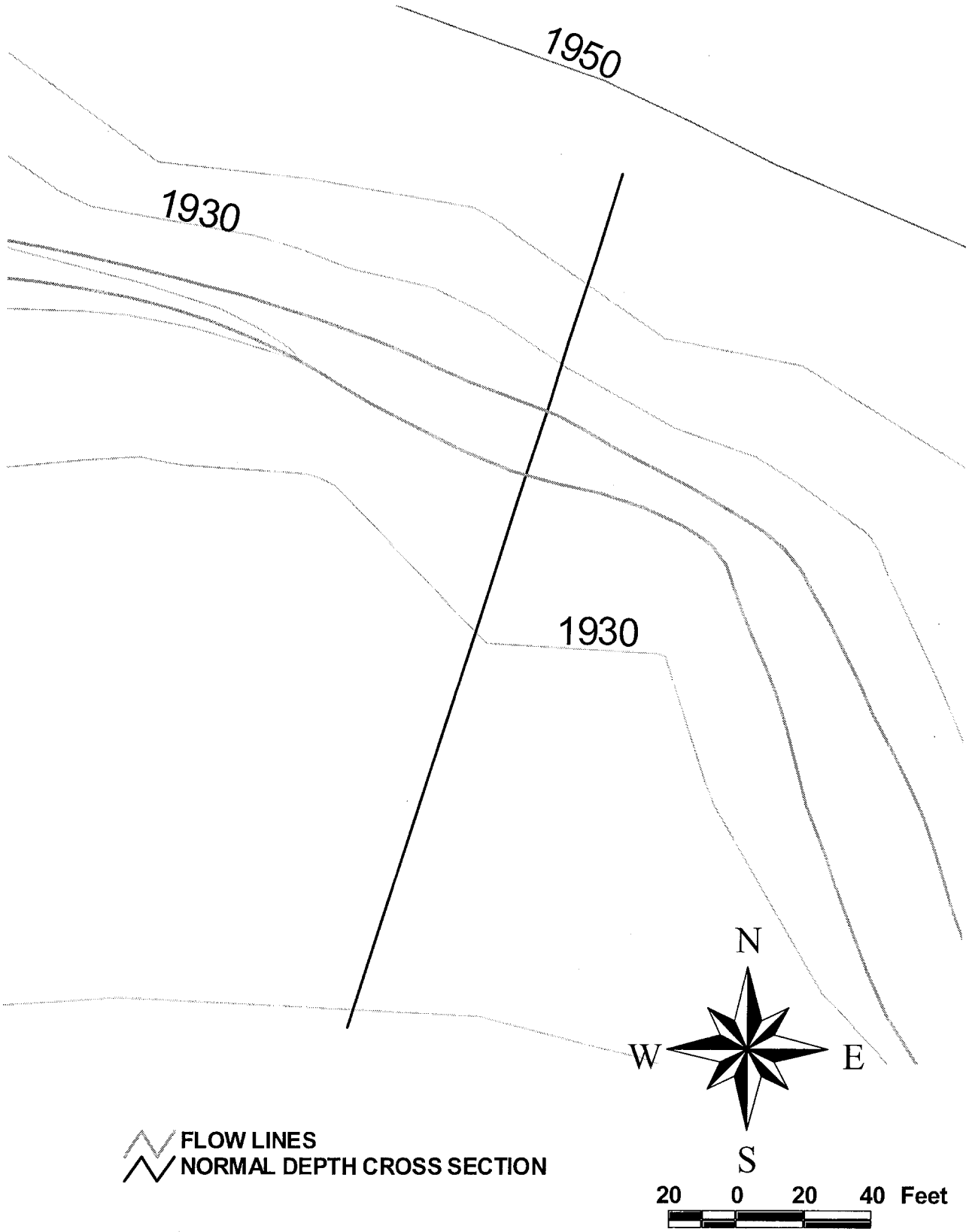
FLOW LINES
NORMAL DEPTH CROSS SECTION

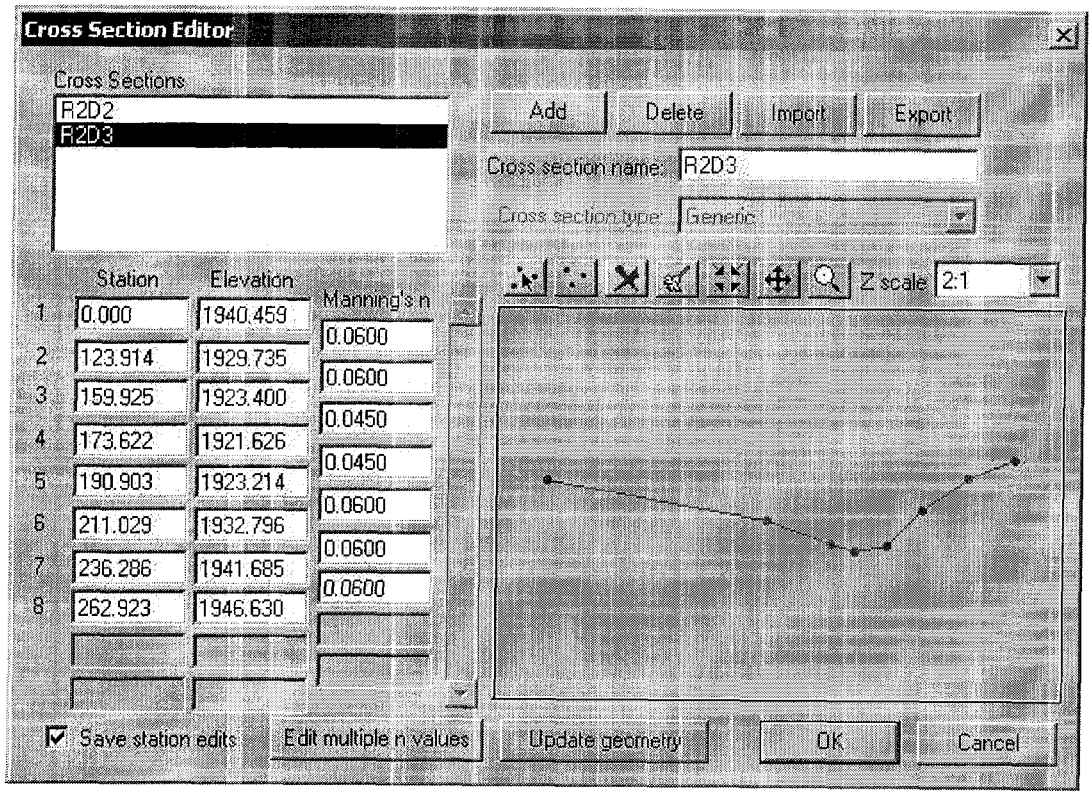
40 0 40 Feet



Calculated Values
Flow: 4078.000 cfs
Depth: 7.924 ft
Area of Flow: 370.866 sq ft
Wetted Perimeter: 89.376 ft
Average Velocity: 10.996 fps
Top Width (T): 87.831 ft
Froude Number: 0.943
Critical Depth: 7.733 ft
Critical Velocity: 11.513 fps
Critical Slope: 0.01772
Manning's Roughness: 0.04390

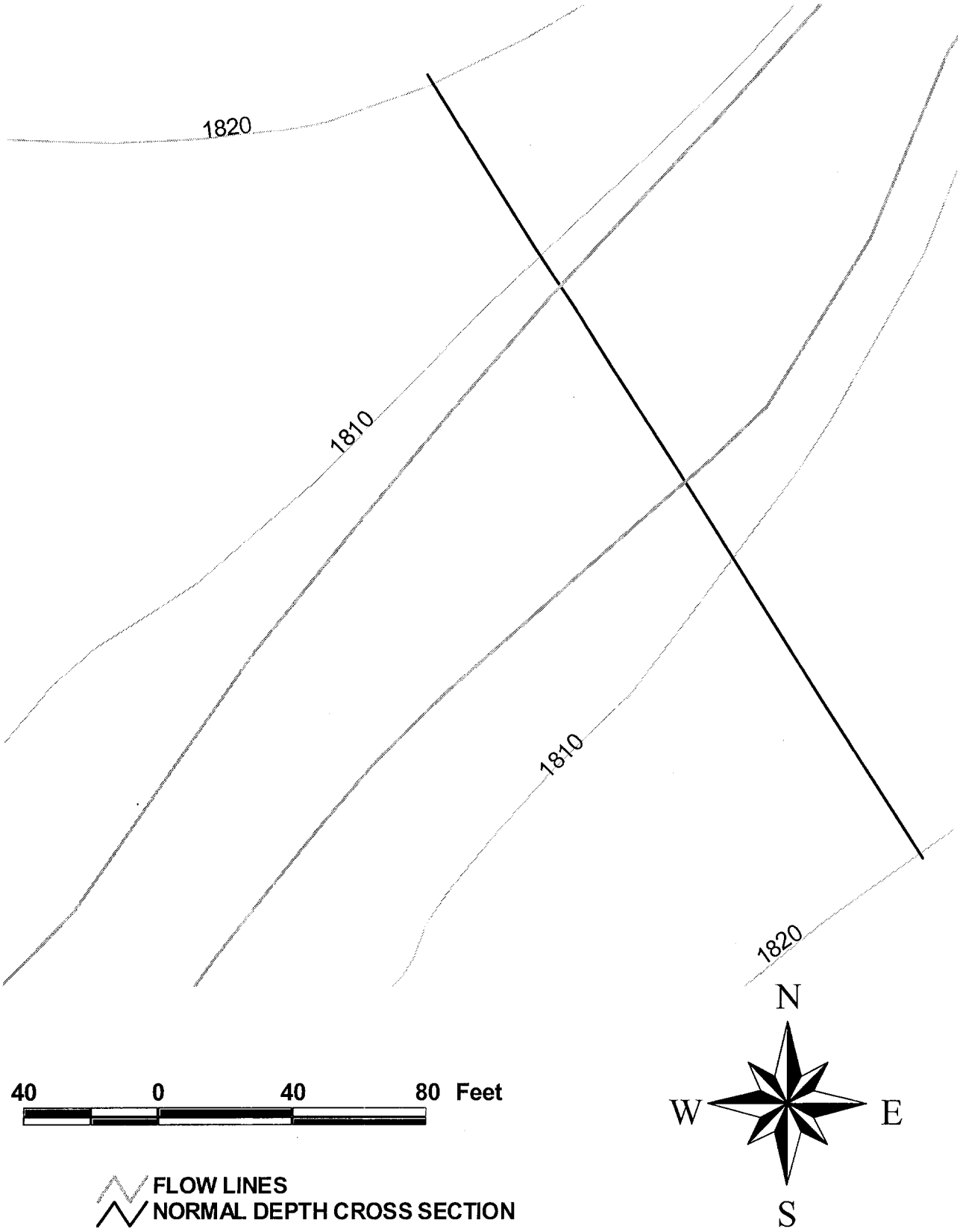
ROUTING REACH R2D3

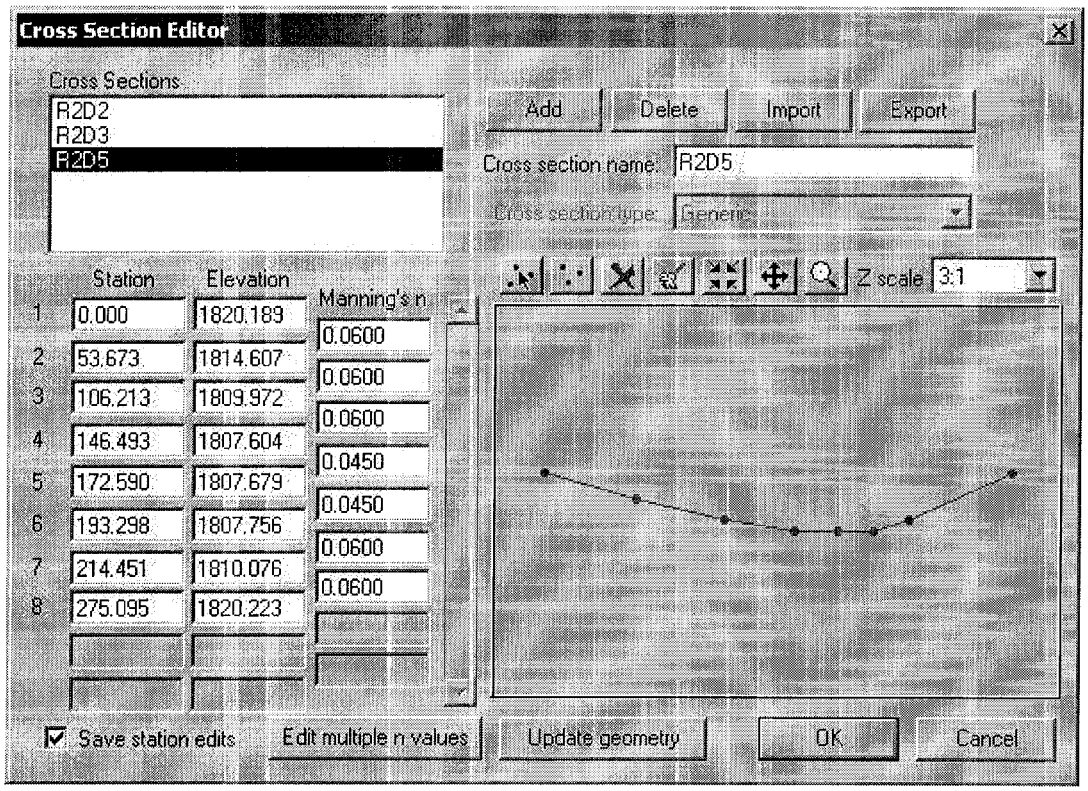




Calculated Values
Flow: 693.000 cfs
Depth: 3.764 ft
Area of Flow: 87.316 sq ft
Wetted Perimeter: 47.075 ft
Average Velocity: 7.937 fps
Top Width (T): 46.395 ft
Froude Number: 1.020
Critical Depth: 3.793 ft
Critical Velocity: 7.815 fps
Critical Slope: 0.01911
Manning's Roughness: 0.04000

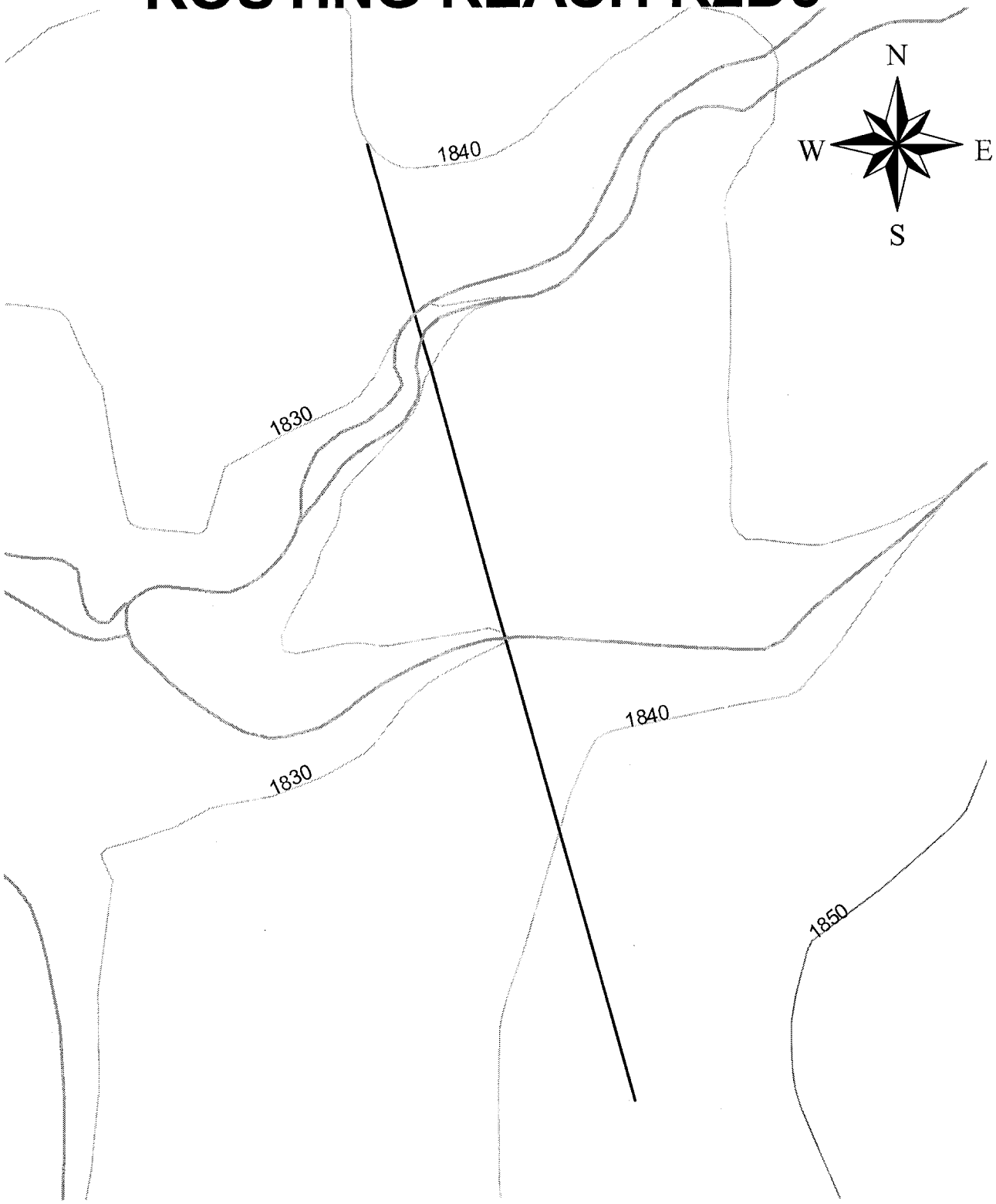
ROUTING REACH R2D5





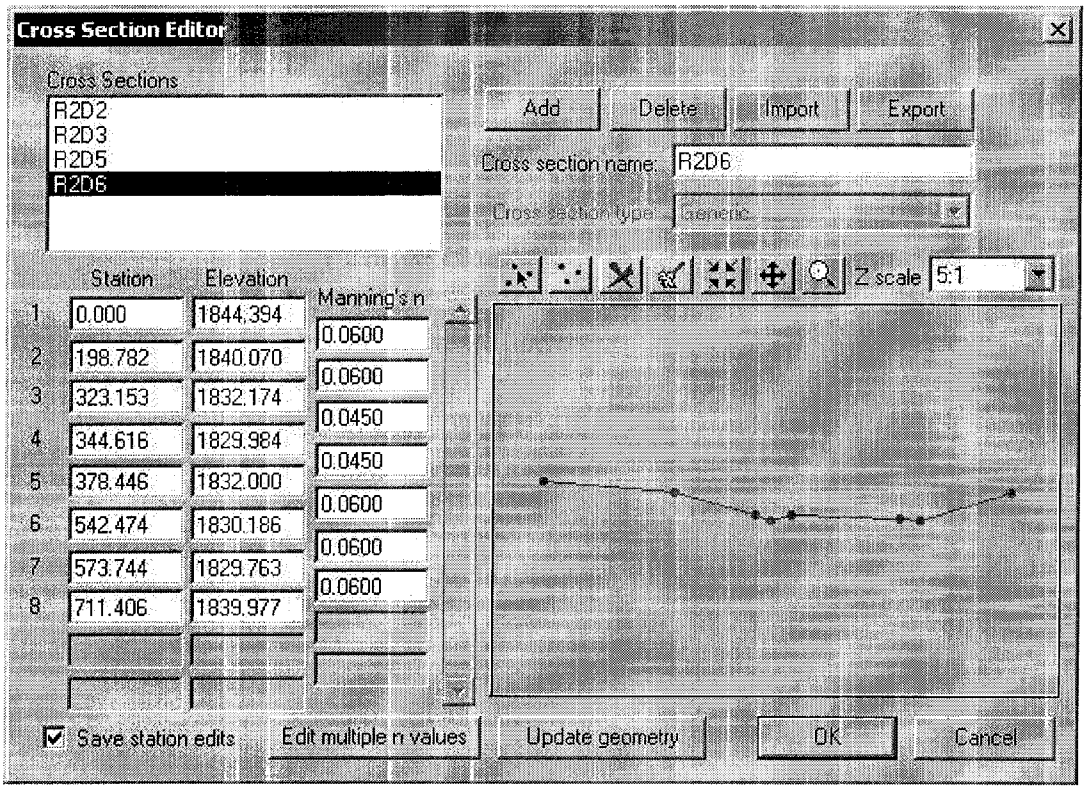
Calculated Values
Flow: 3533.000 cfs
Depth: 4.998 ft
Area of Flow: 520.442 sq ft
Wetted Perimeter: 153.669 ft
Average Velocity: 6.788 fps
Top Width (T): 153.147 ft
Froude Number: 0.649
Critical Depth: 3.988 ft
Critical Velocity: 9.430 fps
Critical Slope: 0.03121
Manning's Roughness: 0.05543

ROUTING REACH R2D6



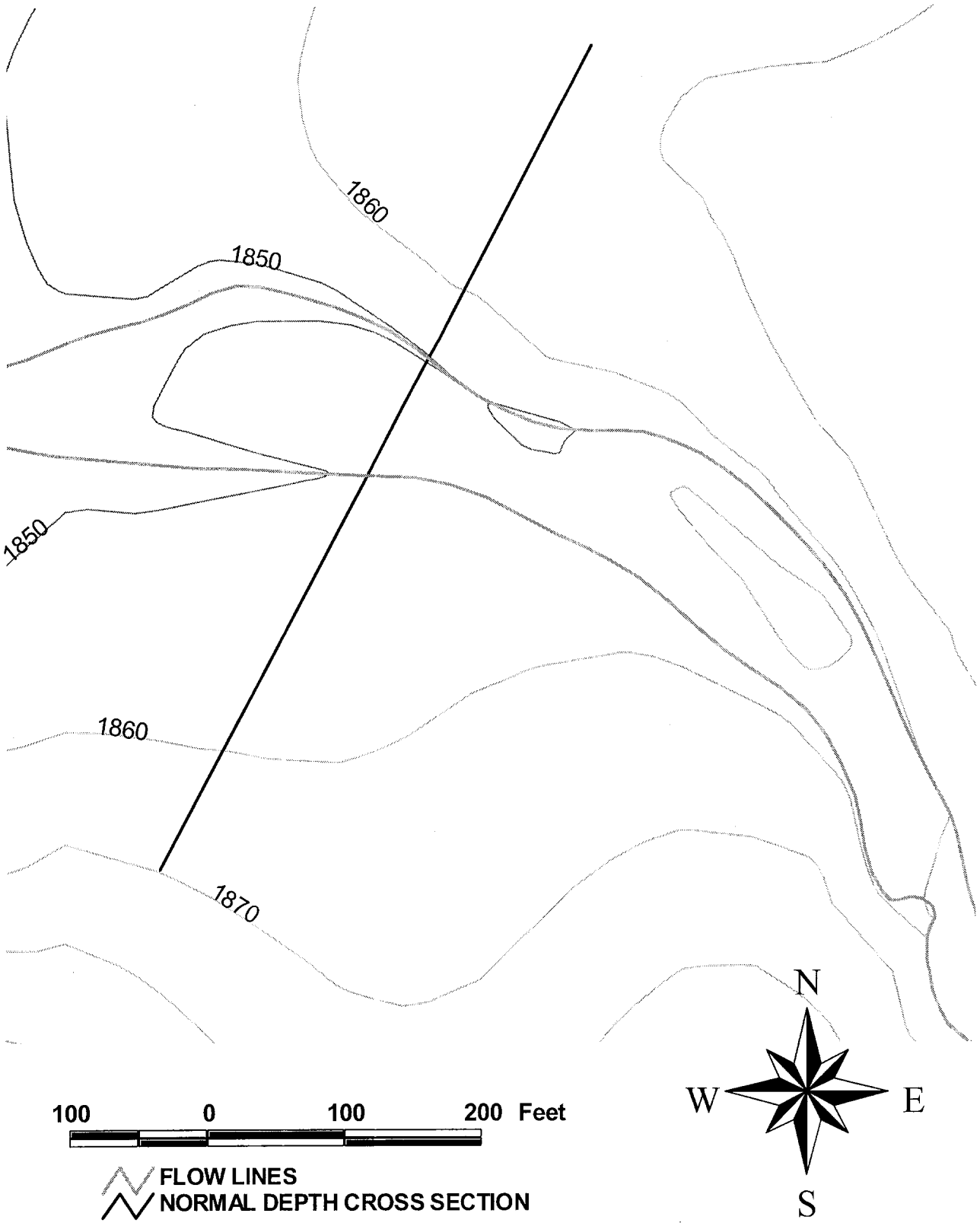
FLOW LINES
NORMAL DEPTH CROSS SECTION

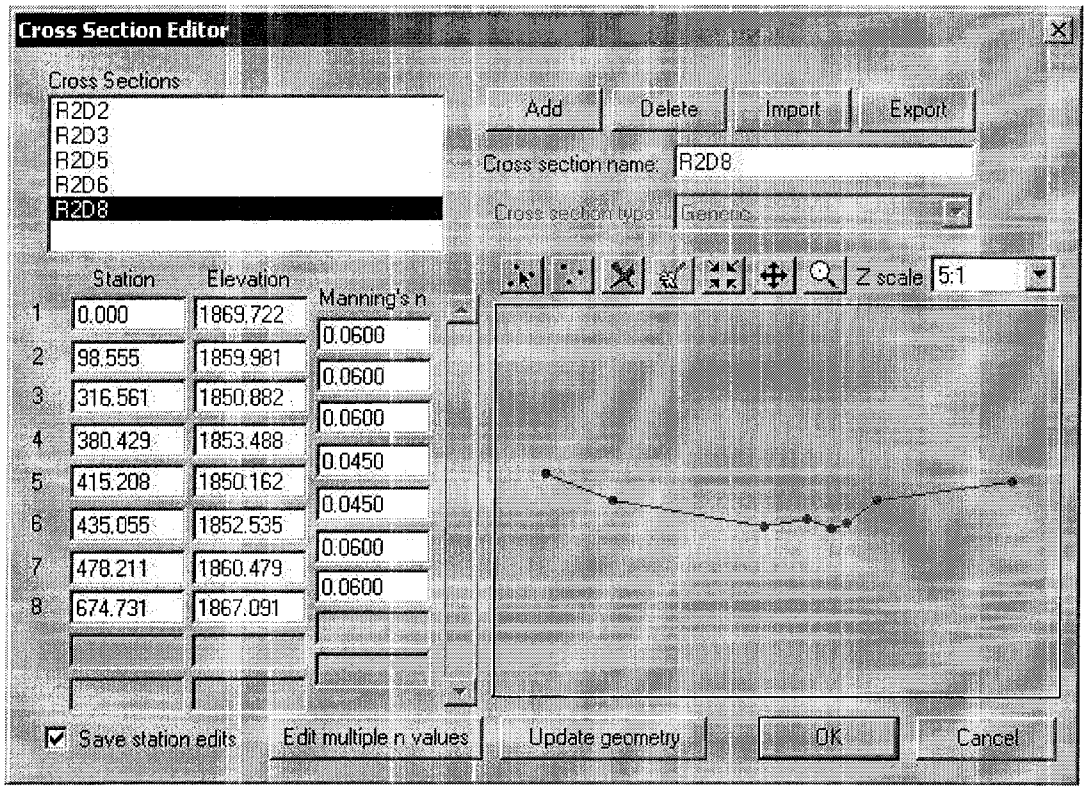
100 0 100 200 F



Calculated Values
Flow: 349.000 cfs
Depth: 1.448 ft
Area of Flow: 120.321 sq ft
Wetted Perimeter: 176.247 ft
Average Velocity: 2.901 fps
Top Width (T): 176.086 ft
Froude Number: 0.618
Critical Depth: 1.208 ft
Critical Velocity: 4.266 fps
Critical Slope: 0.05762
Manning's Roughness: 0.05722

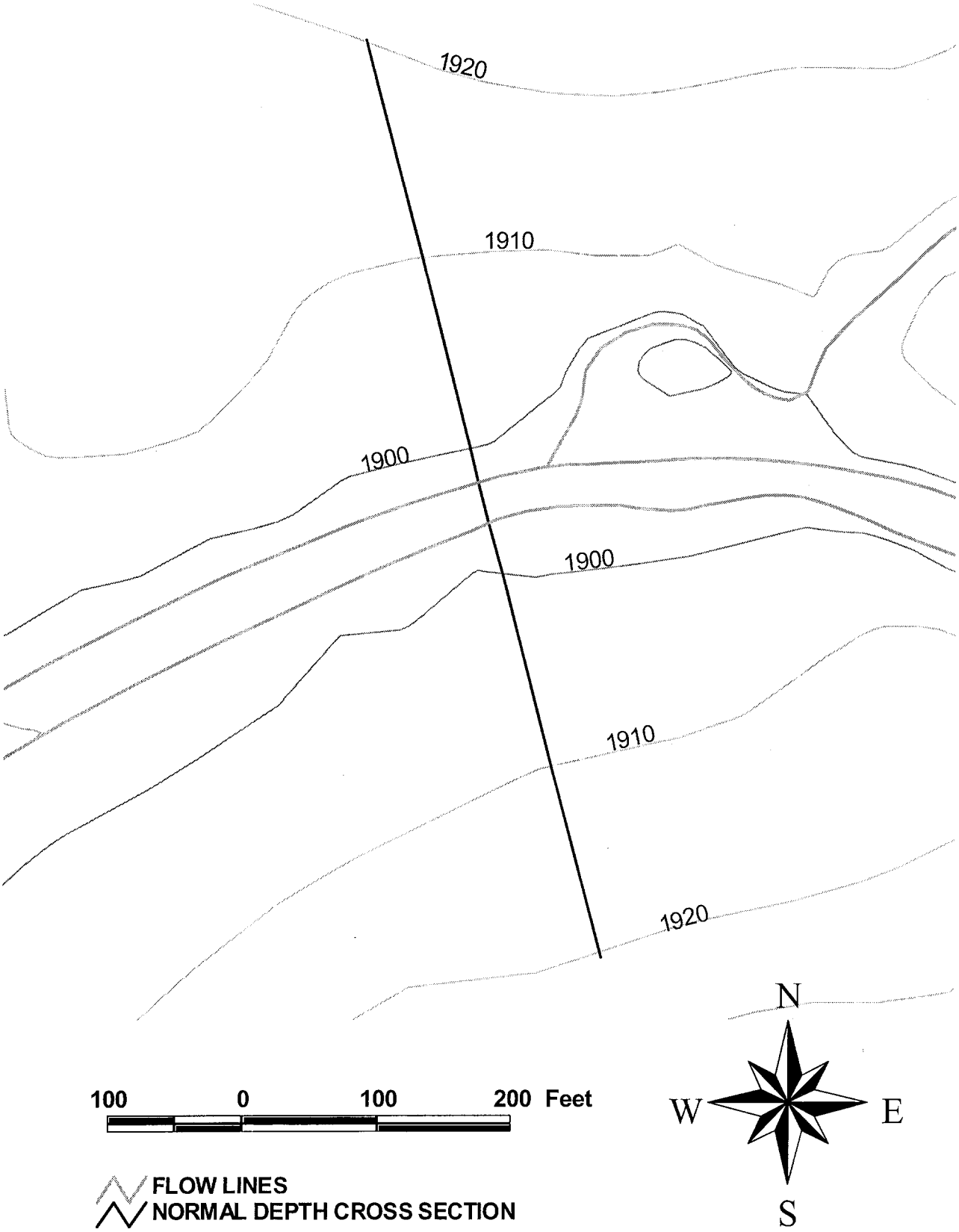
ROUTING REACH R2D8

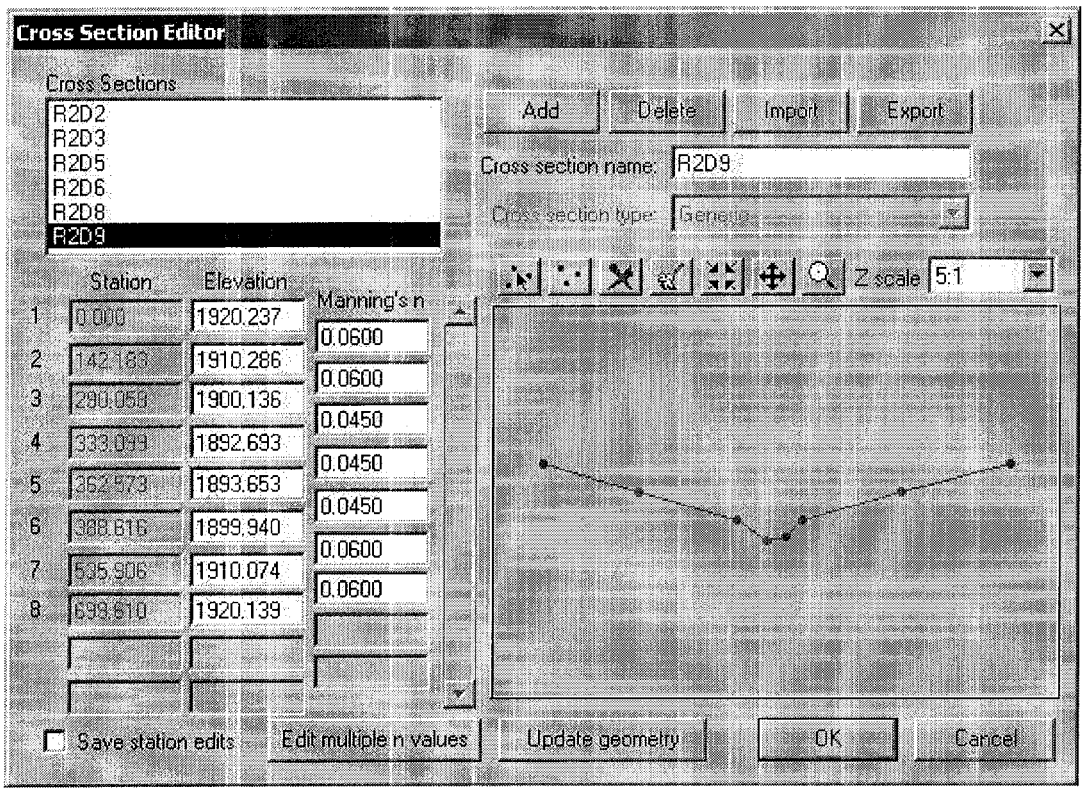




Calculated Values
Flow: 3224.000 cfs
Depth: 3.316 ft
Area of Flow: 616.866 sq ft
Wetted Perimeter: 309.875 ft
Average Velocity: 5.226 fps
Top Width (T): 309.539 ft
Froude Number: 0.652
Critical Depth: 2.783 ft
Critical Velocity: 7.068 fps
Critical Slope: 0.04101
Manning's Roughness: 0.05732

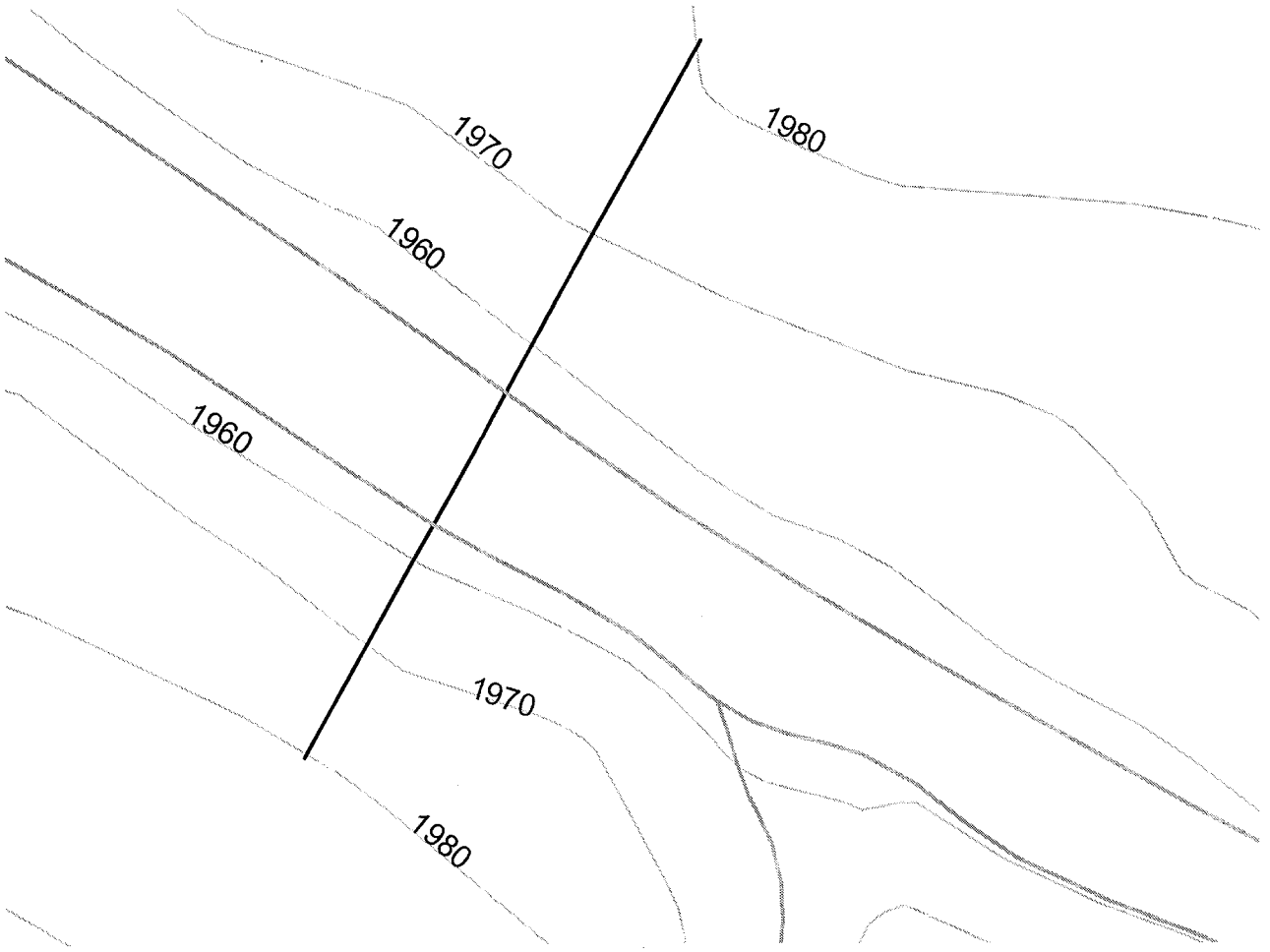
ROUTING REACH R2D9

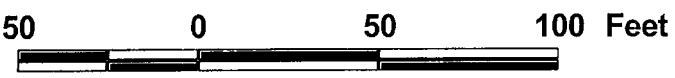


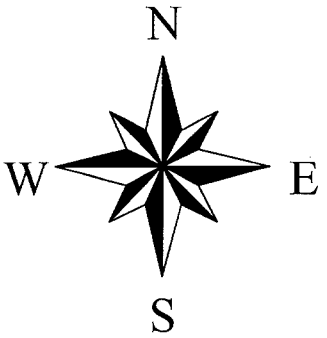


Calculated Values
Flow: 2800.000 cfs
Depth: 3.322 ft
Area of Flow: 618.761 sq ft
Wetted Perimeter: 310.054 ft
Average Velocity: 4.525 fps
Top Width (T): 309.718 ft
Froude Number: 0.564
Critical Depth: 2.636 ft
Critical Velocity: 6.777 fps
Critical Slope: 0.04211
Manning's Roughness: 0.05732

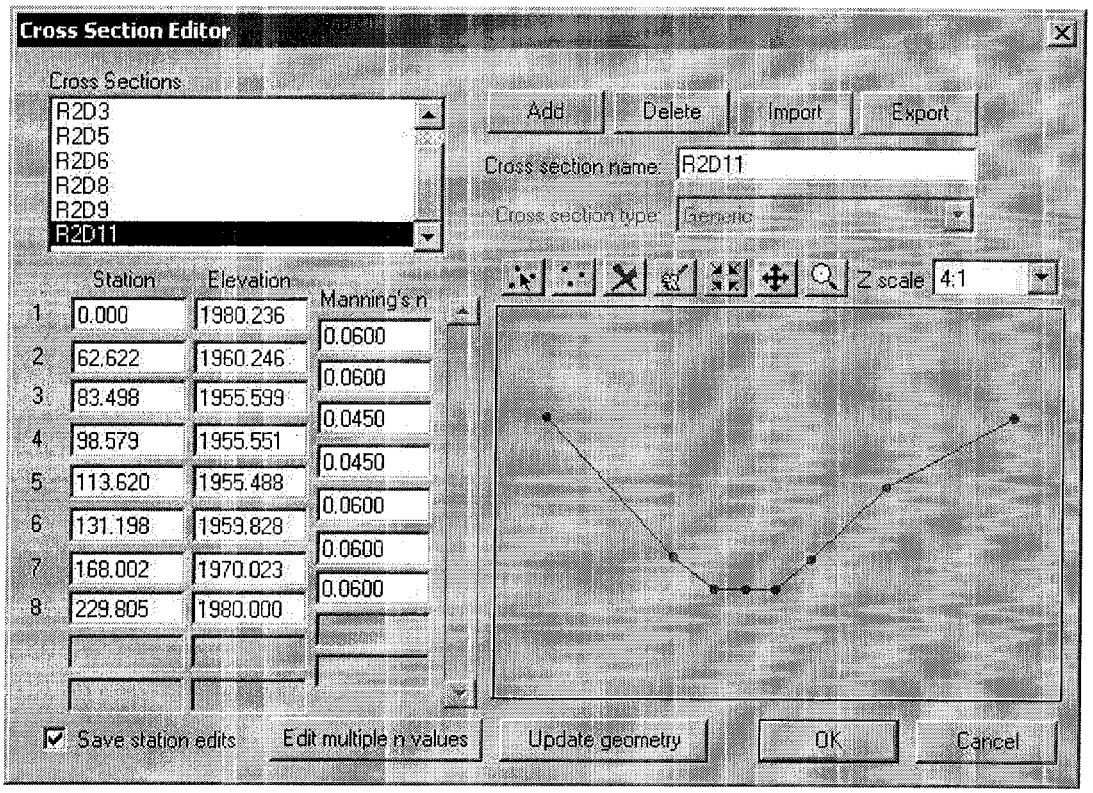
ROUTING REACH R2D11







FLOW LINES
NORMAL DEPTH CROSS SECTION



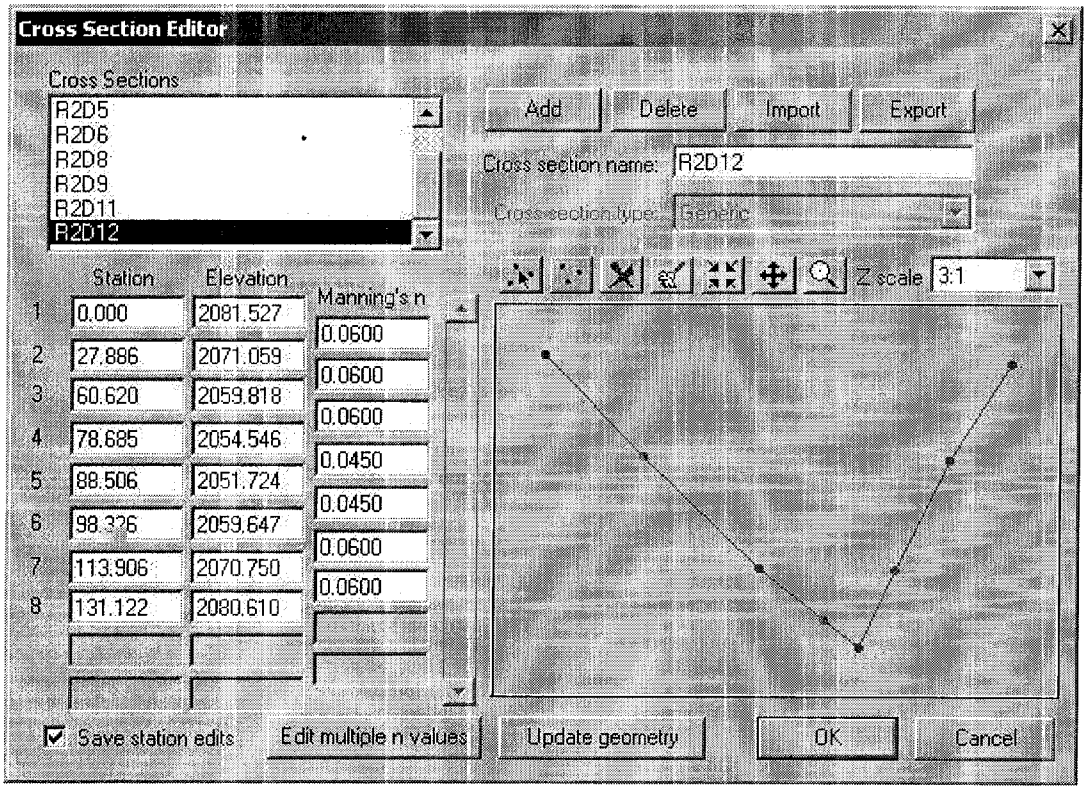
Calculated Values
Flow: 2090.000 cfs
Depth: 4.956 ft
Area of Flow: 249.860 sq ft
Wetted Perimeter: 72.573 ft
Average Velocity: 8.365 fps
Top Width (T): 71.420 ft
Froude Number: 0.788
Critical Depth: 4.359 ft
Critical Velocity: 10.022 fps
Critical Slope: 0.02881
Manning's Roughness: 0.05377

ROUTING REACH R2D12

30 0 30 60 Feet

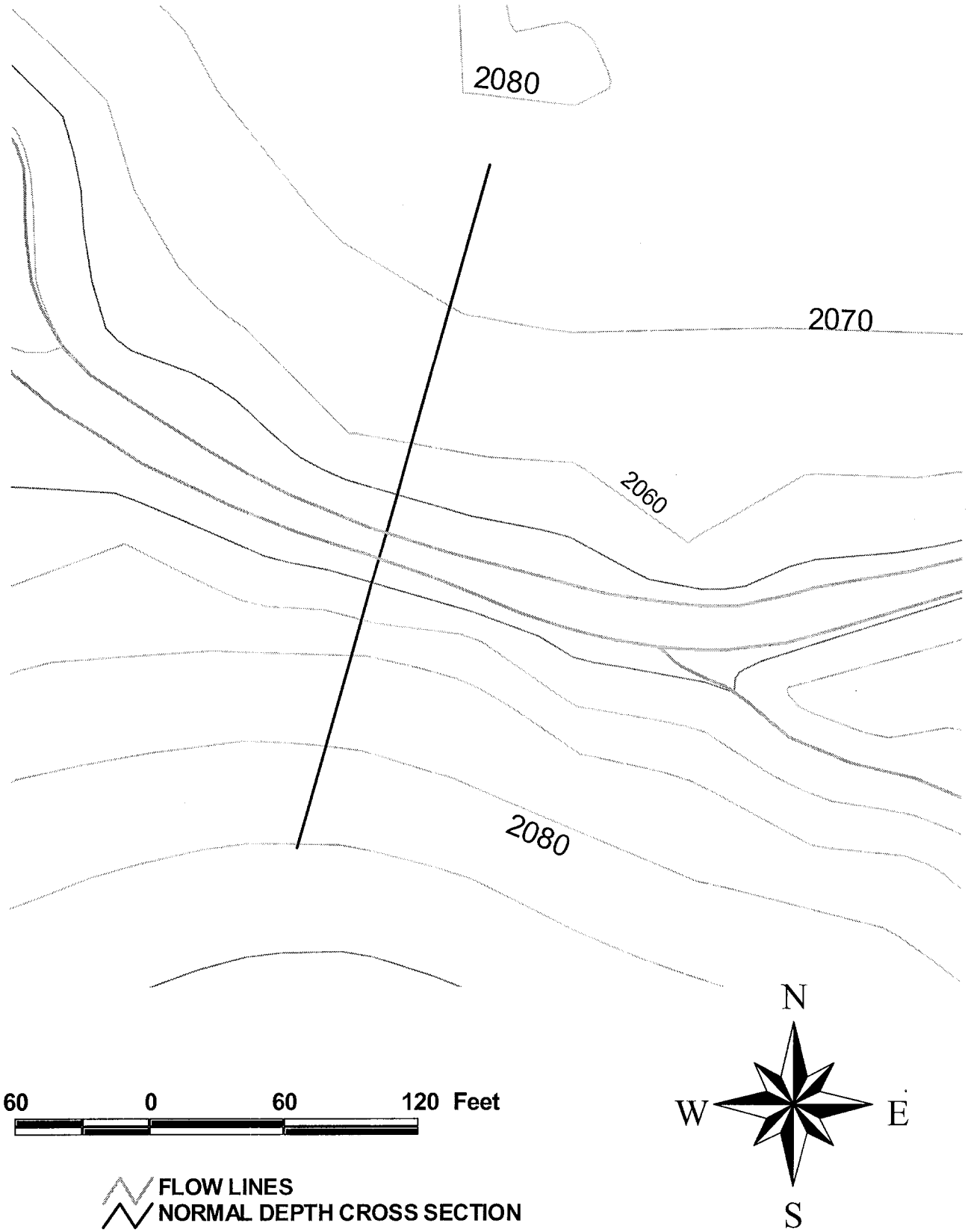
N
W E
S

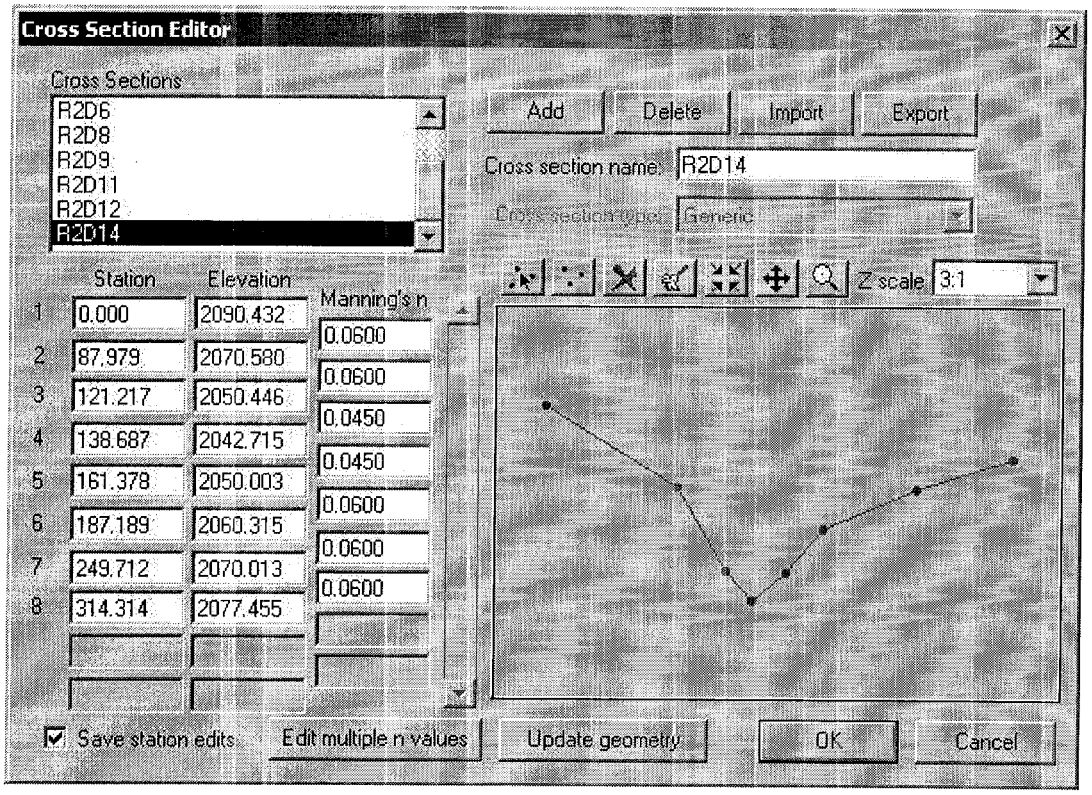
FLOW LINES
NORMAL DEPTH CROSS SECTION



Calculated Values
Flow: 827.000 cfs
Depth: 2.678 ft
Area of Flow: 108.218 sq ft
Wetted Perimeter: 53.110 ft
Average Velocity: 7.642 fps
Top Width (T): 52.502 ft
Froude Number: 0.938
Critical Depth: 2.581 ft
Critical Velocity: 8.018 fps
Critical Slope: 0.03084
Manning's Roughness: 0.05149

ROUTING REACH R2D14





Calculated Values
Flow: 1117.000 cfs
Depth: 6.643 ft
Area of Flow: 118.549 sq ft
Wetted Perimeter: 38.138 ft
Average Velocity: 9.422 fps
Top Width (T): 35.693 ft
Froude Number: 0.911
Critical Depth: 6.400 ft
Critical Velocity: 10.151 fps
Critical Slope: 0.02177
Manning's Roughness: 0.04500

D.4 Reservoir Routing Data

D.5 Flow Splits and Diversions Data

(This report does not consider these items)

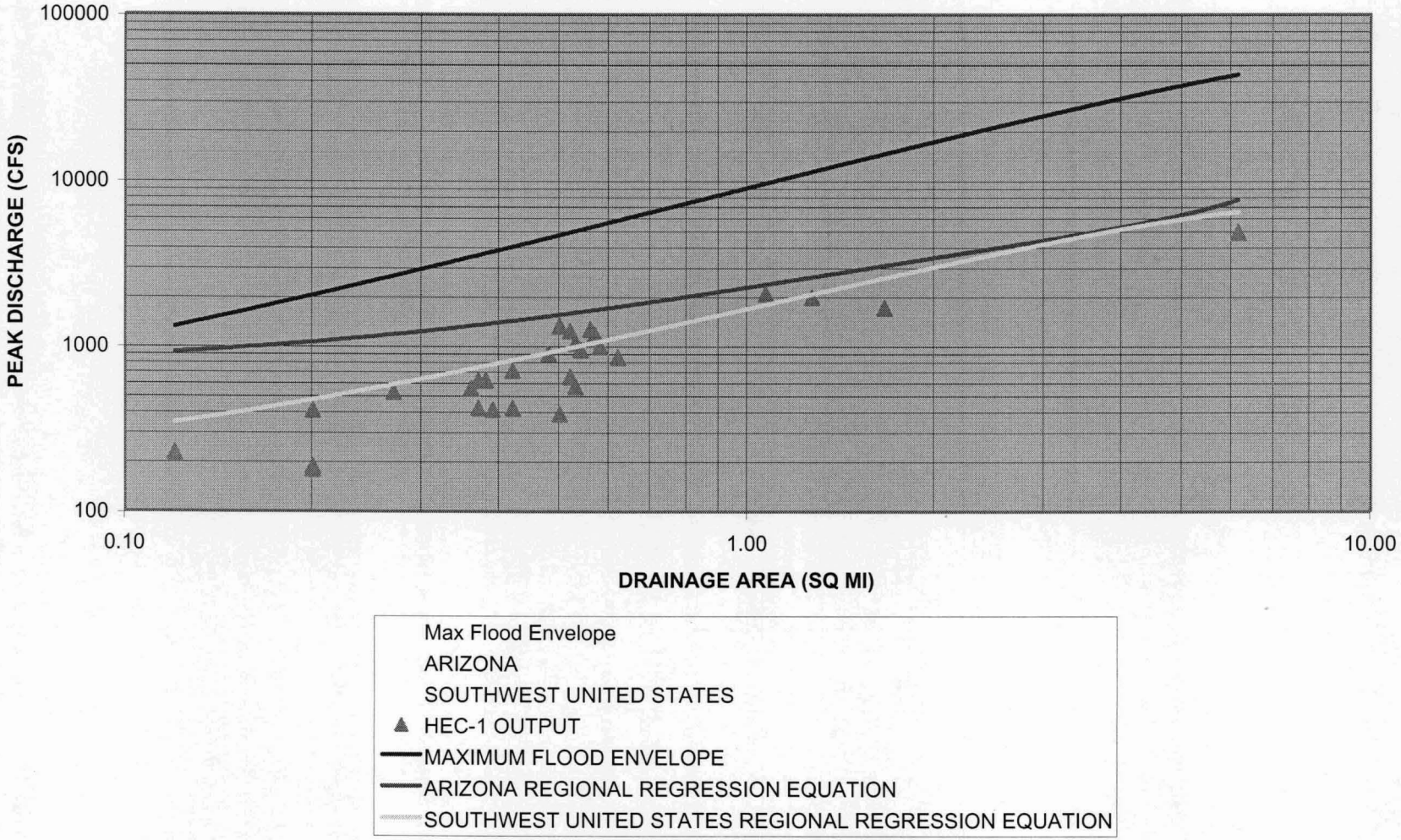
D.6 Hydrologic Calculations

NFF Equations for Arizona and the Southwestern United States

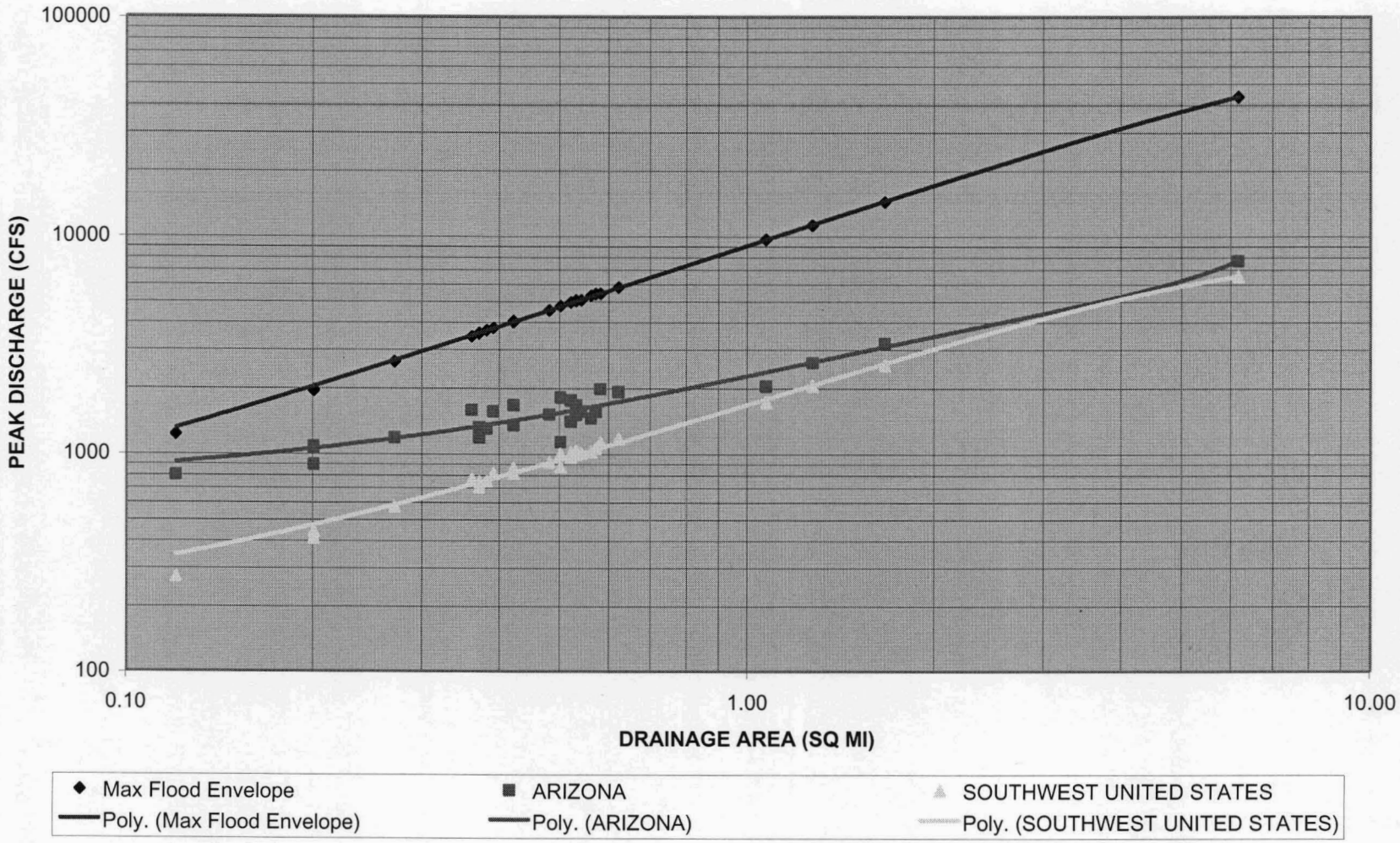
NFF CALCULATION SUMMARY

Drainage I.D.	Area	Basin Average Elevation	Avg. Annual Precip.	ARIZONA EQUATION Peak 100 Year Flood	SOUTH WEST U.S. EQUATION PEAK 100 YEAR FLOOD	HEC-1 DATA
Concentration Points along Agua Fria River (listed in Section 4 of the report)						
CP2A1	1.07	2440.0	13.89	2020	1700	2050
CP2B1	1.27	2200.0	14.12	2580	2030	1947
CP2C1	1.66	2160.0	14.26	3160	2520	1684
CP2D1	6.14	2080.0	14.8	7600	6450	4891
Individual Sub-Basins (Not listed Section 4 of the report)						
2A1	0.57	2241.1	13.993	1540	1050	1156
2A2	0.50	2657.6	13.766	1120	863	1304
2B1	0.27	1981.4	14.362	1170	568	518
2B2	0.48	2201.0	14.197	1500	904	883
2B3	0.52	2320.1	13.927	1390	954	1215
2C1	0.20	1865.1	14.542	1050	433	178
2C2	0.53	2104.8	14.386	1650	1020	560
2C3	0.37	2103.7	14.29	1310	736	415
2C4	0.56	2349.7	14.03	1440	1010	1249
2D1	0.36	1853.5	14.872	1570	755	544
2D2	0.39	1928.1	14.665	1550	803	405
2D3	0.54	2203.7	14.411	1550	997	935
2D4	0.12	1927.5	15.085	788	270	223
2D5	0.42	1933.3	15.063	1650	854	414
2D6	0.50	1953.2	14.858	1790	993	381
2D7	0.20	1886.7	14.858	1070	435	185
2D8	0.58	1969.2	15.063	1960	1120	980
2D9	0.52	2065.2	15.052	1740	1000	641
2D10	0.62	2057.1	14.834	1900	1160	841
2D11	0.20	2155.9	14.671	881	406	402
2D12	0.53	2269.4	14.448	1490	979	1027
2D13	0.38	2199.3	14.753	1290	741	610
2D14	0.37	2359.6	14.995	1170	695	611
2D15	0.42	2258.7	14.782	1340	805	698

100 YEAR PEAK DISCHARGE - DRAINAGE AREA
REGIONAL REGRESSION EQUATIONS ONLY



100 YEAR PEAK DISCHARGE - DRAINAGE AREA
REGIONAL REGRESSION EQUATIONS ONLY



Nationwide Summary of U.S. Geological Survey Regional Regression Equations for Estimating Magnitude and Frequency of Floods for Ungaged Sites, 1993

Compiled By M.E. Jennings, W.O. Thomas, Jr., and H.C. Riggs

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 94-4002

Prepared in cooperation with the
FEDERAL HIGHWAY ADMINISTRATION
and the
FEDERAL EMERGENCY MANAGEMENT AGENCY

Reston, Virginia
1994

ARIZONA

STATEWIDE RURAL

Summary

Arizona is divided into six hydrologic regions (fig. 1). The regression equations developed for these hydrologic regions are for estimating peak discharges (QT) having recurrence intervals T that range from 2 to 500 years. The explanatory basin variables used in the equations are drainage area (A), in square miles; mean basin elevation (E), in thousands of feet; and mean annual precipitation (P), in inches. The variables A and E can be measured from topographic maps, and P can be determined from figure 2. The regression equations were developed from peak-discharge records available through 1975 at 110 continuous-record gaging stations and 111 crest-stage gaging stations, and are applicable to unregulated streams that drain nonurban areas. The standard errors of estimate of the regression equations for the various T-year regression equations range from about 40 to 85 percent. The report by Roeske (1978) includes graphs relating flood characteristics to drainage area on the Little Colorado and Gila Rivers.

Procedure

Topographic maps, the hydrologic regions map (fig. 1), the map of mean annual precipitation (fig. 2), and the following equations are used to estimate the needed peak discharges QT, in cubic feet per second, having selected recurrence intervals T.

Region 1

$$Q2 = 19.0A^{0.660}$$
$$Q = 66.3A^{0.600}$$
$$Q10 = 127A^{0.566}$$
$$Q25 = 252A^{0.532}$$
$$Q50 = 393A^{0.510}$$
$$Q100 = 584A^{0.490}$$
$$Q500 = 1{,}300A^{0.451}$$

Region 2

$$Q2 = 87.0A^{0.433}$$
$$Q5 = 218A^{0.462}$$
$$Q10 = 352A^{0.475}$$
$$Q25 = 586A^{0.487}$$
$$Q50 = 815A^{0.494}$$
$$Q100 = 1{,}100A^{0.499}$$
$$Q500 = 2{,}000A^{0.509}$$

Region 3

$$Q2 = 5.66A^{0.673}\,E^{-0.605}\,P^{1.03}$$
$$Q5 = 31.6A^{0.650}\,E^{-0.868}\,P^{0.987}$$
$$Q10 = 74.7A^{0.638}\,E^{-1.00}\,P^{0.971}$$
$$Q25 = 186A^{0.626}\,E^{-1.14}\,P^{0.944}$$
$$Q50 = 329A^{0.617}\,E^{-1.22}\,P^{0.933}$$
$$Q100 = 553A^{0.610}\,E^{-1.30}\,P^{0.915}$$
$$Q500 = 1{,}530A^{0.595}\,E^{-1.45}\,P^{0.886}$$

Region 4

$$Q2 = 1.38A^{0.491}\,E^{2.25}$$
$$Q5 = 0.319A^{0.446}\,E^{3.60}$$
$$Q10 = 0.143A^{0.423}\,E^{4.31}$$
$$Q25 = 0.0590A^{0.398}\,E^{5.10}$$
$$Q50 = 0.0327A^{0.383}\,E^{5.60}$$
$$Q100 = 0.0188A^{0.369}\,E^{6.09}$$
$$Q500 = 0.0062A^{0.342}\,E^{7.04}$$

Region 5

$$Q2 = 96.6A^{0.555}$$
$$Q5 = 256A^{0.513}$$
$$Q10 = 416A^{0.492}$$
$$Q25 = 685A^{0.471}$$
$$Q50 = 937A^{0.458}$$
$$Q100 = 1{,}230A^{0.447}$$
$$Q500 = 2{,}120A^{0.425}$$

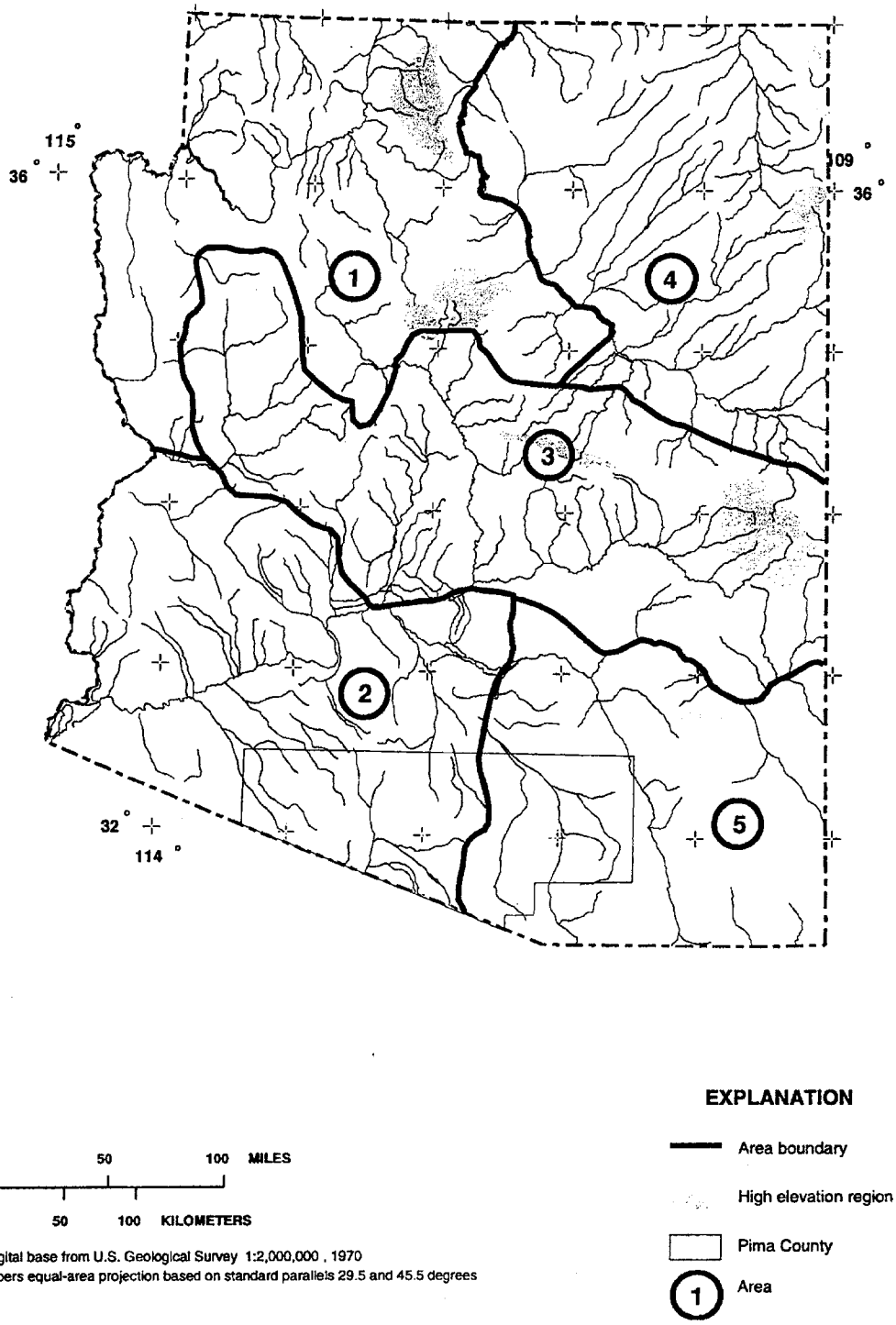
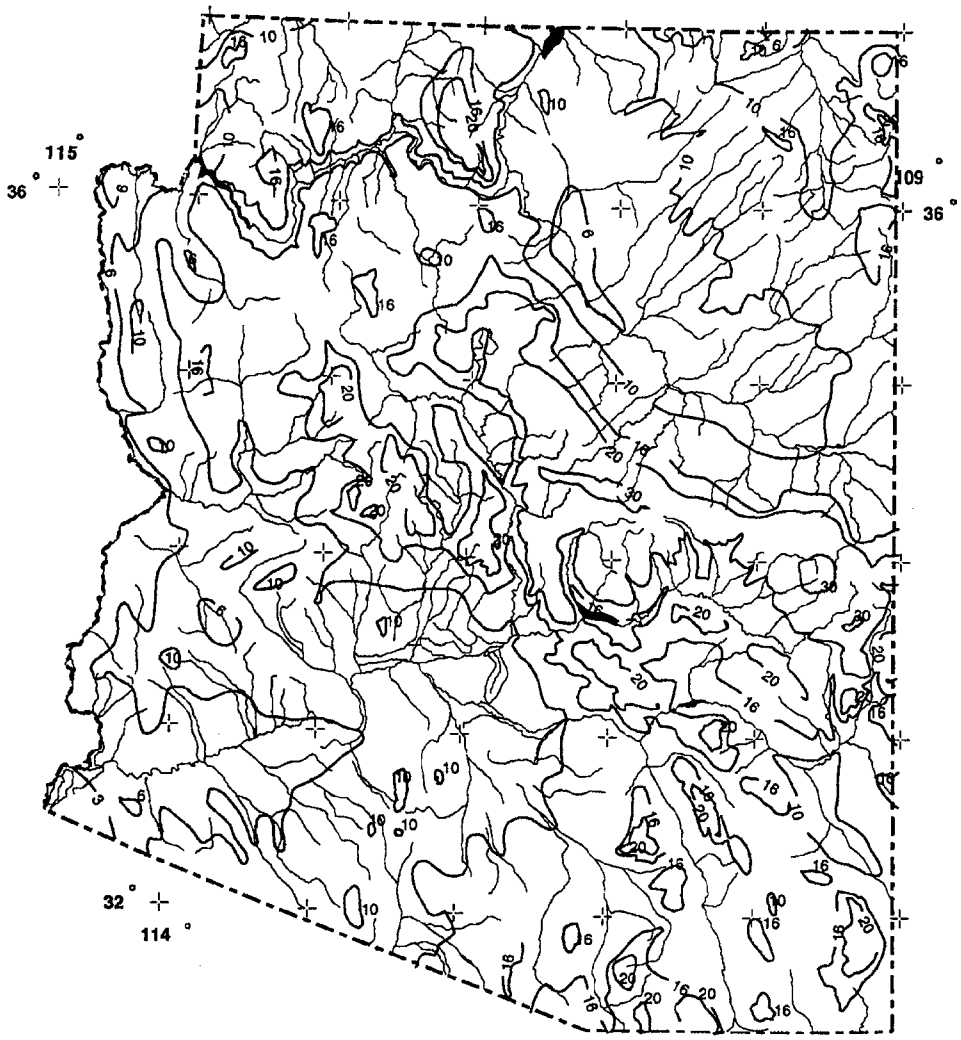


Figure 1. Flood-frequency region map for Arizona.



EXPLANATION

30 — Line of equal mean annual precipitation (interval, in inches, is variable)

0 50 100 MILES

0 50 100 KILOMETERS

Digital base from U.S. Geological Survey 1:2,000,000 , 1970
Albers equal-area projection based on standard parallels 29.5 and 45.5 degrees

Figure 2. Mean annual precipitation in Arizona.

High Elevation (HE) Region

$$Q2 = 8.78A^{0.853}$$
$$Q5 = 19.9A^{0.826}$$
$$Q10 = 29.6A^{0.816}$$
$$Q25 = 44.9A^{0.805}$$
$$Q50 = 58.2A^{0.799}$$
$$Q100 = 72.9A^{0.795}$$
$$Q500 = 113A^{0.787}$$

Reference

Roeske, R.H., 1978, Methods for estimating the magnitude and frequency of floods in Arizona: U.S. Geological Survey Open-File Report 78-711, 82 p.

PIMA COUNTY RURAL

Summary

In a separate study, regression equations were developed for streams in and near Pima County. The study area is one region with regression equations for estimating peak discharges (RQT) having recurrence intervals that range from 2 to 500 years (fig. 1). The explanatory basin variables used in the equations are drainage area (A), in square miles; main-channel slope (S), in feet per mile; and shape factor (Sh), which is squared length of the watershed in miles divided by drainage area (L2/A). These variables can be measured from topographic maps. The regression equations are based on peak-discharge records for 101 stations in and near Pima County with the equations applicable to streams draining rural areas. Standard errors of estimate of the regression equations range from 42 to 60 percent. The report by Eychaner (1984) includes equations for streams draining urban areas based on Sauer and others (1983).

Procedure

Topographic maps, the hydrologic region map (fig. 1) and the following equations are used to estimate peak discharges (RQT), in cubic feet per second, having selected recurrence intervals T for sites in Pima County.

$$\text{LogRQ2} = 2.049 + 0.547\text{LogA} - 0.003(\text{LogA})^2 + 0.299\text{LogS} - 0.194(\text{LogS})^2 - 0.253(\text{LogS})(\text{LogSh})$$

$$\text{LogRQ5} = 2.430 + 0.591\text{LogA} - 0.023(\text{LogA})^2 + 0.489\text{LogS} - 0.275(\text{LogS})^2 - 0.408(\text{LogS})(\text{LogSh})$$

$$\text{LogRQ10} = 2.621 + 0.609\text{LogA} - 0.031(\text{LogA})^2 + 0.633\text{LogS} - 0.288(\text{LogS})^2 - 0.578(\text{LogS})(\text{LogSh})$$

$$\text{LogRQ25} = 2.814 + 0.625\text{LogA} - 0.039(\text{LogA})^2 + 0.679\text{LogS} - 0.329(\text{LogS})^2 - 0.590(\text{LogS})(\text{LogSh})$$

$$\text{LogRQ50} = 2.936 + 0.636\text{LogA} - 0.044(\text{LogA})^2 + 0.706\text{LogS} - 0.350(\text{LogS})^2 - 0.601(\text{LogS})(\text{LogSh})$$

$$\text{LogRQ100} = 3.044 + 0.646\text{LogA} - 0.049(\text{LogA})^2 + 0.729\text{LogS} - 0.367(\text{LogS})^2 - 0.614(\text{LogS})(\text{LogSh})$$

$$\text{LogRQ500} = 3.260 + 0.665\text{LogA} - 0.058(\text{LogA})^2 + 0.776\text{LogS} - 0.396(\text{LogS})^2 - 0.651(\text{LogS})(\text{LogSh})$$

Reference

Eychaner, J.H., 1984, Estimation of magnitude and frequency of floods in Pima County, Arizona, with comparisons of alternative methods: U.S. Geological Survey Water-Resources Investigations Report 84-4142, 69 p.

SOUTHWESTERN UNITED STATES

Summary

A regional flood-frequency study was completed for an area of the southwestern United States, including all of Arizona, Nevada, and Utah, and parts of California, Colorado, Idaho, New Mexico, Oregon, Texas, and Wyoming (fig. 1). The study area was divided into 16 hydrologic flood regions as shown in Figure 1. Region 1 comprises high-elevation areas throughout the study area. The regression equations developed for these regions are for estimating peak discharges (QT) having recurrence intervals T that range from 2 to 100 years. The explanatory basin variables used in the equations are drainage area (AREA), in square miles; mean basin elevation (ELEV/1000), in feet above sea level divided by 1000; mean annual precipitation (PREC), in inches; mean annual free water surface evaporation (EVAP), in inches; latitude of the gaged site minus 28 divided by 10 ((LAT-28)/10), in decimal degrees; and longitude of the gaged site minus 99 divided by 10 ((LONG-99/10)), in decimal degrees. The variables ELEV, LAT and LONG are modified by the given constants in the computer applications of the equations. The user should enter the actual values of ELEV, LAT and LONG. The variables AREA, ELEV, LAT and LONG can be measured from topographic maps. The variable PREC can be obtained from normal-annual precipitation maps (1:500,000 scale) in U.S. Weather Bureau (1959-61, 1963). The variable EVAP can be obtained from figures 2 and 3. The regression equations were developed from peak-discharge records available as of 1986 at 1,162 stations in the 10-state study area. The equations are most applicable to unregulated streams with drainage areas less than 200 square miles. In all regions some stations with drainage areas between 200 and 2000 square miles were used in developing the regression equations. Judicious use should be made of the equations for basins between 200 square miles and the upper limit of the calibration data (this upper limit is provided in the NFF program). The average standard error of prediction of the regression equations range from 45 to 135 percent.

Procedure

Use topographic maps, mean annual precipitation maps in U.S. Weather Bureau (1959-61, 1963), mean annual free water surface evaporation maps in figures 2 and 3, and the following regression equations to estimate the needed peak discharges QT, in cubic feet per second, having selected recurrence intervals T.

High-Elevation Region 1

$$Q2 = 0.124AREA^{0.845}PREC^{1.44}$$
$$Q5 = 0.629AREA^{0.807}PREC^{1.12}$$
$$Q10 = 1.43AREA^{0.786}PREC^{0.958}$$
$$Q25 = 3.08AREA^{0.768}PREC^{0.811}$$
$$Q50 = 4.75AREA^{0.758}PREC^{0.732}$$
$$Q100 = 6.78AREA^{0.750}PREC^{0.668}$$

Northwest Region 2

$$Q2 = 13.1AREA^{0.713}$$
$$Q5 = 22.4AREA^{0.723}$$
$$Q10 = 55.7AREA^{0.727}(ELEV/1,000)^{-0.353}$$
$$Q25 = 84.7AREA^{0.737}(ELEV/1,000)^{-0.438}$$
$$Q50 = 113AREA^{0.746}(ELEV/1,000)^{-0.511}$$
$$Q100 = 148AREA^{0.752}(ELEV/1,000)^{-0.584}$$

South-Central Idaho Region 3

$$Q2 = 0.444AREA^{0.649}PREC^{1.15}$$
$$Q5 = 1.21AREA^{0.639}PREC^{0.995}$$
$$Q10 = 1.99AREA^{0.633}PREC^{0.924}$$
$$Q25 = 3.37AREA^{0.627}PREC^{0.849}$$
$$Q50 = 4.70AREA^{0.625}PREC^{0.802}$$
$$Q100 = 6.42AREA^{0.621}PREC^{0.757}$$

Northeast Region 4

$$Q2 = 0.0405AREA^{0.701}(ELEV/1,000)^{2.91}$$
$$Q5 = 0.408AREA^{0.683}(ELEV/1,000)^{2.05}$$
$$Q10 = 1.26AREA^{0.674}(ELEV/1,000)^{1.64}$$
$$Q25 = 3.74AREA^{0.667}(ELEV/1,000)^{1.24}$$
$$Q50 = 7.04AREA^{0.664}(ELEV/1,000)^{1.02}$$
$$Q100 = 11.8AREA^{0.662}(ELEV/1,000)^{0.835}$$

Eastern Sierras Region 5

$$Q2 = 0.0333AREA^{0.853}(ELEV/1,000)^{2.68}[(LAT-28)/10]^{4.1}$$
$$Q5 = 2.42AREA^{0.823}(ELEV/1,000)^{1.01}[(LAT-28)/10]^{4.1}$$
$$Q10 = 28.0AREA^{0.826}[(LAT-28)/10]^{4.3}$$
$$Q25 = 426AREA^{0.812}(ELEV/1,000)^{-1.10}[(LAT-28)/10]^{4.3}$$
$$Q50 = 2,030AREA^{0.798}(ELEV/1,000)^{-1.71}[(LAT-28)/10]^{4.4}$$
$$Q100 = 7,000AREA^{0.782}(ELEV/1,000)^{-2.18}[(LAT-28)/10]^{4.6}$$

Northern Great Basin Region 6

$$Q2 = 0$$
$$Q5 = 32AREA^{0.80}(ELEV/1,000)^{-0.66}$$
$$Q10 = 590AREA^{0.62}(ELEV/1,000)^{-1.6}$$
$$Q25 = 3,200AREA^{0.62}(ELEV/1,000)^{-2.1}$$
$$Q50 = 5,300AREA^{0.64}(ELEV/1,000)^{-2.1}$$
$$Q100 = 20,000AREA^{0.51}(ELEV/1,000)^{-2.3}$$

South-Central Utah Region 7

$$Q2 = 0.0150AREA^{0.697}(ELEV/1,000)^{3.16}$$
$$Q5 = 0.306AREA^{0.590}(ELEV/1,000)^{2.22}$$
$$Q10 = 1.25AREA^{0.526}(ELEV/1,000)^{1.83}$$
$$Q25 = 122AREA^{0.440}$$
$$Q50 = 183AREA^{0.390}$$
$$Q100 = 264AREA^{0.344}$$

Four Corners Region 8

$$Q2 = 598AREA^{0.501}(ELEV/1,000)^{-1.02}$$
$$Q5 = 2,620AREA^{0.449}(ELEV/1,000)^{-1.28}$$
$$Q10 = 5,310AREA^{0.425}(ELEV/1,000)^{-1.40}$$
$$Q25 = 10,500AREA^{0.403}(ELEV/1,000)^{-1.49}$$
$$Q50 = 16,000AREA^{0.390}(ELEV/1,000)^{-1.54}$$
$$Q100 = 23,300AREA^{0.377}(ELEV/1,000)^{-1.59}$$

Western Colorado Region 9

$$Q2 = 0.204AREA^{0.606}(ELEV/1,000)^{3.5}$$
$$Q5 = 0.181AREA^{0.515}(ELEV/1,000)^{2.9}$$
$$Q10 = 1.18AREA^{0.488}(ELEV/1,000)^{2.2}$$
$$Q25 = 18.2AREA^{0.465}(ELEV/1,000)^{1.1}$$
$$Q50 = 248AREA^{0.449}$$
$$Q100 = 292AREA^{0.444}$$

Southern Great Basin Region 10

$$Q2 = 12AREA^{0.58}$$
$$Q5 = 85AREA^{0.59}$$
$$Q10 = 200AREA^{0.62}$$
$$Q25 = 400AREA^{0.65}$$
$$Q50 = 590AREA^{0.67}$$
$$Q100 = 850AREA^{0.69}$$

Northeast Arizona Region 11

$$Q2 = 26AREA^{0.62}$$
$$Q5 = 130AREA^{0.56}$$
$$Q10 = 0.10AREA^{0.52}EVAP^{2.0}$$
$$Q25 = 0.17AREA^{0.52}EVAP^{2.0}$$
$$Q50 = 0.24AREA^{0.54}EVAP^{2.0}$$
$$Q100 = 0.27AREA^{0.58}EVAP^{2.0}$$

Central Arizona Region 12

$$Q2 = 41.1AREA^{0.629}$$
$$Q5 = 238AREA^{0.687}(ELEV/1,000)^{-0.358}$$
$$Q10 = 479AREA^{0.661}(ELEV/1,000)^{-0.398}$$
$$Q25 = 942AREA^{0.630}(ELEV/1,000)^{-0.383}$$
$$Q50 = 10^{(7.36-4.17AREA**-0.08)}(ELEV/1,000)^{-0.440}$$
$$Q100 = 10^{(6.55-3.17AREA**-0.11)}(ELEV/1,000)^{-0.454}$$

Southern Arizona Region 13

$$Q2 = 10^{(6.38-4.29AREA**-0.06)}$$
$$Q5 = 10^{(5.78-3.31AREA**-0.08)}$$
$$Q10 = 10^{(5.68-3.02AREA**-0.09)}$$
$$Q25 = 10^{(5.64-2.78AREA**-0.10)}$$
$$Q50 = 10^{(5.57-2.59AREA**-0.11)}$$
$$Q100 = 10^{(5.52-2.42AREA**-0.12)}$$

Upper Gila Basin Region 14

$$Q2 = 583AREA^{0.588}(ELEV/1,000)^{-1.3}$$
$$Q5 = 618AREA^{0.524}(ELEV/1,000)^{-0.70}$$
$$Q10 = 361AREA^{0.464}$$
$$Q25 = 581AREA^{0.462}$$
$$Q50 = 779AREA^{0.462}$$
$$Q100 = 1,010AREA^{0.463}$$

Upper Rio Grande Basin Region 15

$$Q2 = 18,700AREA^{0.730}(ELEV/1,000)^{-2.86}[(LONG-99)/10)]^{2.8}$$
$$Q5 = 31,700AREA^{0.646}(ELEV/1,000)^{-2.67}[(LONG-99)/10)]^{2.7}$$
$$Q10 = 26,000AREA^{0.582}(ELEV/1,000)^{-2.27}[(LONG-99)/10)]^{2.7}$$
$$Q25 = 34,800AREA^{0.532}(ELEV/1,000)^{-2.15}[(LONG-99)/10)]^{2.6}$$
$$Q50 = 44,200AREA^{0.501}(ELEV/1,000)^{-2.11}[(LONG-99)/10)]^{2.5}$$
$$Q100 = 91,800AREA^{0.439}(ELEV/1,000)^{-2.22}[(LONG-99)/10)]^{2.5}$$

Southeast Region 16

$$Q2 = 14AREA^{0.51}(EVAP - 32)^{0.55}$$
$$Q5 = 37AREA^{0.48}(EVAP - 32)^{0.63}$$
$$Q10 = 52AREA^{0.47}(EVAP - 32)^{0.67}$$
$$Q25 = 70AREA^{0.48}(EVAP - 32)^{0.74}$$
$$Q50 = 110AREA^{0.47}(EVAP - 34)^{0.74}$$
$$Q100 = 400AREA^{0.50}(EVAP - 37)^{0.45}$$

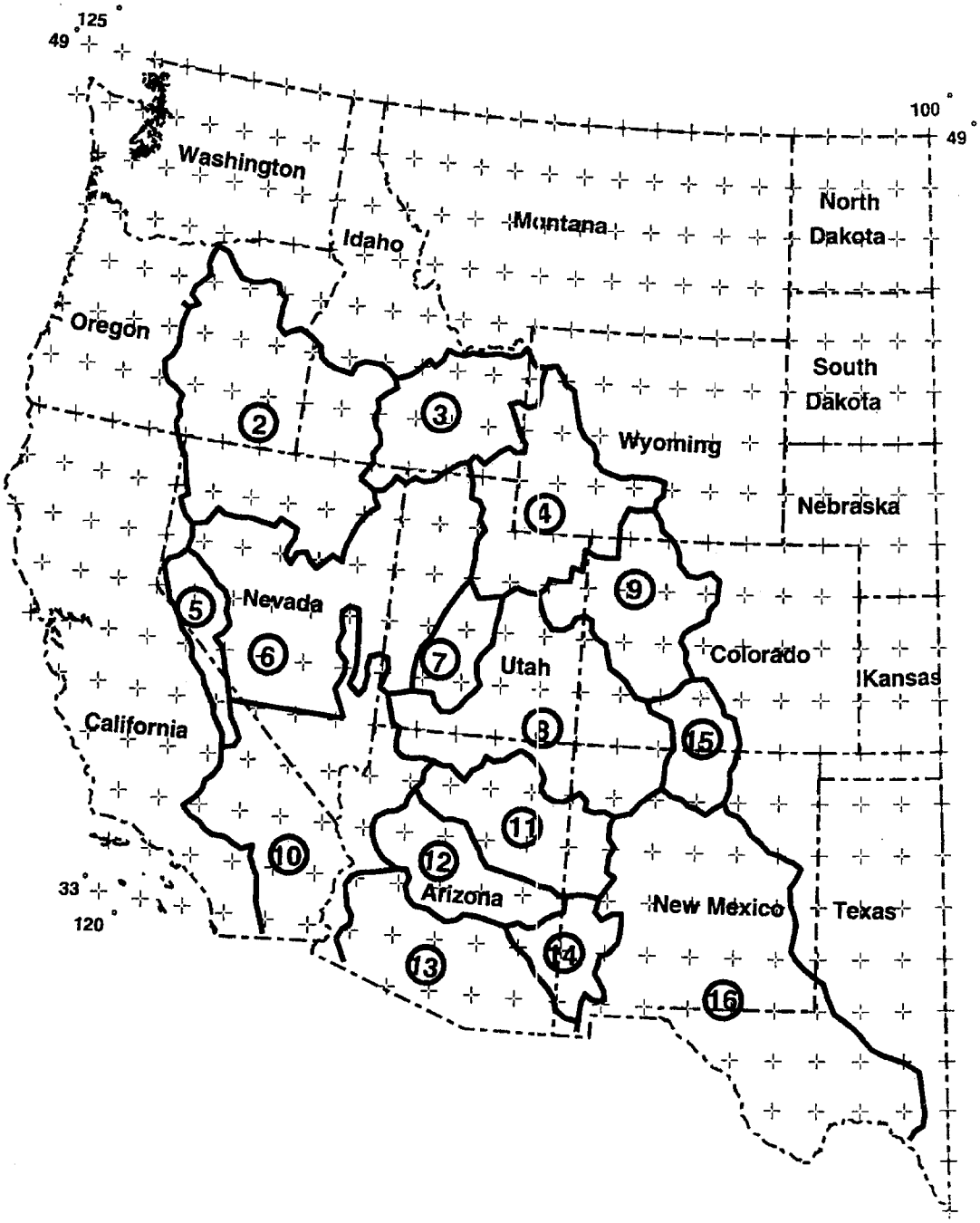
Reference

Thomas, B.E., Hjalmarson, H.W., and Waltemeyer, S.D., 1993, Methods for estimating magnitude and frequency of floods in the southwestern United States: U.S. Geological Survey Open-File Report 93-419, 193 pages.

Additional References

U.S. Weather Bureau, 1959-61, Climates of the States: U.S. Department of Commerce, Weather Bureau, Climatography of the United States, no. 60 [section for each State].

U.S. Weather Bureau, 1963, Normal annual precipitation (1931-60) for the States of Arizona, Colorado, New Mexico, Utah: U.S. Department of Commerce, Weather Bureau maps, scale 1:500,000.



EXPLANATION

Region boundary

Region

0 250 500 MILES

0 250 500 KILOMETERS

Digital base from U.S. Geological Survey 1:2,000,000 , 1970
Albers equal-area projection based on standard parallels 29.5 and 45.5 degrees

Figure 1. Flood regions in study area.

NFF Flow Calculations
Arizona Equations

NFF FLOW CALCULATIONS FOR CONFLUENCE POINTS ALONG THE AGUA FRIA RIVER (RESULTS LISTED IN SECTION 4)

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: CP2A1, Total Area (sq mi): 1.07

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum	
Central Mountain Area					
U.S. Max Fld Rgn: 16					
	Drainage Area (sq mi) A*:	1.07	0.06	5499.00	
Mean Basin Elevation (thousands of feet) E*:		2.44	1.78		7.40
Mean Annual Precipitation (in) P:		13.89	10.00	30.00	

****

MAXIMUM FLOOD ENVELOPE: 9560 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	52	81.0	3
Rural Peak	Q5	205	64.0	5
Rural Peak	Q10	413	58.0	7
Rural Peak	Q25	846	58.0	8
Rural Peak	Q50	1350	61.0	9
Rural Peak	Q100	2020	66.0	9
Rural Peak	Q500	4520	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: CP2B1, Total Area (sq mi): 1.27

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum	
Central Mountain Area					
U.S. Max Fld Rgn: 16					
	Drainage Area (sq mi) A*:	1.27	0.06	5499.00	
Mean Basin Elevation (thousands of feet) E*:		2.20	1.78		7.40
Mean Annual Precipitation (in) P:		14.12	10.00	30.00	

****

MAXIMUM FLOOD ENVELOPE: 11100 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	63	81.0	3
Rural Peak	Q5	254	64.0	5
Rural Peak	Q10	517	58.0	7
Rural Peak	Q25	1070	58.0	8
Rural Peak	Q50	1720	61.0	9
Rural Peak	Q100	2580	66.0	9
Rural Peak	Q500	5860	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: CP2C1, Total Area (sq mi): 1.66

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum	
Central Mountain Area					
U.S. Max Fld Rgn: 16					
	Drainage Area (sq mi) A*:	1.66	0.06	5499.00	
Mean Basin Elevation (thousands of feet) E*:		2.16	1.78		7.40
Mean Annual Precipitation (in) P:		14.26	10.00	30.00	

****

MAXIMUM FLOOD ENVELOPE: 14200 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	77	81.0	3
Rural Peak	Q5	311	64.0	5
Rural Peak	Q10	632	58.0	7
Rural Peak	Q25	1310	58.0	8
Rural Peak	Q50	2100	61.0	9
Rural Peak	Q100	3160	66.0	9
Rural Peak	Q500	7150	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: CP2D1, Total Area (sq mi): 6.14

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	6.14	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.08	1.78	7.40
Mean Annual Precipitation (in) P:		14.80	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 43100 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	198	81.0	3
Rural Peak	Q5	778	64.0	5
Rural Peak	Q10	1570	58.0	7
Rural Peak	Q25	3200	58.0	8
Rural Peak	Q50	5100	61.0	9
Rural Peak	Q100	7600	66.0	9
Rural Peak	Q500	17000	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2A1, Total Area (sq mi): 0.57

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.57	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.24	1.78	7.40
Mean Annual Precipitation (in) P:		13.99	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 5340 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	36	81.0	3
Rural Peak	Q5	148	64.0	5
Rural Peak	Q10	303	58.0	7
Rural Peak	Q25	632	58.0	8
Rural Peak	Q50	1020	61.0	9
Rural Peak	Q100	1540	66.0	9
Rural Peak	Q500	3540	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2A2, Total Area (sq mi): 0.50

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.50	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.66	1.78	7.40
Mean Annual Precipitation (in) P:		13.77	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 4690 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	29	81.0	3
Rural Peak	Q5	115	64.0	5
Rural Peak	Q10	230	58.0	7
Rural Peak	Q25	470	58.0	8
Rural Peak	Q50	752	61.0	9
Rural Peak	Q100	1120	66.0	9
Rural Peak	Q500	2510	78.0	10

End of flow data.

NFF FLOW CALCULATIONS INDIVIDUAL SUB-BASINS (RESULTS NOT LISTED IN SECTION 4)

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2B1, Total Area (sq mi): 0.27

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.27	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.98	1.78	7.40
	Mean Annual Precipitation (in) P:	14.36	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 2600 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	24	81.0	3
Rural Peak	Q5	103	64.0	5
Rural Peak	Q10	217	58.0	7
Rural Peak	Q25	465	58.0	8
Rural Peak	Q50	765	61.0	9
Rural Peak	Q100	1170	66.0	9
Rural Peak	Q500	2760	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2B2, Total Area (sq mi): 0.48

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.48	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	2.20	1.78	7.40
	Mean Annual Precipitation (in) P:	14.97	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 4490 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	35	81.0	3
Rural Peak	Q5	142	64.0	5
Rural Peak	Q10	293	58.0	7
Rural Peak	Q25	613	58.0	8
Rural Peak	Q50	995	61.0	9
Rural Peak	Q100	1500	66.0	9
Rural Peak	Q500	3450	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2B3, Total Area (sq mi): 0.52

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.52	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	2.32	1.78	7.40
	Mean Annual Precipitation (in) P:	13.93	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 4890 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	33	81.0	3
Rural Peak	Q5	134	64.0	5
Rural Peak	Q10	275	58.0	7
Rural Peak	Q25	570	58.0	8
Rural Peak	Q50	922	61.0	9
Rural Peak	Q100	1390	66.0	9
Rural Peak	Q500	3170	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2C1, Total Area (sq mi): 0.20

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.20	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.87	1.78	7.40
	Mean Annual Precipitation (in) P:	14.54	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 1920 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	20	81.0	3
Rural Peak	Q5	90	64.0	5
Rural Peak	Q10	191	58.0	7
Rural Peak	Q25	413	58.0	8
Rural Peak	Q50	684	61.0	9
Rural Peak	Q100	1050	66.0	9
Rural Peak	Q500	2520	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2C2, Total Area (sq mi): 0.53

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.53	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.10	1.78	7.40
Mean Annual Precipitation (in) P:		14.39	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 4990 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	37	81.0	3
Rural Peak	Q5	153	64.0	5
Rural Peak	Q10	317	58.0	7
Rural Peak	Q25	667	58.0	8
Rural Peak	Q50	1090	61.0	9
Rural Peak	Q100	1650	66.0	9
Rural Peak	Q500	3800	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2C3, Total Area (sq mi): 0.37

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.37	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.10	1.78	7.40
Mean Annual Precipitation (in) P:		14.29	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 3520 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	29	81.0	3
Rural Peak	Q5	120	64.0	5
Rural Peak	Q10	249	58.0	7
Rural Peak	Q25	527	58.0	8
Rural Peak	Q50	861	61.0	9
Rural Peak	Q100	1310	66.0	9
Rural Peak	Q500	3050	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2C4, Total Area (sq mi): 0.56

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.56	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.35	1.78	7.40
Mean Annual Precipitation (in) P:		14.03	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 5240 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	35	81.0	3
Rural Peak	Q5	140	64.0	5
Rural Peak	Q10	286	58.0	7
Rural Peak	Q25	593	58.0	8
Rural Peak	Q50	957	61.0	9
Rural Peak	Q100	1440	66.0	9
Rural Peak	Q500	3270	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D1, Total Area (sq mi): 0.36

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.36	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		1.85	1.78	7.40
Mean Annual Precipitation (in) P:		14.87	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 3400 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	31	81.0	3
Rural Peak	Q5	136	64.0	5
Rural Peak	Q10	288	58.0	7
Rural Peak	Q25	619	58.0	8
Rural Peak	Q50	1020	61.0	9
Rural Peak	Q100	1570	66.0	9
Rural Peak	Q500	3710	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D2, Total Area (sq mi): 0.39

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.39	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.93	1.78	7.40
	Mean Annual Precipitation (in) P:	14.66	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 3710 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	32	81.0	3
Rural Peak	Q5	137	64.0	5
Rural Peak	Q10	288	58.0	7
Rural Peak	Q25	615	58.0	8
Rural Peak	Q50	1010	61.0	9
Rural Peak	Q100	1550	66.0	9
Rural Peak	Q500	3640	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D3, Total Area (sq mi): 0.54

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.54	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	2.20	1.78	7.40
	Mean Annual Precipitation (in) P:	14.41	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 5000 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	36	81.0	3
Rural Peak	Q5	148	64.0	5
Rural Peak	Q10	304	58.0	7
Rural Peak	Q25	635	58.0	8
Rural Peak	Q50	1030	61.0	9
Rural Peak	Q100	1550	66.0	9
Rural Peak	Q500	3570	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D4, Total Area (sq mi): 0.12

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.12	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.93	1.78	7.40
	Mean Annual Precipitation (in) P:	15.09	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 1210 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	15	81.0	3
Rural Peak	Q5	67	64.0	5
Rural Peak	Q10	142	58.0	7
Rural Peak	Q25	308	58.0	8
Rural Peak	Q50	512	61.0	9
Rural Peak	Q100	788	66.0	9
Rural Peak	Q500	1890	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D5, Total Area (sq mi): 0.42

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.42	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.93	1.78	7.40
	Mean Annual Precipitation (in) P:	15.06	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 3960 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	35	81.0	3
Rural Peak	Q5	147	64.0	5
Rural Peak	Q10	309	58.0	7
Rural Peak	Q25	660	58.0	8
Rural Peak	Q50	1080	61.0	9
Rural Peak	Q100	1650	66.0	9
Rural Peak	Q500	3880	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D6, Total Area (sq mi): 0.50

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.50	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.95	1.78	7.40
	Mean Annual Precipitation (in) P:	14.86	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 4690 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	38	81.0	3
Rural Peak	Q5	162	64.0	5
Rural Peak	Q10	338	58.0	7
Rural Peak	Q25	718	58.0	8
Rural Peak	Q50	1180	61.0	9
Rural Peak	Q100	1790	66.0	9
Rural Peak	Q500	4190	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D7, Total Area (sq mi): 0.20

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.20	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.89	1.78	7.40
	Mean Annual Precipitation (in) P:	14.86	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 1930 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	21	81.0	3
Rural Peak	Q5	91	64.0	5
Rural Peak	Q10	194	58.0	7
Rural Peak	Q25	419	58.0	8
Rural Peak	Q50	693	61.0	9
Rural Peak	Q100	1070	66.0	9
Rural Peak	Q500	2540	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D8, Total Area (sq mi): 0.58

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.58	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	1.97	1.78	7.40
	Mean Annual Precipitation (in) P:	15.06	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 5360 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	42	81.0	3
Rural Peak	Q5	178	64.0	5
Rural Peak	Q10	371	58.0	7
Rural Peak	Q25	787	58.0	8
Rural Peak	Q50	1290	61.0	9
Rural Peak	Q100	1960	66.0	9
Rural Peak	Q500	4560	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D9, Total Area (sq mi): 0.52

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.52	0.06	5499.00
	Mean Basin Elevation (thousands of feet) E*:	2.06	1.78	7.40
	Mean Annual Precipitation (in) P:	15.05	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 4880 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	38	81.0	3
Rural Peak	Q5	161	64.0	5
Rural Peak	Q10	333	58.0	7
Rural Peak	Q25	702	58.0	8
Rural Peak	Q50	1140	61.0	9
Rural Peak	Q100	1740	66.0	9
Rural Peak	Q500	4020	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D10, Total Area (sq mi): 0.62

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.62	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.06	1.78	7.40
Mean Annual Precipitation (in) P:		14.83	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 5730 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	43	81.0	3
Rural Peak	Q5	177	64.0	5
Rural Peak	Q10	366	58.0	7
Rural Peak	Q25	771	58.0	8
Rural Peak	Q50	1250	61.0	9
Rural Peak	Q100	1900	66.0	9
Rural Peak	Q500	4400	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D11, Total Area (sq mi): 0.20

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.20	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.16	1.78	7.40
Mean Annual Precipitation (in) P:		14.67	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 1920 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	19	81.0	3
Rural Peak	Q5	80	64.0	5
Rural Peak	Q10	167	58.0	7
Rural Peak	Q25	353	58.0	8
Rural Peak	Q50	579	61.0	9
Rural Peak	Q100	881	66.0	9
Rural Peak	Q500	2060	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D12, Total Area (sq mi): 0.53

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.53	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.27	1.78	7.40
Mean Annual Precipitation (in) P:		14.45	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 4970 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	35	81.0	3
Rural Peak	Q5	144	64.0	5
Rural Peak	Q10	294	58.0	7
Rural Peak	Q25	613	58.0	8
Rural Peak	Q50	991	61.0	9
Rural Peak	Q100	1490	66.0	9
Rural Peak	Q500	3410	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D13, Total Area (sq mi): 0.38

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Mountain Area				
U.S. Max Fld Rgn: 16				
	Drainage Area (sq mi) A*:	0.38	0.06	5499.00
Mean Basin Elevation (thousands of feet) E*:		2.20	1.78	7.40
Mean Annual Precipitation (in) P:		14.75	10.00	30.00

****

MAXIMUM FLOOD ENVELOPE: 3620 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	29	81.0	3
Rural Peak	Q5	121	64.0	5
Rural Peak	Q10	250	58.0	7
Rural Peak	Q25	525	58.0	8
Rural Peak	Q50	854	61.0	9
Rural Peak	Q100	1290	66.0	9
Rural Peak	Q500	2980	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D14, Total Area (sq mi): 0.37

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum	
Central Mountain Area					
U.S. Max Fld Rgn: 16					
	Drainage Area (sq mi) A*:	0.37	0.06	5499.00	
Mean Basin Elevation (thousands of feet) E*:		2.36	1.78		7.40
Mean Annual Precipitation (in) P:		14.99	10.00	30.00	

****

MAXIMUM FLOOD ENVELOPE: 3500 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	28	81.0	3
Rural Peak	Q5	113	64.0	5
Rural Peak	Q10	232	58.0	7
Rural Peak	Q25	481	58.0	8
Rural Peak	Q50	779	61.0	9
Rural Peak	Q100	1170	66.0	9
Rural Peak	Q500	2680	78.0	10

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 2D15, Total Area (sq mi): 0.42

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum	
Central Mountain Area					
U.S. Max Fld Rgn: 16					
	Drainage Area (sq mi) A*:	0.42	0.06	5499.00	
Mean Basin Elevation (thousands of feet) E*:		2.26	1.78		7.40
Mean Annual Precipitation (in) P:		14.78	10.00	30.00	

****

MAXIMUM FLOOD ENVELOPE: 4010 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	31	81.0	3
Rural Peak	Q5	127	64.0	5
Rural Peak	Q10	262	58.0	7
Rural Peak	Q25	546	58.0	8
Rural Peak	Q50	886	61.0	9
Rural Peak	Q100	1340	66.0	9
Rural Peak	Q500	3070	78.0	10

End of flow data.

NFF Flow Calculations
Southwestern United States Equations

NFF FLOW CALCULATIONS FOR CONFLUENCE POINTS ALONG THE AGUA FRIA RIVER (RESULTS LISTED IN SECTION 4)

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: CP2A1, Total Area (sq mi): 1.07

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	1.07	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2434.95	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 9560 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	43	105.0	0
Rural Peak	Q5	182	68.0	2
Rural Peak	Q10	353	52.0	6
Rural Peak	Q25	701	40.0	18
Rural Peak	Q50	1110	37.0	28
Rural Peak	Q100	1700	39.0	32
Rural Peak	Q500	3560	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: CP2B1, Total Area (sq mi): 1.27

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	1.27	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2203.31	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 11100 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	48	105.0	0
Rural Peak	Q5	211	68.0	2
Rural Peak	Q10	410	52.0	6
Rural Peak	Q25	809	40.0	18
Rural Peak	Q50	1310	37.0	28
Rural Peak	Q100	2030	39.0	32
Rural Peak	Q500	4260	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: CP2C1, Total Area (sq mi): 1.66

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	1.66	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2158.96	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 14200 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	57	105.0	0
Rural Peak	Q5	256	68.0	2
Rural Peak	Q10	494	52.0	6
Rural Peak	Q25	967	40.0	18
Rural Peak	Q50	1620	37.0	28
Rural Peak	Q100	2520	39.0	32
Rural Peak	Q500	5370	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: CP2D1, Total Area (sq mi): 6.14

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	6.14	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2079.69	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 43100 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	129	105.0	0
Rural Peak	Q5	637	68.0	2
Rural Peak	Q10	1190	52.0	6
Rural Peak	Q25	2230	40.0	18
Rural Peak	Q50	4110	37.0	28
Rural Peak	Q100	6450	39.0	32
Rural Peak	Q500	13900	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2A1, Total Area (sq mi): 0.57

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.57	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2241.10	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 5340 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	29	105.0	0
Rural Peak	Q5	122	68.0	2
Rural Peak	Q10	241	52.0	6
Rural Peak	Q25	488	40.0	18
Rural Peak	Q50	703	37.0	28
Rural Peak	Q100	1050	39.0	32
Rural Peak	Q500	2060	N/A	32

End of flow data.

NFF CALCULATIONS FOR INDIVIDUAL SUB-BASINS (RESULTS NOT LISTED IN SECTION 4)

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2A2, Total Area (sq mi): 0.50

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.50	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2657.60	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4690 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	27	105.0	0
Rural Peak	Q5	104	68.0	2
Rural Peak	Q10	205	52.0	6
Rural Peak	Q25	419	40.0	18
Rural Peak	Q50	583	37.0	28
Rural Peak	Q100	863	39.0	32
Rural Peak	Q500	1690	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2B1, Total Area (sq mi): 0.27

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.27	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1981.40	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 2600 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	18	105.0	0
Rural Peak	Q5	76	68.0	2
Rural Peak	Q10	154	52.0	6
Rural Peak	Q25	318	40.0	18
Rural Peak	Q50	397	37.0	28
Rural Peak	Q100	568	39.0	32
Rural Peak	Q500	993	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2B2, Total Area (sq mi): 0.48

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.48	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2201.00	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4490 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	26	105.0	0
Rural Peak	Q5	108	68.0	2
Rural Peak	Q10	215	52.0	6
Rural Peak	Q25	437	40.0	18
Rural Peak	Q50	610	37.0	28
Rural Peak	Q100	904	39.0	32
Rural Peak	Q500	1730	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2B3, Total Area (sq mi): 0.52

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.52	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2320.10	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4890 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	27	105.0	0
Rural Peak	Q5	113	68.0	2
Rural Peak	Q10	223	52.0	6
Rural Peak	Q25	453	40.0	18
Rural Peak	Q50	641	37.0	28
Rural Peak	Q100	954	39.0	32
Rural Peak	Q500	1850	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2C1, Total Area (sq mi): 0.20

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.20	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1865.10	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 1920 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	15	105.0	0
Rural Peak	Q5	62	68.0	2
Rural Peak	Q10	128	52.0	6
Rural Peak	Q25	267	40.0	18
Rural Peak	Q50	311	37.0	28
Rural Peak	Q100	433	39.0	32
Rural Peak	Q500	717	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2C2, Total Area (sq mi): 0.53

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.53	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2104.80	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4990 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	28	105.0	0
Rural Peak	Q5	119	68.0	2
Rural Peak	Q10	235	52.0	6
Rural Peak	Q25	477	40.0	18
Rural Peak	Q50	682	37.0	28
Rural Peak	Q100	1020	39.0	32
Rural Peak	Q500	1960	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2C4, Total Area (sq mi): 0.56

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.56	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2349.70	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 5240 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	29	105.0	0
Rural Peak	Q5	118	68.0	2
Rural Peak	Q10	233	52.0	6
Rural Peak	Q25	473	40.0	18
Rural Peak	Q50	677	37.0	28
Rural Peak	Q100	1010	39.0	32
Rural Peak	Q500	1980	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2C3, Total Area (sq mi): 0.37

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.37	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2103.70	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 3520 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	22	105.0	0
Rural Peak	Q5	92	68.0	2
Rural Peak	Q10	185	52.0	6
Rural Peak	Q25	378	40.0	18
Rural Peak	Q50	504	37.0	28
Rural Peak	Q100	736	39.0	32
Rural Peak	Q500	1350	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D1, Total Area (sq mi): 0.36

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.36	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1853.50	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 3400 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	21	105.0	0
Rural Peak	Q5	94	68.0	2
Rural Peak	Q10	190	52.0	6
Rural Peak	Q25	389	40.0	18
Rural Peak	Q50	517	37.0	28
Rural Peak	Q100	755	39.0	32
Rural Peak	Q500	1370	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D2, Total Area (sq mi): 0.39

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.39	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1928.10	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 3710 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	23	105.0	0
Rural Peak	Q5	99	68.0	2
Rural Peak	Q10	198	52.0	6
Rural Peak	Q25	405	40.0	18
Rural Peak	Q50	548	37.0	28
Rural Peak	Q100	803	39.0	32
Rural Peak	Q500	1480	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D3, Total Area (sq mi): 0.54

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.54	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2203.70	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 5000 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	28	105.0	0
Rural Peak	Q5	117	68.0	2
Rural Peak	Q10	231	52.0	6
Rural Peak	Q25	470	40.0	18
Rural Peak	Q50	669	37.0	28
Rural Peak	Q100	997	39.0	32
Rural Peak	Q500	1930	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D4, Total Area (sq mi): 0.12

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.12	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1927.50	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 1210 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	11	105.0	0
Rural Peak	Q5	45	68.0	2
Rural Peak	Q10	93	52.0	6
Rural Peak	Q25	196	40.0	18
Rural Peak	Q50	202	37.0	28
Rural Peak	Q100	270	39.0	32
Rural Peak	Q500	412	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D5, Total Area (sq mi): 0.42

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.42	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1933.30	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 3960 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	24	105.0	0
Rural Peak	Q5	103	68.0	2
Rural Peak	Q10	207	52.0	6
Rural Peak	Q25	423	40.0	18
Rural Peak	Q50	580	37.0	28
Rural Peak	Q100	854	39.0	32
Rural Peak	Q500	1590	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D6, Total Area (sq mi): 0.50

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.50	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1953.20	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4690 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	27	105.0	0
Rural Peak	Q5	116	68.0	2
Rural Peak	Q10	232	52.0	6
Rural Peak	Q25	471	40.0	18
Rural Peak	Q50	667	37.0	28
Rural Peak	Q100	993	39.0	32
Rural Peak	Q500	1890	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D7, Total Area (sq mi): 0.20

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.20	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1886.70	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 1930 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	15	105.0	0
Rural Peak	Q5	63	68.0	2
Rural Peak	Q10	128	52.0	6
Rural Peak	Q25	267	40.0	18
Rural Peak	Q50	312	37.0	28
Rural Peak	Q100	435	39.0	32
Rural Peak	Q500	722	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D6, Total Area (sq mi): 0.50

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.50	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1953.20	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4690 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	27	105.0	0
Rural Peak	Q5	116	68.0	2
Rural Peak	Q10	232	52.0	6
Rural Peak	Q25	471	40.0	18
Rural Peak	Q50	667	37.0	28
Rural Peak	Q100	993	39.0	32
Rural Peak	Q500	1890	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D8, Total Area (sq mi): 0.58

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.58	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	1969.20	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 5360 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	29	105.0	0
Rural Peak	Q5	128	68.0	2
Rural Peak	Q10	254	52.0	6
Rural Peak	Q25	513	40.0	18
Rural Peak	Q50	745	37.0	28
Rural Peak	Q100	1120	39.0	32
Rural Peak	Q500	2160	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D9, Total Area (sq mi): 0.52

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.52	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2065.20	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4880 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	27	105.0	0
Rural Peak	Q5	117	68.0	2
Rural Peak	Q10	233	52.0	6
Rural Peak	Q25	473	40.0	18
Rural Peak	Q50	673	37.0	28
Rural Peak	Q100	1000	39.0	32
Rural Peak	Q500	1930	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D11, Total Area (sq mi): 0.20

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.20	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2155.90	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 1920 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	15	105.0	0
Rural Peak	Q5	59	68.0	2
Rural Peak	Q10	121	52.0	6
Rural Peak	Q25	252	40.0	18
Rural Peak	Q50	292	37.0	28
Rural Peak	Q100	406	39.0	32
Rural Peak	Q500	679	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D10, Total Area (sq mi): 0.62

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.62	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2057.10	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 5730 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	30	105.0	0
Rural Peak	Q5	132	68.0	2
Rural Peak	Q10	262	52.0	6
Rural Peak	Q25	528	40.0	18
Rural Peak	Q50	774	37.0	28
Rural Peak	Q100	1160	39.0	32
Rural Peak	Q500	2280	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D12, Total Area (sq mi): 0.53

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.53	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2269.40	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4970 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	28	105.0	0
Rural Peak	Q5	115	68.0	2
Rural Peak	Q10	228	52.0	6
Rural Peak	Q25	463	40.0	18
Rural Peak	Q50	657	37.0	28
Rural Peak	Q100	979	39.0	32
Rural Peak	Q500	1900	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D13, Total Area (sq mi): 0.38

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.38	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2199.30	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 3620 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	22	105.0	0
Rural Peak	Q5	93	68.0	2
Rural Peak	Q10	185	52.0	6
Rural Peak	Q25	379	40.0	18
Rural Peak	Q50	507	37.0	28
Rural Peak	Q100	741	39.0	32
Rural Peak	Q500	1380	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D14, Total Area (sq mi): 0.37

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.37	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2359.60	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 3500 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	22	105.0	0
Rural Peak	Q5	88	68.0	2
Rural Peak	Q10	176	52.0	6
Rural Peak	Q25	361	40.0	18
Rural Peak	Q50	477	37.0	28
Rural Peak	Q100	695	39.0	32
Rural Peak	Q500	1290	N/A	32

End of flow data.

Flow data computed with the National Flood Frequency Program in WMS.

Southwestern US, Basin: 2D15, Total Area (sq mi): 0.42

Region	Variable Descriptor	Input Value	Suggested Minimum	Suggested Maximum
Central Arizona Region 12				
U.S. Max Fld Rgn: 16				
Contributing Drainage Area (sq mi)	AREA*:	0.42	0.10	1520.00
Mean Basin Elevation (ft)	ELEV*:	2258.70	1730.00	8700.00

****

MAXIMUM FLOOD ENVELOPE: 4010 (cfs)

Recurrence Interval		Peak (cfs)	Std Error	Equiv. Years
Rural Peak	Q2	24	105.0	0
Rural Peak	Q5	99	68.0	2
Rural Peak	Q10	196	52.0	6
Rural Peak	Q25	402	40.0	18
Rural Peak	Q50	547	37.0	28
Rural Peak	Q100	805	39.0	32
Rural Peak	Q500	1520	N/A	32

End of flow data.

HEC-1 Input File Created by WMS

```
ID100-Yr 6-Hr Storm/ Clark Unit Hydrograph/ Green Ampt Rainfall Losses/ Normal
ID
ID
*DIAGRAM
*LISTING
IT     5  1JAN94       0     190
IO     5
IN    15  1JAN94       0
JD   3.5  0.0001
* Pattern 1
PC   0.0     0.8     1.6     2.5     3.3     4.1     5.0     5.8     6.6     7.4
PC   8.7     9.9    11.8    13.8    21.6    37.7    83.4    91.1    93.1    95.0
PC  96.2    97.2    98.3    99.1   100.0
IN    15  1JAN94       0
JD  3.48     0.5
* Pattern 1
PC   0.0     0.8     1.6     2.5     3.3     4.1     5.0     5.8     6.6     7.4
PC   8.7     9.9    11.8    13.8    21.6    37.7    83.4    91.1    93.1    95.0
PC  96.2    97.2    98.3    99.1   100.0
IN    15  1JAN94       0
JD  3.41     2.8
* Pattern 2
PC   0.0     0.9     1.6     2.5     3.4     4.2     5.1     5.9     6.7     7.6
PC   8.7    10.0    12.0    16.3    25.2    45.1    69.4    83.7    90.0    93.8
PC  95.0    96.3    97.5    98.8   100.0
IN    15  1JAN94       0
JD  3.23    16.0
* Pattern 3
PC   0.0     1.5     2.0     3.0     4.8     6.3     7.6     9.0    10.5    11.9
PC  13.5    15.2    17.5    22.2    30.4    47.2    67.0    79.6    86.8    91.2
PC  94.6    96.0    97.3    98.7   100.0
IN    15  1JAN94       0
JD  3.23    16.0
* Pattern 3
PC   0.0     1.5     2.0     3.0     4.8     6.3     7.6     9.0    10.5    11.9
PC  13.5    15.2    17.5    22.2    30.4    47.2    67.0    79.6    86.8    91.2
PC  94.6    96.0    97.3    98.7   100.0
KK   2A2
KO     5       0     0.0       1       0
BA   0.5
LG  0.15   0.196  10.967   0.028   9.664
UC 0.388   0.217
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK  R2A2   CNAME '  CP2A2
KO     5       0     0.0       0       0
RS     1    FLOW     0.0     0.0
RC  0.07   0.045    0.07 6185.09  0.0694 1919.59
* R2A2
RX   0.0   43.61   56.14   60.68   65.42   72.09   87.22  109.03
RY1920.0 1901.95 1896.42 1894.41 1893.27 1897.27 1906.39 1919.59
KK   2A1
KO     5       0     0.0       1       0
BA0.5744
LG  0.15   0.343   7.105   0.114  22.839
UC 0.471   0.305
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2A1   CNAME    R2A1
```

```
KO      5       0     0.0       0       0
HC      2
KK   R2A1   CNAME   CP2A1
KO      5       0     0.0       0       0
RN   R2A1
KK    2B3
KO      5       0     0.0       1       0
BA0.5225
LG   0.15   0.368   5.181   0.257  21.567
UC 0.396   0.206
* Natural
UA    0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK   R2B3   CNAME   CP2B3
KO      5       0     0.0       0       0
RS      2    FLOW     0.0     0.0
RC   0.07   0.045    0.07 5921.88  0.0386  2013.8
* R2B3
RX    0.0    15.0    35.0   38.56    40.0   45.01   60.01   75.01
RY2013.8 2005.25 1993.97 1992.31  1991.4 1994.71  2004.7 2014.73
KK    2B2
KO      5       0     0.0       1       0
BA0.4775
LG   0.15    0.35   4.535   0.344  27.509
UC 0.475   0.329
* Natural
UA    0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2B2   CNAME    R2B2
KO      5       0     0.0       0       0
HC      2
KK   R2B2   CNAME   CP2B2
KO      5       0     0.0       0       0
RS      1    FLOW     0.0     0.0
RC   0.07   0.045    0.07 4313.66  0.0362 1790.18
* R2B2
RX    0.0    24.7   54.33   59.27   64.21   69.15   93.85   138.3
RY1791.1 1779.54 1764.86 1762.42 1763.96 1765.75 1774.51 1790.18
KK    2B1
KO      5       0     0.0       1       0
BA0.2699
LG   0.15    0.39   5.737   0.189  33.576
UC 0.429   0.357
* Natural
UA    0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2B1   CNAME    R2B1
KO      5       0     0.0       0       0
HC      2
KK   R2B1   CNAME   CP2B1
KO      5       0     0.0       0       0
RN   R2B1
KK    2C4
KO      5       0     0.0       1       0
BA0.5624
LG   0.15    0.35   4.491   0.369  26.527
UC 0.417   0.215
* Natural
UA    0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK   R2C4   CNAME   CP2C4
KO      5       0     0.0       0       0
RS      3    FLOW     0.0     0.0
RC   0.07   0.045    0.07 9869.21  0.0316  2024.8
* R2C4
RX    0.0   19.11   44.71   47.78   57.34   60.18    66.9   95.57
RY2024.8 2017.42 2004.95 2003.25 2002.34  2004.2 2008.69 2027.29
KK    2C2
KO      5       0     0.0       1       0
BA0.5345
LG   0.15    0.35   4.591   0.325   14.82
UC 0.733   0.731
* Natural
UA    0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK    2C3
KO      5       0     0.0       1       0
BA0.3696
LG   0.15    0.35   4.336   0.385  24.148
```

```
UC  0.65   0.701
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2C2   CNAME    R2C2
KO     5       0     0.0       0       0
HC     3
KK  R2C2   CNAME   CP2C2
KO     5       0     0.0       0       0
RS     3    FLOW     0.0     0.0
RC  0.07   0.045    0.07 5065.76  0.0254  1811.0
* R2C2
RX   0.0   58.44  155.84   194.8  214.28  233.76  253.24  331.16
RY1819.9 1807.75 1805.11  1802.5 1803.08 1805.43 1807.74  1811.4
KK   2C1
KO     5       0     0.0       1       0
BA 0.197
LG  0.15    0.37    5.22   0.231   0.304
UC 0.679   0.925
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2C1   CNAME    R2C1
KO     5       0     0.0       0       0
HC     2
KK  R2C1   CNAME   CP2C1
KO     5       0     0.0       0       0
RN  R2C1
KK   2D3
KO     5       0     0.0       1       0
BA0.5354
LG  0.15   0.354   4.936   0.278  17.608
UC 0.512   0.357
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK  R2D3   CNAME   CP2D3
KO     5       0     0.0       0       0
RS     4    FLOW     0.0     0.0
RC  0.06   0.045    0.06 9665.01  0.0199  1940.0
* R2D3
RX   0.0  123.91  159.93  173.62   190.9  211.03  236.29  262.92
RY1940.4 1929.73  1923.4 1921.63 1923.21  1932.8 1941.68 1946.63
KK  2D12
KO     5       0     0.0       1       0
BA0.5322
LG  0.15    0.38   5.421   0.227  11.853
UC 0.467   0.285
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK R2D12   CNAME  CP2D12
KO     5       0     0.0       0       0
RS     1    FLOW     0.0     0.0
RC  0.06   0.045    0.06 1971.46   0.027  2080.0
* R2D12
RX   0.0   27.89   60.62   78.69   88.51   98.33  113.91  131.12
RY2081.5 2071.06 2059.82 2054.55 2051.72 2059.65 2070.75 2080.61
KK  2D14
KO     5       0     0.0       1       0
BA0.3677
LG 0.138   0.343   5.305   0.242  27.407
UC 0.508   0.438
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK  2D15
KO     5       0     0.0       1       0
BA0.4242
LG 0.138   0.339   5.181   0.256  35.308
UC 0.563   0.436
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KKCP2D14   CNAME   R2D14
KO     5       0     0.0       0       0
HC     2
KK R2D14   CNAME  CP2D14
KO     5       0     0.0       0       0
```

```
RS      1    FLOW     0.0     0.0
RC  0.06   0.045    0.06 3306.76  0.0179  2077.0
* R2D14
RX   0.0   87.98  121.22  138.69  161.38  187.19  249.71  314.31
RY2090.4 2070.58 2050.45 2042.71  2050.0 2060.32 2070.01 2077.45
KK  2D13
KO      5       0     0.0       1       0
BA0.3812
LG 0.143   0.366   5.664   0.205  20.753
UC 0.525   0.453
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK  2D11
KO      5       0     0.0       1       0
BA0.1971
LG  0.15    0.38   5.465   0.218     0.0
UC 0.367   0.269
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KKCP2D11   CNAME   R2D11
KO      5       0     0.0       0       0
HC      4
KK R2D11   CNAME  CP2D11
KO      5       0     0.0       0       0
IN      0  1JAN99       0
RS      2    FLOW     0.0     0.0
RC  0.06   0.045    0.06 4525.63  0.0176  1980.0
* R2D11
RX   0.0   62.62    83.5   98.58  113.62   131.2   168.0  229.81
RY1980.2 1960.25  1955.6 1955.55 1955.49 1959.83 1970.02  1980.0
KK   2D9
KO      5       0     0.0       1       0
BA0.5211
LG 0.144   0.363   6.339    0.15    9.47
UC 0.738   0.645
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK  2D10
KO      5       0     0.0       1       0
BA0.6188
LG 0.147   0.382   5.798   0.181   8.579
UC 0.683   0.504
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2D9   CNAME    R2D9
KO      5       0     0.0       0       0
HC      3
KK  R2D9   CNAME   CP2D9
KO      5       0     0.0       0       0
RS      2    FLOW     0.0     0.0
RC  0.06   0.045    0.06 5102.16  0.0121  1920.0
* R2D9
RX   0.0  142.18  290.06   333.1  362.57  388.62  535.91  699.61
RY1920.2 1910.29 1900.14 1829.69 1893.65 1899.94 1910.07 1920.14
KK   2D8
KO      5       0     0.0       1       0
BA0.5759
LG  0.15   0.397   6.058   0.164   8.258
UC 0.592   0.354
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2D8   CNAME    R2D8
KO      5       0     0.0       0       0
HC      2
KK  R2D8   CNAME   CP2D8
KO      5       0     0.0       0       0
RS      2    FLOW     0.0     0.0
RC  0.06   0.045    0.06  3198.9  0.0161  1867.0
* R2D8
RX   0.0   98.56  316.56  380.43  415.21  435.06  478.21  674.73
RY1869.7 1859.98 1850.88 1853.49 1850.16 1852.54 1860.48 1867.09
KK   2D6
KO      5       0     0.0       1       0
BA   0.5
```

```
LG  0.15    0.35   4.559    0.32     0.0
UC 1.042   0.995
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK  R2D6   CNAME   CP2D6
KO     5       0     0.0       0       0
RS     2    FLOW     0.0     0.0
RC  0.06   0.045    0.06 2035.72  0.0206  1839.0
* R2D6
RX   0.0  198.78  323.15  344.62  378.45  542.47  573.74  711.41
RY1844.3 1840.07 1832.17 1829.98  1832.0 1830.19 1829.76 1839.98
KK   2D7
KO     5       0     0.0       1       0
BA 0.199
LG  0.15   0.392   6.165   0.157     0.0
UC 0.767   0.924
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK   2D5
KO     5       0     0.0       1       0
BA0.4188
LG  0.15    0.35   4.644   0.302   9.261
UC 0.846   0.776
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2D5   CNAME    R2D5
KO     5       0     0.0       0       0
HC     4
KK  R2D5   CNAME   CP2D5
KO     5       0     0.0       0       0
RS     1    FLOW     0.0     0.0
RC  0.06   0.045    0.06  965.12  0.0125  1820.0
* R2D5
RX   0.0   53.67  106.21  146.49  172.59   193.3  214.45   275.1
RY1820.1 1814.61 1809.97  1807.6 1807.68 1807.76 1810.08 1820.22
KK   2D4
KO     5       0     0.0       1       0
BA0.1235
LG  0.15    0.39    5.72   0.187  25.797
UC 0.392     0.4
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK   2D2
KO     5       0     0.0       1       0
BA0.3902
LG  0.15   0.397   5.932    0.17   9.325
UC 0.771   0.808
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2D2   CNAME    R2D2
KO     5       0     0.0       0       0
HC     4
KK  R2D2   CNAME   CP2D2
KO     5       0     0.0       0       0
RS     2    FLOW     0.0     0.0
RC  0.06    0.04    0.06 4867.21  0.0157  1803.0
* R2D2
RX   0.0   38.24   76.47  114.71  152.94  191.18  229.42  267.65
RY1804.9 1800.95 1792.68 1782.43  1773.1 1777.75 1785.07 1792.98
KK   2D1
KO     5       0     0.0       1       0
BA0.3569
LG  0.15   0.383   6.339   0.148  11.227
UC  0.55   0.482
* Natural
UA   0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA 100.0
KK CP2D1   CNAME    R2D1
KO     5       0     0.0       0       0
HC     2
KK  R2D1   CNAME   CP2D1
KO     5       0     0.0       0       0
RN  R2D1
ZZ
```

HEC-1 Output File

```
1****************************************                                    **********************
 *                                      *                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF
 *              MAY   1991              *                                    *   HYDROLOGIC ENGINEE
 *           VERSION 4.0.1E             *                                    *         609 SECOND S
 *                                      *                                    *      DAVIS, CALIFORN
 *  RUN DATE 12/05/2002 TIME  6:27 PM   *                                    *          (916) 551-1
 *                                      *                                    *
****************************************                                    ****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT PAGE 1

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   Watershed #2, Upper Agua Fria Zone A Floodplain Delineation Study
  2           ID   Flood Control District Contract FCD2000C020, RBF Job Number 45-100648
  3           ID   By RBF Consulting for the Flood Control District of Maricopa County, 9/3/2002
  4           ID   100-Yr 6-Hr Storm/ Clark Unit Hydrograph/ Green Ampt Rainfall Losses/ Normal
  5           ID   HEC-1 Input File Name "0648ws2.hc1", HEC-1 Output File Name "0648ws2.out"
  6           ID   Revised from the WMS Generated HEC-1 file to Add more concentration points
  7           ID
              *DIAGRAM
  8           IT       5  1JAN94       0     190
  9           IO       5
 10           IN      15  1JAN94       0
 11           JD     3.5  0.0001
              * Pattern 1
 12           PC     0.0     0.8     1.6     2.5     3.3     4.1     5.0     5.8     6.6     7.4
 13           PC     8.7     9.9    11.8    13.8    21.6    37.7    83.4    91.1    93.1    95.0
 14           PC    96.2    97.2    98.3    99.1   100.0
 15           IN      15  1JAN94       0
 16           JD    3.48     0.5
              * Pattern 1
 17           PC     0.0     0.8     1.6     2.5     3.3     4.1     5.0     5.8     6.6     7.4
 18           PC     8.7     9.9    11.8    13.8    21.6    37.7    83.4    91.1    93.1    95.0
 19           PC    96.2    97.2    98.3    99.1   100.0
 20           IN      15  1JAN94       0
 21           JD    3.41     2.8
              * Pattern 2
 22           PC     0.0     0.9     1.6     2.5     3.4     4.2     5.1     5.9     6.7     7.6
 23           PC     8.7    10.0    12.0    16.3    25.2    45.1    69.4    83.7    90.0    93.8
 24           PC    95.0    96.3    97.5    98.8   100.0
 25           IN      15  1JAN94       0
 26           JD    3.23    16.0
              * Pattern 3
 27           PC     0.0     1.5     2.0     3.0     4.8     6.3     7.6     9.0    10.5    11.9
 28           PC    13.5    15.2    17.5    22.2    30.4    47.2    67.0    79.6    86.8    91.2
 29           PC    94.6    96.0    97.3    98.7   100.0

 30           KK     2A2
 31           BA     0.5
 32           LG    0.15   0.196  10.967   0.028   9.664
 33           UC   0.388   0.217
              * Natural
 34           UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 35           UA   100.0

 36           KK    R2A2   CNAME   CP2A2
 37           KM   UPSTREAM LIMITS OF WASH 7N2ES7
 38           RS       1    FLOW     0.0     0.0
 39           RC    0.07   0.045    0.07 6185.09  0.0694 1919.59
              * R2A2
 40           RX     0.0   43.61   56.14   60.68   65.42   72.09   87.22  109.03
 41           RY  1920.0 1901.95 1896.42 1894.41 1893.27 1897.27 1906.39 1919.59
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  42          KK     2A1
  43          BA  0.5744
  44          LG    0.15   0.343   7.105   0.114  22.839
  45          UC   0.471   0.305
              * Natural
  46          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  47          UA   100.0

  48          KK   CP2A1
  49          KM   DOWNSTREAM LIMITS OF WASH 7N2ES7
  50          HC       2

  51          KK     2B3
  52          BA  0.5225
  53          LG    0.15   0.368   5.181   0.257  21.567
  54          UC   0.396   0.206
              * Natural
  55          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  56          UA   100.0

  57          KK    R2B3   CNAME   CP2B3
  58          RS       2    FLOW     0.0     0.0
  59          RC    0.07   0.045    0.07 5921.88  0.0386  2013.8
              * R2B3
  60          RX     0.0    15.0    35.0   38.56    40.0   45.01   60.01   75.01
  61          RY  2013.8 2005.25 1993.97 1992.31  1991.4 1994.71  2004.7 2014.73

  62          KK     2B2
  63          BA  0.4775
  64          LG    0.15    0.35   4.535   0.344  27.509
  65          UC   0.475   0.329
              * Natural
  66          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  67          UA   100.0

  68          KK   CP2B2   CNAME    R2B2
  69          KM   UPSTREAM LIMIT OF WASH 7N2ES6S REACH 1
  70          KM   DOWNSTREAM LIMIT OF WASH 7N2ES6S REACH 2
  71          HC       2

  72          KK    R2B2   CNAME   CP2B2
  73          RS       1    FLOW     0.0     0.0
  74          RC    0.07   0.045    0.07 4313.66  0.0362 1790.18
              * R2B2
  75          RX     0.0    24.7   54.33   59.27   64.21   69.15   93.85   138.3
  76          RY  1791.1 1779.54 1764.86 1762.42 1763.96 1765.75 1774.51 1790.18

  77          KK     2B1
  78          BA  0.2699
  79          LG    0.15    0.39   5.737   0.189  33.576
  80          UC   0.429   0.357
              * Natural
  81          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  82          UA   100.0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  83          KK   CP2B1
  84          KM   DOWNSTREAM LIMIT OF WASH 7N2ES6 REACH 1
  85          HC       2

  86          KK     2C4
  87          BA  0.5624
  88          LG    0.15    0.35   4.491   0.369  26.527
  89          UC   0.417   0.215
              * Natural
  90          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  91          UA   100.0

  92          KK    R2C4   CNAME   CP2C4
  93          KM   UPSTREAM LIMIT OF WASH 7N2ES6N REACH 2
  94          RS       3    FLOW     0.0     0.0
  95          RC    0.07   0.045    0.07 9869.21  0.0316  2024.8
              * R2C4
  96          RX     0.0   19.11   44.71   47.78   57.34   60.18    66.9   95.57
  97          RY  2024.8 2017.42 2004.95 2003.25 2002.34  2004.2 2008.69 2027.29

  98          KK     2C3
  99          BA  0.3696
 100          LG    0.15    0.35   4.336   0.385  24.148
 101          UC    0.65   0.701
              * Natural
 102          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 103          UA   100.0

 104          KK   CP2C3
 105          KM   DOWNSTREAM LIMIT OF WASH 7N2ES6N REACH 2
 106          HC       2

 107          KK     2C2
 108          KM   DOWNSTREAM LIMIT OF WASH 7N2ES6N T1
 109          BA  0.5345
 110          LG    0.15    0.35   4.591   0.325   14.82
 111          UC   0.733   0.731
              * Natural
 112          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 113          UA   100.0

 114          KK   CP2C2   CNAME    R2C2
 115          KM   UPSTREAM LIMIT OF WASH 7N2ES6N REACH 1
 116          HC       2

 117          KK    R2C2   CNAME   CP2C2
 118          RS       3    FLOW     0.0     0.0
 119          RC    0.07   0.045    0.07 5065.76  0.0254  1811.0
              * R2C2
 120          RX     0.0   58.44  155.84   194.8  214.28  233.76  253.24  331.16
 121          RY  1819.9 1807.75 1805.11  1802.5 1803.08 1805.43 1807.74  1811.4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 122          KK     2C1
 123          BA  0.1970
 124          LG    0.15    0.37    5.22   0.231   0.304
 125          UC   0.679   0.925
              * Natural
 126          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 127          UA   100.0

 128          KK   CP2C1
 129          KM   DOWNSTREAM LIMIT OF WASH 7N2ES6N REACH 1
 130          HC       2

 131          KK     2D3
 132          BA  0.5354
 133          LG    0.15   0.354   4.936   0.278  17.608
 134          UC   0.512   0.357
              * Natural
 135          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 136          UA   100.0

 137          KK    R2D3   CNAME   CP2D3
 138          KM   UPSTREAM LIMIT OF WASH 8N2ES31 T1
 139          RS       4    FLOW     0.0     0.0
 140          RC    0.06   0.045    0.06 9665.01  0.0199  1940.0
              * R2D3
 141          RX     0.0  123.91  159.93  173.62   190.9  211.03  236.29  262.92
 142          RY  1940.4 1929.73  1923.4 1921.63 1923.21  1932.8 1941.68 1946.63

 143          KK     2D2
 144          BA  0.3902
 145          LG    0.15   0.397   5.932    0.17   9.325
 146          UC   0.771   0.808
              * Natural
 147          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 148          UA   100.0

 149          KK  CP2D2U
 150          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 T1
 151          HC       2

 152          KK    2D12
 153          BA  0.5322
 154          LG    0.15    0.38   5.421   0.227  11.853
 155          UC   0.467   0.285
              * Natural
 156          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 157          UA   100.0

 158          KK   R2D12   CNAME  CP2D12
 159          KM   UPSTREAM LIMIT OF WASH 8N23S31 REACH 6
 160          RS       1    FLOW     0.0     0.0
 161          RC    0.06   0.045    0.06 1971.46   0.027  2080.0
              * R2D12
 162          RX     0.0   27.89   60.62   78.69   88.51   98.33  113.91  131.12
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 163          RY  2081.5 2071.06 2059.82 2054.55 2051.72 2059.65 2070.75 2080.61

 164          KK    2D11
 165          BA  0.1971
 166          LG    0.15    0.38   5.465   0.218     0.0
 167          UC   0.367   0.269
              * Natural
 168          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 169          UA   100.0

 170          KK  CP2D11U
 171          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 REACH 6
 172          HC       2

 173          KK    2D14
 174          BA  0.3677
 175          LG   0.138   0.343   5.305   0.242  27.407
 176          UC   0.508   0.438
              * Natural
 177          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 178          UA   100.0

 179          KK    2D15
 180          BA  0.4242
 181          LG   0.138   0.339   5.181   0.256  35.308
 182          UC   0.563   0.436
              * Natural
 183          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 184          UA   100.0

 185          KK  CP2D14   CNAME   R2D14
 186          KM   UPSTREAM LIMIT OF WASH 8N2ES31 T4
              * CP2D14 is located at Table Mesa Road
 187          HC       2

 188          KK   R2D14   CNAME  CP2D14
 189          RS       1    FLOW     0.0     0.0
 190          RC    0.06   0.045    0.06 3306.76  0.0179  2077.0
              * R2D14
 191          RX     0.0   87.98  121.22  138.69  161.38  187.19  249.71  314.31
 192          RY  2090.4 2070.58 2050.45 2042.71  2050.0 2060.32 2070.01 2077.45

 193          KK    2D13
 194          BA  0.3812
 195          LG   0.143   0.366   5.664   0.205  20.753
 196          UC   0.525   0.453
              * Natural
 197          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 198          UA   100.0
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 199          KK  CP2D13
 200          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 T4
 201          HC       2

 202          KK  CP2D11   CNAME   R2D11
 203          KM   UPSTREAM LIMIT OF WASH 8N2ES31 REACH 5
 204          HC       2

 205          KK   R2D11   CNAME  CP2D11
 206          RS       2    FLOW     0.0     0.0
 207          RC    0.06   0.045    0.06 4525.63  0.0176  1980.0
              * R2D11
 208          RX     0.0   62.62    83.5   98.58  113.62   131.2   168.0  229.81
 209          RY  1980.2 1960.25  1955.6 1955.55 1955.49 1959.83 1970.02  1980.0

 210          KK    2D10
 211          BA  0.6188
 212          LG   0.147   0.382   5.798   0.181   8.579
 213          UC   0.683   0.504
              * Natural
 214          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 215          UA   100.0

 216          KK  CP2D10
 217          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 REACH 5
 218          HC       2

 219          KK     2D9
 220          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 T3
 221          BA  0.5211
 222          LG   0.144   0.363   6.339    0.15    9.47
 223          UC   0.738   0.645
              * Natural
 224          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 225          UA   100.0

 226          KK   CP2D9   CNAME    R2D9
 227          KM   UPSTREAM LIMIT OF WASH 8N2ES31 REACH 4
 228          HC       2

 229          KK    R2D9   CNAME   CP2D9
 230          RS       2    FLOW     0.0     0.0
 231          RC    0.06   0.045    0.06 5102.16  0.0121  1920.0
              * R2D9
 232          RX     0.0  142.18  290.06   333.1  362.57  388.62  535.91  699.61
 233          RY  1920.2 1910.29 1900.14 1829.69 1893.65 1899.94 1910.07 1920.14

 234          KK     2D8
 235          BA  0.5759
 236          LG    0.15   0.397   6.058   0.164   8.258
 237          UC   0.592   0.354
              * Natural
 238          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 239          UA   100.0
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 240          KK   CP2D8   CNAME    R2D8
 241          KM   UPSTREAM LIMIT OF WASH 8N2ES31 REACH 3
 242          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 REACH 4
 243          HC       2

 244          KK    R2D8   CNAME   CP2D8
 245          RS       2    FLOW     0.0     0.0
 246          RC    0.06   0.045    0.06  3198.9  0.0161  1867.0
              * R2D8
 247          RX     0.0   98.56  316.56  380.43  415.21  435.06  478.21  674.73
 248          RY  1869.7 1859.98 1850.88 1853.49 1850.16 1852.54 1860.48 1867.09

 249          KK     2D7
 250          BA  0.1990
 251          LG    0.15   0.392   6.165   0.157     0.0
 252          UC   0.767   0.924
              * Natural
 253          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 254          UA   100.0

 255          KK   CP2D7
 256          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 REACH 3
 257          HC       2

 258          KK     2D6
 259          BA  0.5000
 260          LG    0.15    0.35   4.559    0.32     0.0
 261          UC   1.042   0.995
              * Natural
 262          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 263          UA   100.0

 264          KK    R2D6   CNAME   CP2D6
 265          KM   UPSTREAM LIMITS OF WASH 8N2ES31 T2
 266          RS       2    FLOW     0.0     0.0
 267          RC    0.06   0.045    0.06 2035.72  0.0206  1839.0
              * R2D6
 268          RX     0.0  198.78  323.15  344.62  378.45  542.47  573.74  711.41
 269          RY  1844.3 1840.07 1832.17 1829.98  1832.0 1830.19 1829.76 1839.98

 270          KK     2D5
 271          BA  0.4188
 272          LG    0.15    0.35   4.644   0.302   9.261
 273          UC   0.846   0.776
              * Natural
 274          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 275          UA   100.0

 276          KK  CP2D5U
 277          KM   DOWNSTREAM LIMITS OF WASH 8N2ES31 T2
 278          HC       2
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 279          KK   CP2D5   CNAME    R2D5
 280          KM   UPSTREAM LIMIT OF WASH 8N2ES31 REACH 2
 281          HC       2

 282          KK    R2D5   CNAME   CP2D5
 283          RS       1    FLOW     0.0     0.0
 284          RC    0.06   0.045    0.06  965.12  0.0125  1820.0
              * R2D5
 285          RX     0.0  108.07  137.55  147.37  186.67   196.5   235.8   275.1
 286          RY  1820.1 1809.86 1808.13 1807.61 1807.73 1808.11 1813.65 1820.22

 287          KK     2D4
 288          BA  0.1235
 289          LG    0.15    0.39    5.72   0.187  25.797
 290          UC   0.392     0.4
              * Natural
 291          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 292          UA   100.0

 293          KK   CP2D4
 294          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 REACH 2
 295          HC       2

 296          KK   CP2D2   CNAME    R2D2
 297          KM   UPSTREAM LIMIT OF WASH 8N2ES31 REACH 1
 298          HC       2

 299          KK    R2D2   CNAME   CP2D2
 300          RS       2    FLOW     0.0     0.0
 301          RC    0.06    0.04    0.06 4867.21  0.0157  1803.0
              * R2D2
 302          RX     0.0   40.78  142.75  163.14  174.43  183.53   265.1  305.89
 303          RY  1804.9  1800.4 1775.59 1774.34 1775.16 1776.82 1792.45 1803.01

 304          KK     2D1
 305          BA  0.3569
 306          LG    0.15   0.383   6.339   0.148  11.227
 307          UC    0.55   0.482
              * Natural
 308          UA     0.0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 309          UA   100.0

 310          KK   CP2D1
 311          KM   DOWNSTREAM LIMIT OF WASH 8N2ES31 REACH 1
 312          HC       2
 313          ZZ
```

```
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  30         2A2
              V
              V
  36        R2A2
              .
              .
  42          .         2A1
              .           .
              .           .
  48      CP2A1............
              .
              .
  51          .         2B3
              .           V
              .           V
  57          .        R2B3
              .           .
              .           .
  62          .           .         2B2
              .           .           .
              .           .           .
  68          .      CP2B2............
              .           V
              .           V
  72          .        R2B2
              .           .
              .           .
  77          .           .         2B1
              .           .           .
              .           .           .
  83          .      CP2B1............
              .           .
              .           .
  86          .           .         2C4
              .           .           V
              .           .           V
  92          .           .        R2C4
              .           .           .
              .           .           .
  98          .           .           .         2C3
              .           .           .           .
              .           .           .           .
 104          .           .      CP2C3............
              .           .           .
              .           .           .
 107          .           .           .         2C2
              .           .           .           .
              .           .           .           .
 114          .           .      CP2C2............
              .           .           V
              .           .           V
 117          .           .        R2C2
              .           .           .
              .           .           .
 122          .           .           .         2C1
              .           .           .           .
              .           .           .           .
 128          .           .      CP2C1............
              .           .           .
              .           .           .
 131          .           .           .         2D3
              .           .           .           V
              .           .           .           V
 137          .           .           .        R2D3
              .           .           .           .
              .           .           .           .
 143          .           .           .           .         2D2
              .           .           .           .           .
              .           .           .           .           .
 149          .           .           .     CP2D2U............
              .           .           .           .
              .           .           .           .
 152          .           .           .           .        2D12
              .           .           .           .           V
              .           .           .           .           V
 158          .           .           .           .       R2D12
              .           .           .           .           .
              .           .           .           .           .
 164          .           .           .           .           .        2D11
              .           .           .           .           .          .
              .           .           .           .           .          .
 170          .           .           .           .     CP2D11............
              .           .           .           .           .
              .           .           .           .           .
 173          .           .           .           .           .        2D14
              .           .           .           .           .          .
              .           .           .           .           .          .
 179          .           .           .           .           .          .        2D15
```

```
                .         .         .         .         .         .         .
                .         .         .         .         .         .         .
185             .         .         .         .         .     CP2D14.........
                .         .         .         .         .         V
                .         .         .         .         .         V
188             .         .         .         .         .      R2D14
                .         .         .         .         .         .
                .         .         .         .         .         .
193             .         .         .         .         .         .        2D13
                .         .         .         .         .         .         .
                .         .         .         .         .         .         .
199             .         .         .         .         .     CP2D13.........
                .         .         .         .         .         .
                .         .         .         .         .         .
202             .         .         .         .   CP2D11.........
                .         .         .         .       V
                .         .         .         .       V
205             .         .         .         .    R2D11
                .         .         .         .       .
                .         .         .         .       .
210             .         .         .         .       .       2D10
                .         .         .         .       .         .
                .         .         .         .       .         .
216             .         .         .         .   CP2D10.........
                .         .         .         .       .
                .         .         .         .       .
219             .         .         .         .       .        2D9
                .         .         .         .       .         .
                .         .         .         .       .         .
226             .         .         .         .    CP2D9.........
                .         .         .         .       V
                .         .         .         .       V
229             .         .         .         .     R2D9
                .         .         .         .       .
                .         .         .         .       .
234             .         .         .         .       .        2D8
                .         .         .         .       .         .
                .         .         .         .       .         .
240             .         .         .         .    CP2D8.........
                .         .         .         .       V
                .         .         .         .       V
244             .         .         .         .     R2D8
                .         .         .         .       .
                .         .         .         .       .
249             .         .         .         .       .        2D7
                .         .         .         .       .         .
                .         .         .         .       .         .
255             .         .         .         .   CP2D7.........
                .         .         .         .       .
                .         .         .         .       .
258             .         .         .         .       .        2D6
                .         .         .         .       .         V
                .         .         .         .       .         V
264             .         .         .         .       .      R2D6
                .         .         .         .       .         .
                .         .         .         .       .         .
270             .         .         .         .       .         .        2D5
                .         .         .         .       .         .         .
                .         .         .         .       .         .         .
276             .         .         .         .       .    CP2D5U.........
                .         .         .         .       .         .
                .         .         .         .       .         .
279             .         .         .         .   CP2D5.........
                .         .         .         .       V
                .         .         .         .       V
282             .         .         .         .     R2D5
                .         .         .         .       .
                .         .         .         .       .
287             .         .         .         .       .        2D4
                .         .         .         .       .         .
                .         .         .         .       .         .
293             .         .         .         .   CP2D4.........
                .         .         .         .       .
                .         .         .         .       .
296             .         .         .     CP2D2.........
                .         .         .         V
                .         .         .         V
299             .         .         .      R2D2
                .         .         .         .
                .         .         .         .
304             .         .         .         .      2D1
                .         .         .         .       .
                .         .         .         .       .
310             .         .         .     CP2D1.........
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
*           VERSION 4.0.1E             *
*                                      *
*  RUN DATE 12/05/2002 TIME  6:27 PM   *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
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```
Watershed #2, Upper Agua Fria Zone A Floodplain Delineation Study
Flood Control District Contract FCD2000C020, RBF Job Number 45-100648
By RBF Consulting for the Flood Control District of Maricopa County, 9/3/2002
100-Yr 6-Hr Storm/ Clark Unit Hydrograph/ Green Ampt Rainfall Losses/ Normal
HEC-1 Input File Name "0648ws2.hc1", HEC-1 Output File Name "0648ws2.out"
Revised from the WMS Generated HEC-1 file to Add more concentration points

 9 IO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN           5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1JAN94  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ,         190  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1JAN94  ENDING DATE
                    NDTIME        1545  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   15.75 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

11 JD          INDEX STORM NO. 1
                     STRM        3.50  PRECIPITATION DEPTH
                     TRDA        0.00  TRANSPOSITION DRAINAGE AREA

12 PI            PRECIPITATION PATTERN
                   0.27      0.27      0.27      0.27      0.27      0.27      0.30      0.30      0.30      0.27
                   0.27      0.27      0.27      0.27      0.27      0.30      0.30      0.30      0.27      0.27
                   0.27      0.27      0.27      0.27      0.27      0.27      0.27      0.43      0.43      0.43
                   0.40      0.40      0.40      0.63      0.63      0.63      0.67      0.67      0.67      2.60
                   2.60      2.60      5.37      5.37      5.37     15.23     15.23     15.23      2.57      2.57
                   2.57      0.67      0.67      0.67      0.63      0.63      0.63      0.40      0.40      0.40
                   0.33      0.33      0.33      0.37      0.37      0.37      0.27      0.27      0.27      0.30
                   0.30      0.30

16 JD          INDEX STORM NO. 2
                     STRM        3.48  PRECIPITATION DEPTH
                     TRDA        0.50  TRANSPOSITION DRAINAGE AREA

17 PI            PRECIPITATION PATTERN
                   0.27      0.27      0.27      0.27      0.27      0.27      0.30      0.30      0.30      0.27
                   0.27      0.27      0.27      0.27      0.27      0.30      0.30      0.30      0.27      0.27
                   0.27      0.27      0.27      0.27      0.27      0.27      0.27      0.43      0.43      0.43
                   0.40      0.40      0.40      0.63      0.63      0.63      0.67      0.67      0.67      2.60
                   2.60      2.60      5.37      5.37      5.37     15.23     15.23     15.23      2.57      2.57
                   2.57      0.67      0.67      0.67      0.63      0.63      0.63      0.40      0.40      0.40
                   0.33      0.33      0.33      0.37      0.37      0.37      0.27      0.27      0.27      0.30
                   0.30      0.30

21 JD          INDEX STORM NO. 3
                     STRM        3.41  PRECIPITATION DEPTH
                     TRDA        2.80  TRANSPOSITION DRAINAGE AREA

22 PI            PRECIPITATION PATTERN
                   0.30      0.30      0.30      0.23      0.23      0.23      0.30      0.30      0.30      0.30
                   0.30      0.30      0.27      0.27      0.27      0.30      0.30      0.30      0.27      0.27
                   0.27      0.27      0.27      0.27      0.27      0.30      0.30      0.30      0.37      0.37
                   0.43      0.43      0.43      0.67      0.67      0.67      1.43      1.43      1.43      2.97
                   2.97      2.97      6.63      6.63      6.63      8.10      8.10      8.10      4.77      4.77
                   4.77      2.10      2.10      2.10      1.27      1.27      1.27      0.40      0.40      0.40
                   0.43      0.43      0.43      0.40      0.40      0.40      0.43      0.43      0.43      0.40
                   0.40      0.40

26 JD          INDEX STORM NO. 4
                     STRM        3.23  PRECIPITATION DEPTH
                     TRDA       16.00  TRANSPOSITION DRAINAGE AREA

27 PI            PRECIPITATION PATTERN
```

0.50	0.50	0.50	0.17	0.17	0.17	0.33	0.33	0.33	0.60
0.60	0.60	0.50	0.50	0.50	0.43	0.43	0.43	0.47	0.47
0.47	0.50	0.50	0.50	0.47	0.47	0.47	0.53	0.53	0.53
0.57	0.57	0.57	0.77	0.77	0.77	1.57	1.57	1.57	2.73
2.73	2.73	5.60	5.60	5.60	6.60	6.60	6.60	4.20	4.20
4.20	2.40	2.40	2.40	1.47	1.47	1.47	1.13	1.13	1.13
0.47	0.47	0.47	0.43	0.43	0.43	0.47	0.47	0.47	0.43
0.43	0.43								

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	2A2	1304.	4.25	144.	55.	55.	0.50		
+	ROUTED TO	R2A2	1216.	4.25	144.	55.	55.	0.50		
+	HYDROGRAPH AT	2A1	1156.	4.33	148.	57.	57.	0.57		
+	2 COMBINED AT	CP2A1	2050.	4.33	287.	110.	110.	1.07		
+	HYDROGRAPH AT	2B3	1215.	4.25	121.	46.	46.	0.52		
+	ROUTED TO	R2B3	1141.	4.33	121.	46.	46.	0.52		
+	HYDROGRAPH AT	2B2	883.	4.33	112.	43.	43.	0.48		
+	2 COMBINED AT	CP2B2	1733.	4.33	222.	85.	85.	1.00		
+	ROUTED TO	R2B2	1646.	4.42	222.	85.	85.	1.00		
+	HYDROGRAPH AT	2B1	518.	4.25	70.	27.	27.	0.27		
+	2 COMBINED AT	CP2B1	1947.	4.33	285.	109.	109.	1.27		
+	HYDROGRAPH AT	2C4	1249.	4.25	129.	49.	49.	0.56		
+	ROUTED TO	R2C4	1110.	4.42	128.	49.	49.	0.56		
+	HYDROGRAPH AT	2C3	415.	4.50	82.	32.	32.	0.37		
+	2 COMBINED AT	CP2C3	1349.	4.42	201.	77.	77.	0.93		
+	HYDROGRAPH AT	2C2	560.	4.50	113.	43.	43.	0.53		
+	2 COMBINED AT	CP2C2	1626.	4.42	296.	114.	114.	1.47		
+	ROUTED TO	R2C2	1587.	4.58	296.	114.	114.	1.47		
+	HYDROGRAPH AT	2C1	178.	4.50	39.	15.	15.	0.20		
+	2 COMBINED AT	CP2C1	1684.	4.58	327.	126.	126.	1.66		
+	HYDROGRAPH AT	2D3	935.	4.33	119.	46.	46.	0.54		
+	ROUTED TO	R2D3	811.	4.58	119.	46.	46.	0.54		
+	HYDROGRAPH AT	2D2	405.	4.58	87.	33.	33.	0.39		
+	2 COMBINED AT	CP2D2U	1096.	4.58	197.	76.	76.	0.93		
+	HYDROGRAPH AT	2D12	1027.	4.25	116.	44.	44.	0.53		
+	ROUTED TO	R2D12	1030.	4.33	116.	44.	44.	0.53		
+	HYDROGRAPH AT	2D11	402.	4.25	39.	15.	15.	0.20		
+	2 COMBINED AT	CP2D11	1275.	4.33	151.	58.	58.	0.73		
+	HYDROGRAPH AT	2D14	611.	4.33	90.	35.	35.	0.37		

+	HYDROGRAPH AT	2D15	698.	4.42	109.	42.	42.	0.42
+	2 COMBINED AT	CP2D14	1192.	4.33	195.	75.	75.	0.79
+	ROUTED TO	R2D14	1143.	4.42	195.	75.	75.	0.79
+	HYDROGRAPH AT	2D13	610.	4.33	91.	35.	35.	0.38
+	2 COMBINED AT	CP2D13	1562.	4.42	276.	106.	106.	1.17
+	2 COMBINED AT	CP2D11	2340.	4.42	407.	156.	156.	1.90
+	ROUTED TO	R2D11	2304.	4.50	406.	156.	156.	1.90
+	HYDROGRAPH AT	2D10	841.	4.50	135.	52.	52.	0.62
+	2 COMBINED AT	CP2D10	2788.	4.50	520.	199.	199.	2.52
+	HYDROGRAPH AT	2D9	641.	4.50	119.	46.	46.	0.52
+	2 COMBINED AT	CP2D9	3145.	4.50	618.	237.	237.	3.04
+	ROUTED TO	R2D9	3083.	4.58	618.	237.	237.	3.04
+	HYDROGRAPH AT	2D8	980.	4.42	127.	48.	48.	0.58
+	2 COMBINED AT	CP2D8	3601.	4.58	718.	275.	275.	3.62
+	ROUTED TO	R2D8	3558.	4.67	718.	275.	275.	3.62
+	HYDROGRAPH AT	2D7	185.	4.58	42.	16.	16.	0.20
+	2 COMBINED AT	CP2D7	3664.	4.67	749.	288.	288.	3.82
+	HYDROGRAPH AT	2D6	381.	4.75	94.	36.	36.	0.50
+	ROUTED TO	R2D6	367.	4.92	94.	36.	36.	0.50
+	HYDROGRAPH AT	2D5	414.	4.58	86.	33.	33.	0.42
+	2 COMBINED AT	CP2D5U	651.	4.83	169.	65.	65.	0.92
+	2 COMBINED AT	CP2D5	3999.	4.67	870.	335.	335.	4.74
+	ROUTED TO	R2D5	4004.	4.75	870.	335.	335.	4.74
+	HYDROGRAPH AT	2D4	223.	4.25	31.	12.	12.	0.12
+	2 COMBINED AT	CP2D4	4074.	4.75	893.	344.	344.	4.86
+	2 COMBINED AT	CP2D2	4733.	4.75	1044.	402.	402.	5.79
+	ROUTED TO	R2D2	4689.	4.83	1043.	402.	402.	5.79
+	HYDROGRAPH AT	2D1	544.	4.42	83.	32.	32.	0.36
+	2 COMBINED AT	CP2D1	4891.	4.83	1105.	426.	426.	6.14

*** NORMAL END OF HEC-1 ***

E.1 Field Reconnaissance and Roughness Coefficient Estimation

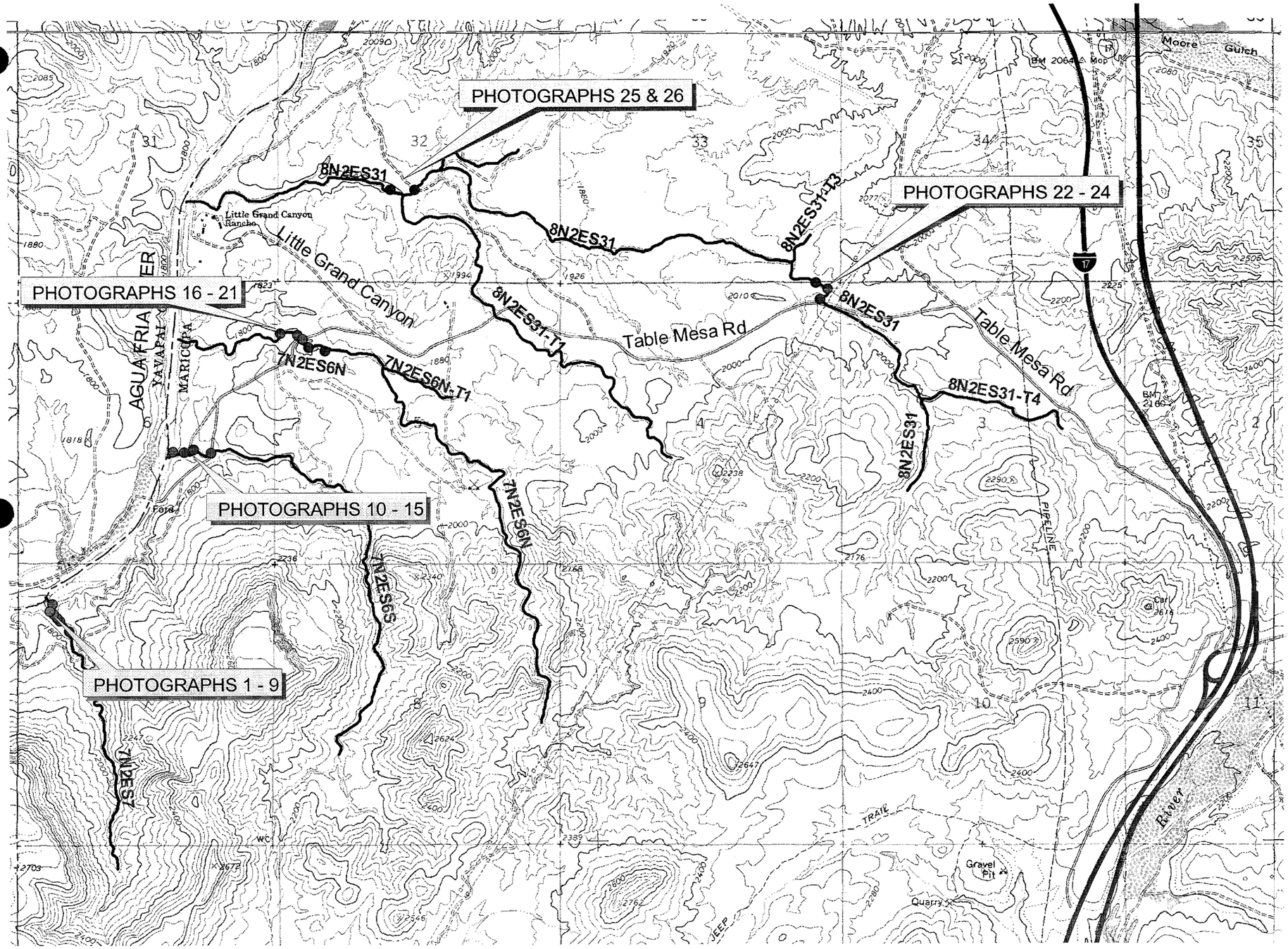
E.1.1 Field Reconnaissance

The project team visited Watershed No. 2 (Table Mesa Road Area) on September 6, 2001. The purpose of the field trip was to observe the watershed and floodplain conditions, obtain photographic documentation, and estimate Manning's n values. The aerial photographs and USGS maps show that there is very little development in Watershed No. 2. The main areas of development are dirt roads, camp grounds, Interstate 17, and utility easements. Table E.1-1 lists the washes that the project team attempted to visit, the sub-basins that the washes are in, and photograph numbers that correspond to the listed wash. Figure E.1-1 shows the location of the photographs on the USGS topographic maps, and the photographs are on the following pages.

Table E.1-1- List of the Washes in Watershed 1 and the Corresponding Photographs

Wash Name	Sub-Basin	Photograph Numbers
7N2ES7	2A	1-9
7N2ES6S	2B	10-15
7N2ES6N	2C	16-21
7N2ES6N-T1	2C	No Photographs
8N2ES31	2D	22-26
8N2ES31-T1	2D	No Photographs
8N2ES31-T2	2D	No Photographs
8N2ES31-T3	2D	No Photographs
8N2ES31-T4	2D	No Photographs

Access to these washes was obtained from the Interstate-17 freeway at the Table Mesa Road Exit. The washes listed above are tributary to the Agua Fria River. All of Wash 7N2ES7 (Sub-Basin 2A), most of Wash 7N2ES6S (Sub-Basin 2B), and about one-half of Wash 7N2ES6N (Sub-Basin 2C) are highly mountainous with limited access. For that reason most of the photos are taken at or near the confluence of each wash with the Agua Fria River. The terrain around Wash 8N2ES31 and its tributaries (Sub-Basin 2D) is not as steep and is accessible from several dirt roads, allowing a better evaluation of the hydrologic and hydraulic characteristics of the watershed and wash.



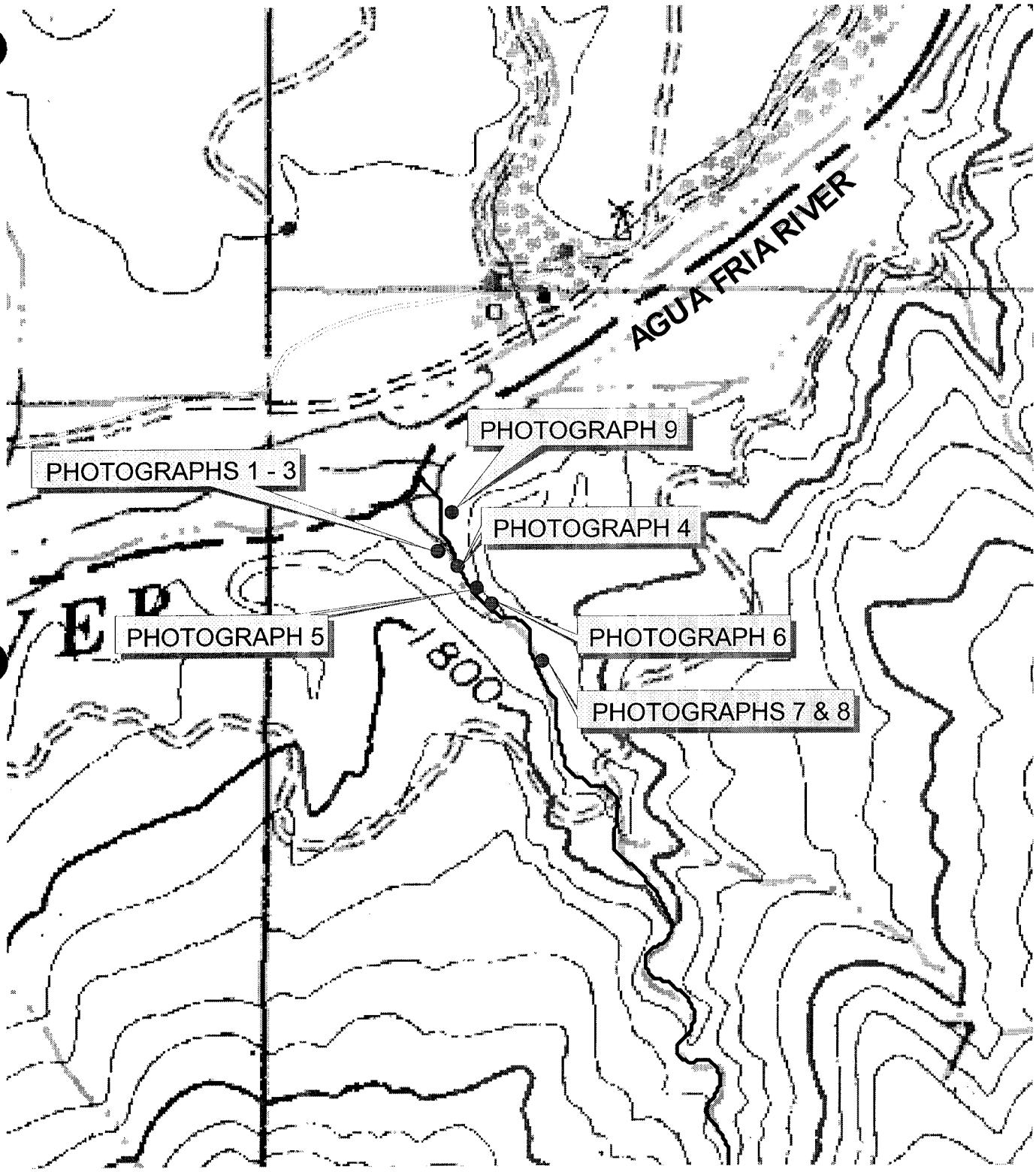
LEGEND

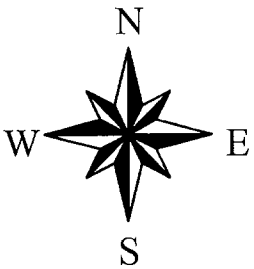
- LOCATION OF PHOTOGRAPH
- WASHES WITH PROPOSED FLOODPLAINS

2000 0 2000 4000 Feet

FIGURE E.1-1- PHOTOGRAPH LOCATIONS

7N2ES7





500 0 500 1000 Feet

Photograph 1- Looking upstream from near the confluence of the wash with the Agua Fria River.
Wash: 7N2ES7
Sub-Basin: 2A

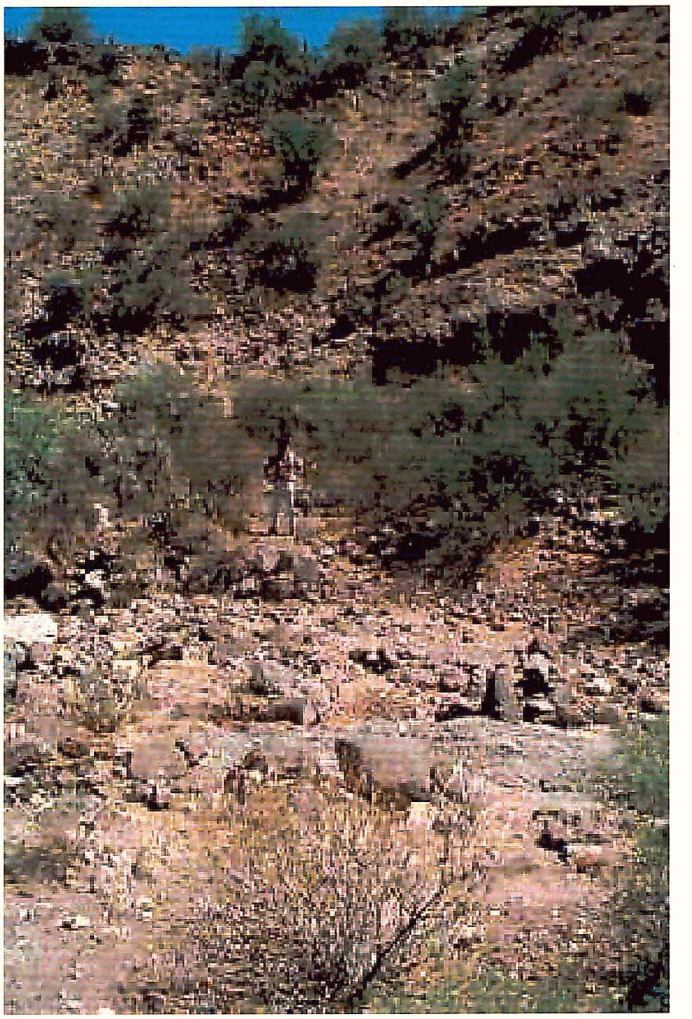
Photograph 2- Looking upstream from near the confluence of the wash with the Agua Fria River.
Wash: 7N2ES7
Sub-Basin: 2A

Photograph 3- Looking at the overbank vegetation
Wash: 7N2ES7
Sub-Basin: 2A

Photograph 4- Looking upstream
Wash: 7N2ES7
Sub-Basin: 2A

Photograph 5- Looking upstream along the channel of the wash
Wash: 7N2ES7
Sub-Basin: 2A

Photograph 6- Looking upstream from the wash overbank
Wash: 7N2ES7
Sub-Basin: 2A

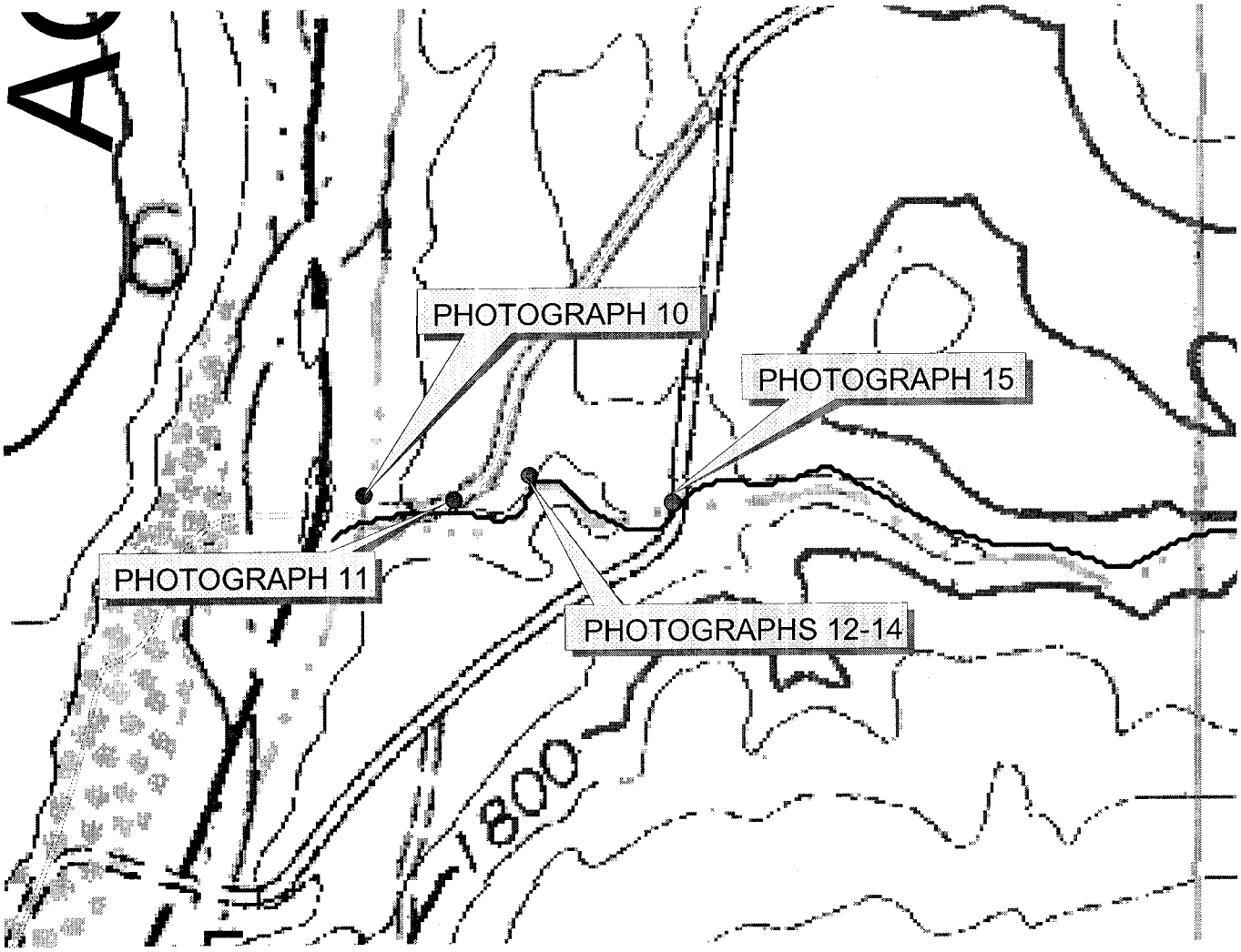


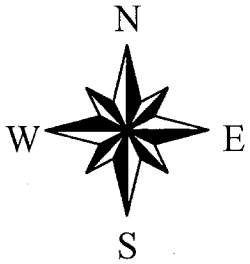
Photograph 7- Looking from the left bank across the channel to the right bank.
Wash: 7N2ES7
Sub-Basin: 2A

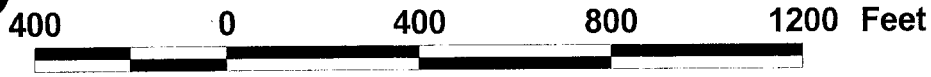
Photograph 8- Looking upstream along the main channel.
Wash: 7N2ES31
Sub-Basin: 2A

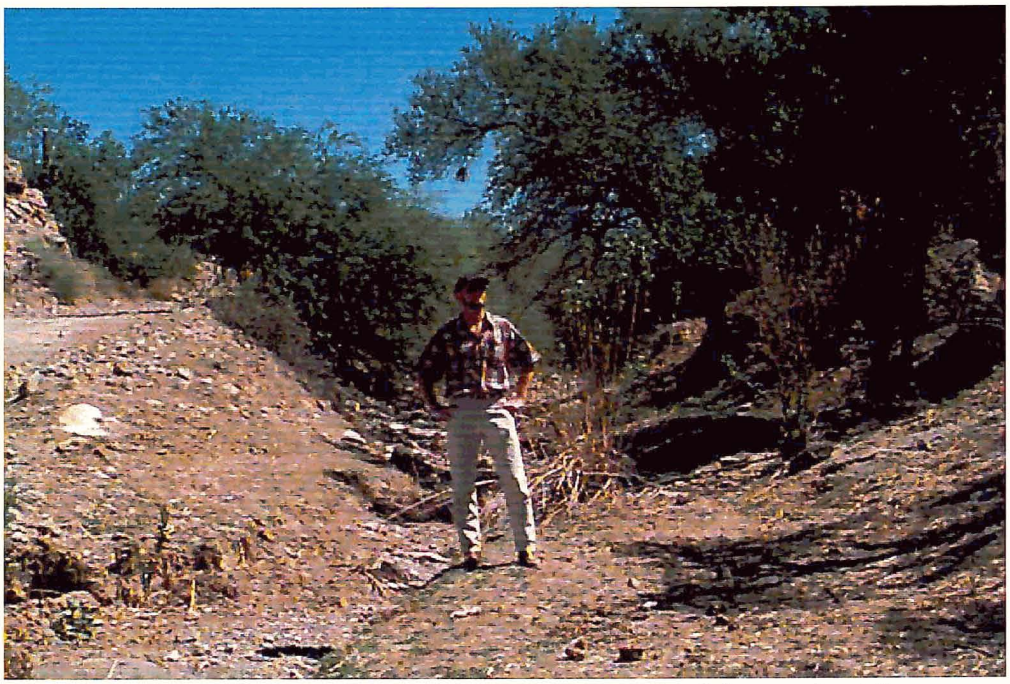
Photograph 9- Looking Upstream from the mouth of the wash at its confluence with the Agua Fria River.
Wash: 7N2ES7
Sub-Basin: 2A

7N2ES6S

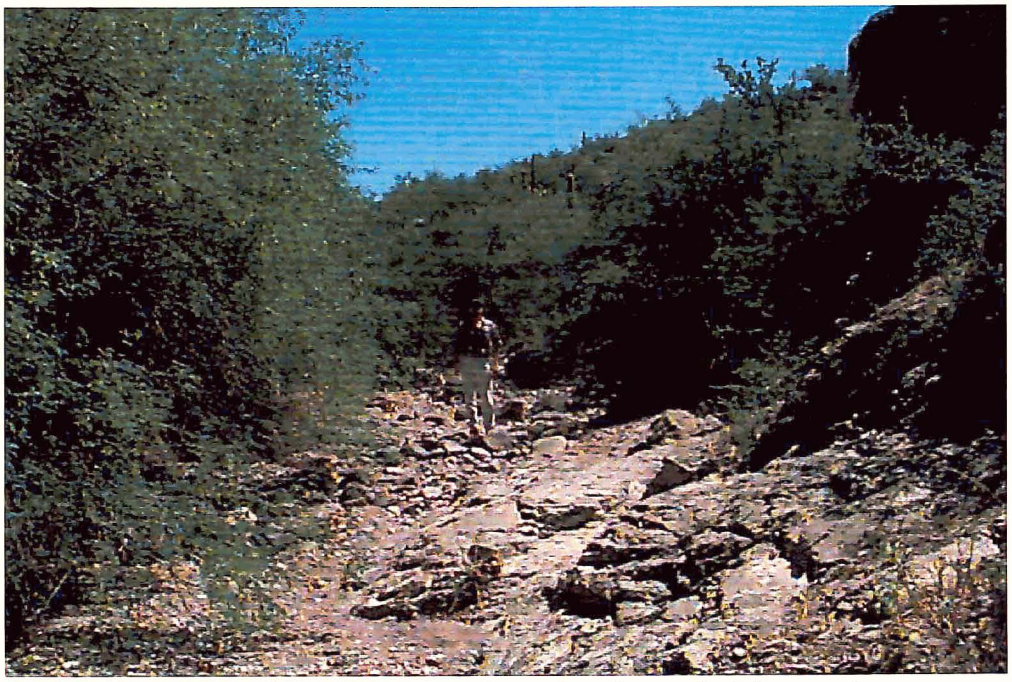

PHOTOGRAPH 10
PHOTOGRAPH 15
PHOTOGRAPH 11
PHOTOGRAPHS 12-14
1800


N
W
E
S


400
0
400
800
1200 Feet



Photograph 10- Looking upstream from the mouth of the wash at the confluence with the Agua Fria River.
Wash: 7N2ES6S
Sub-Basin: 2B

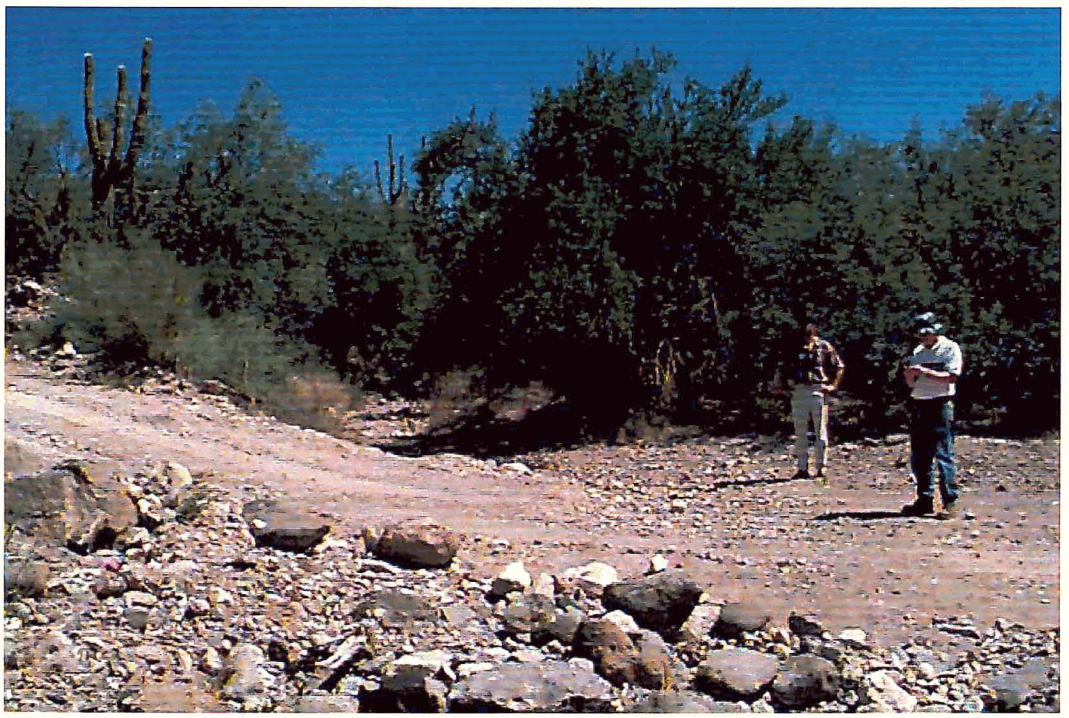


Photograph 11- Looking upstream along the channel of the wash
Wash: 7N2ES6S
Sub-Basin: 2B

Photograph 12- Looking upstream along the channel of the wash at a bend.
Wash: 7N2ES6S
Sub-Basin: 2B

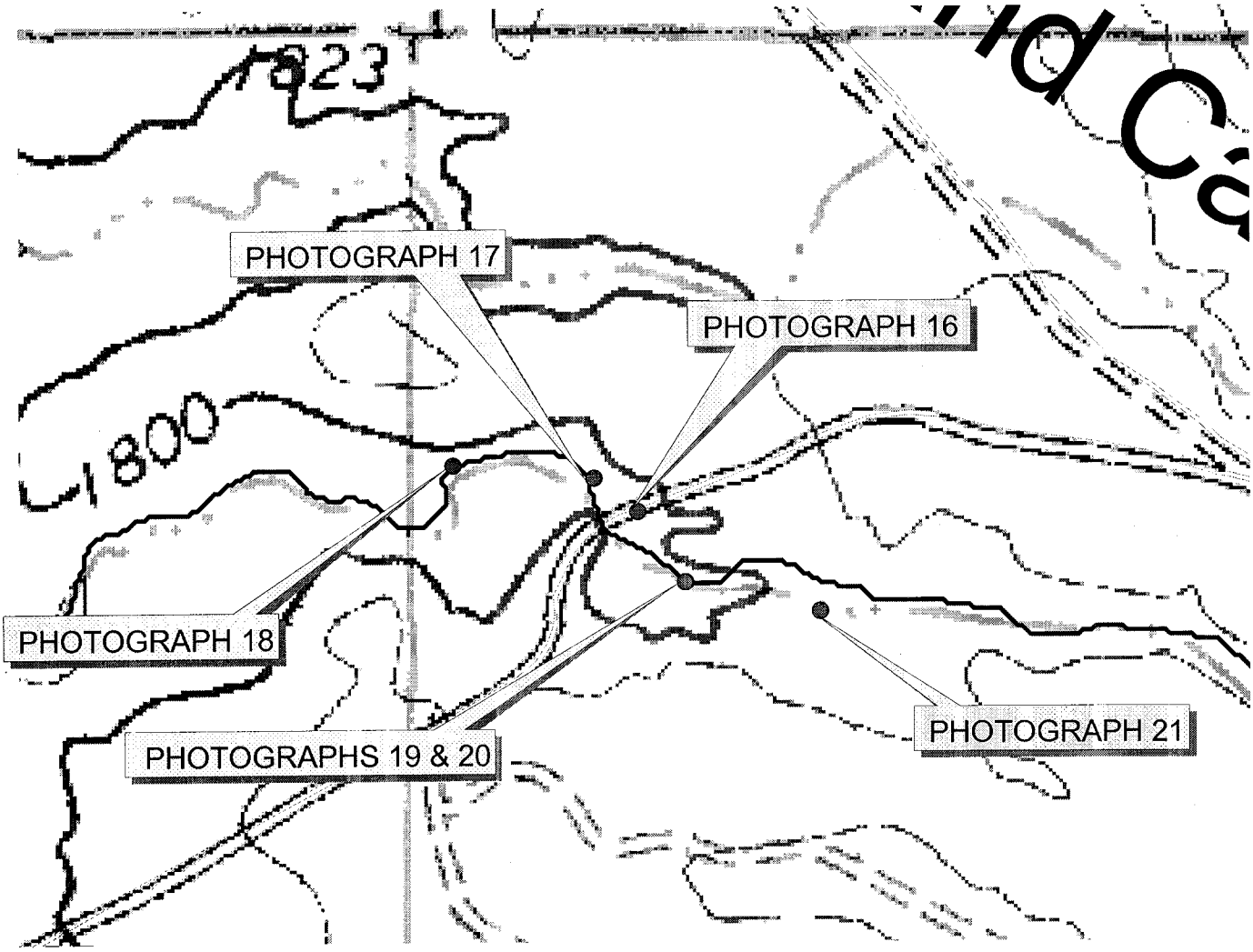
Photograph 13- Looking upstream, to the south of Photograph 12
Wash: 7N2ES6S
Sub-Basin: 2B

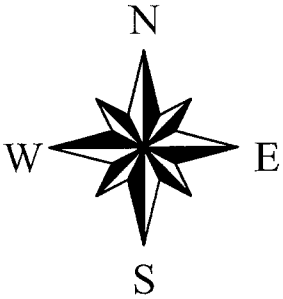
Photograph 14- Looking downstream from the bend in the wash.
Wash: 7N2ES6S
Sub-Basin: 2B

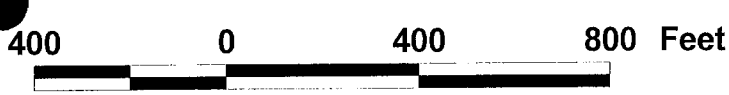


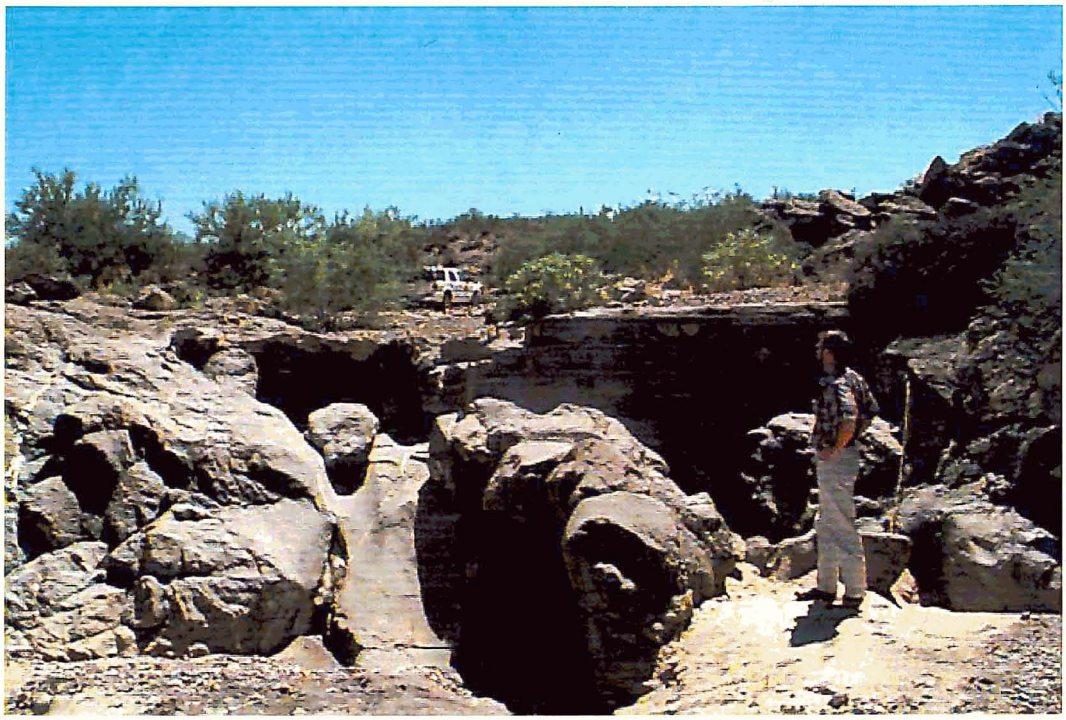
Photograph 15- Looking upstream at the crossing.
Wash: 7N2ES6S
Sub-Basin: 2B

7N2ES6N

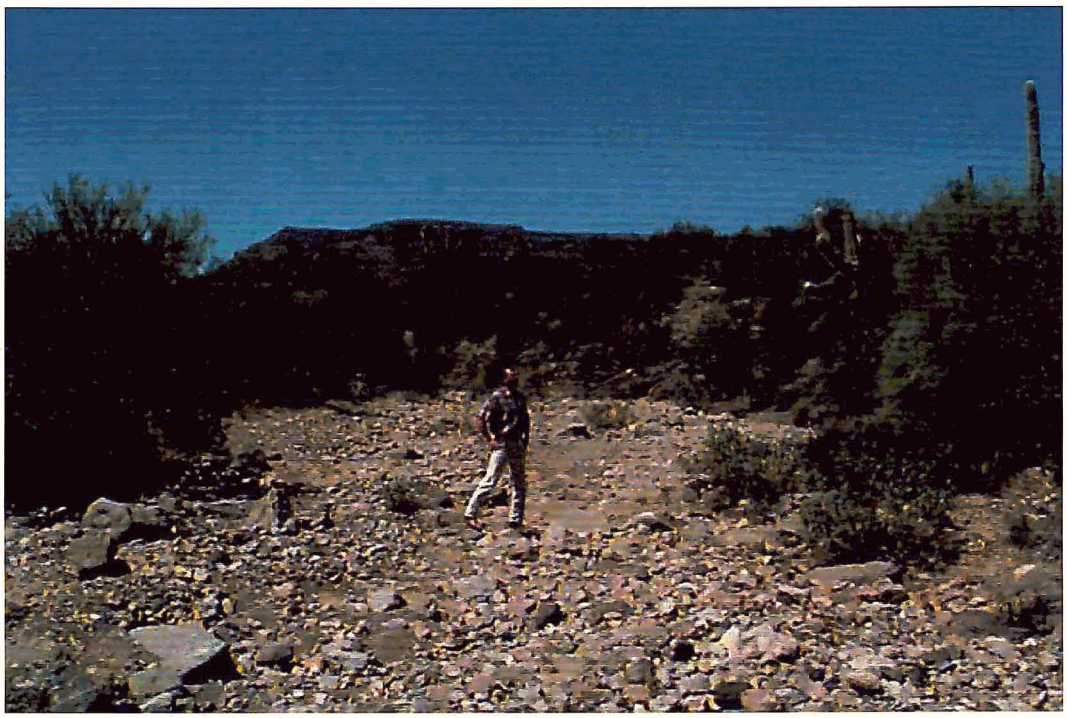

PHOTOGRAPH 17
PHOTOGRAPH 16
PHOTOGRAPH 18
PHOTOGRAPHS 19 & 20
PHOTOGRAPH 21


N
W
E
S


400
0
400
800 Feet



Photograph 16- Looking upstream at an old weir/grade control structure
Wash: 7N2ES6N
Sub-Basin: 2C



Photograph 17- Looking downstream along channel of wash
Wash: 7N2ES6N
Sub-Basin: 2C

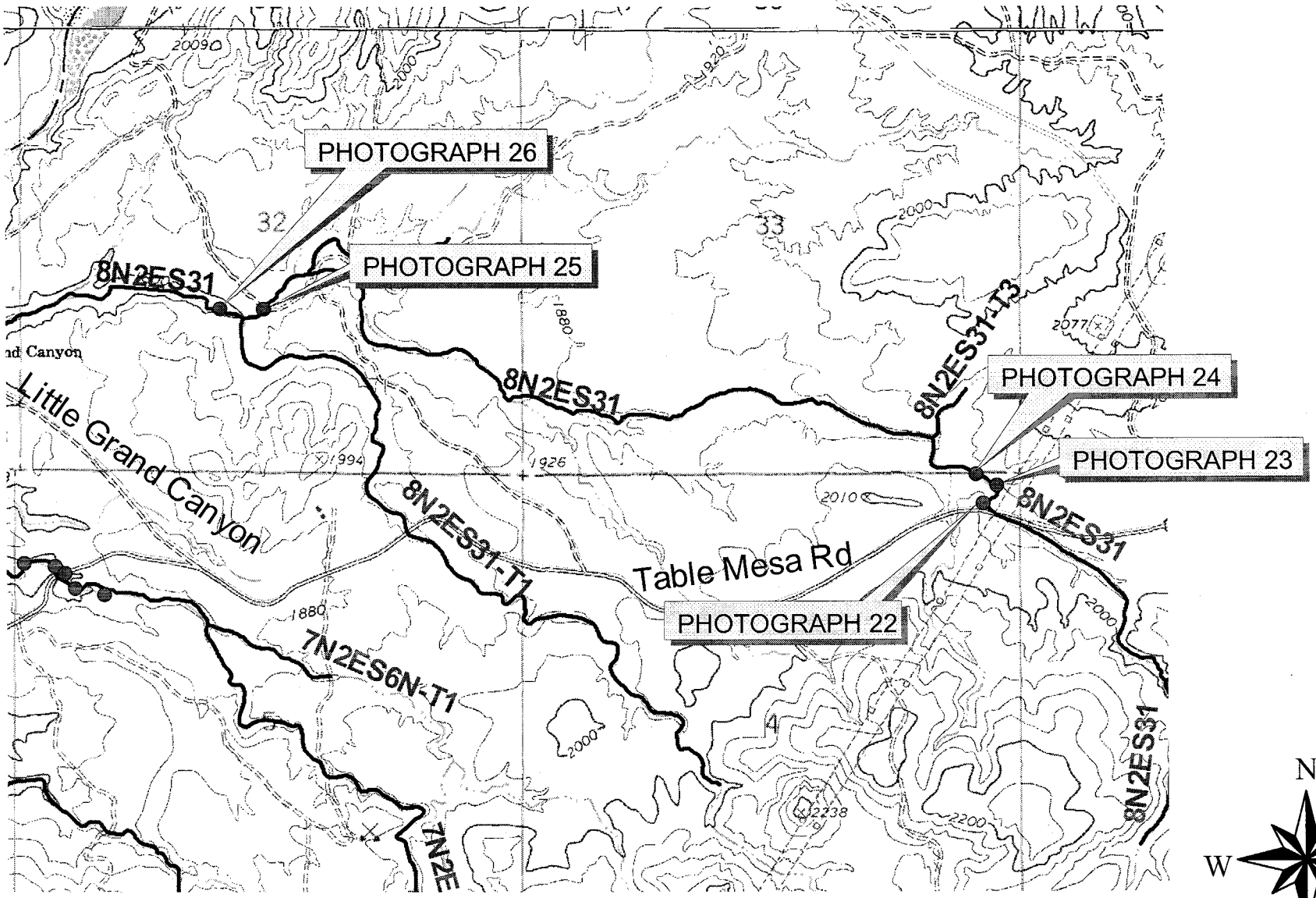
Photograph 18- Looking downstream along the channel of the wash
Wash: 7N2ES6N
Sub-Basin: 2C

Photograph 19- Looking upstream
Wash: 7N2ES6N
Sub-Basin: 2C

Photograph 20- Looking upstream
Wash: 7N2ES6N
Sub-Basin: 2C

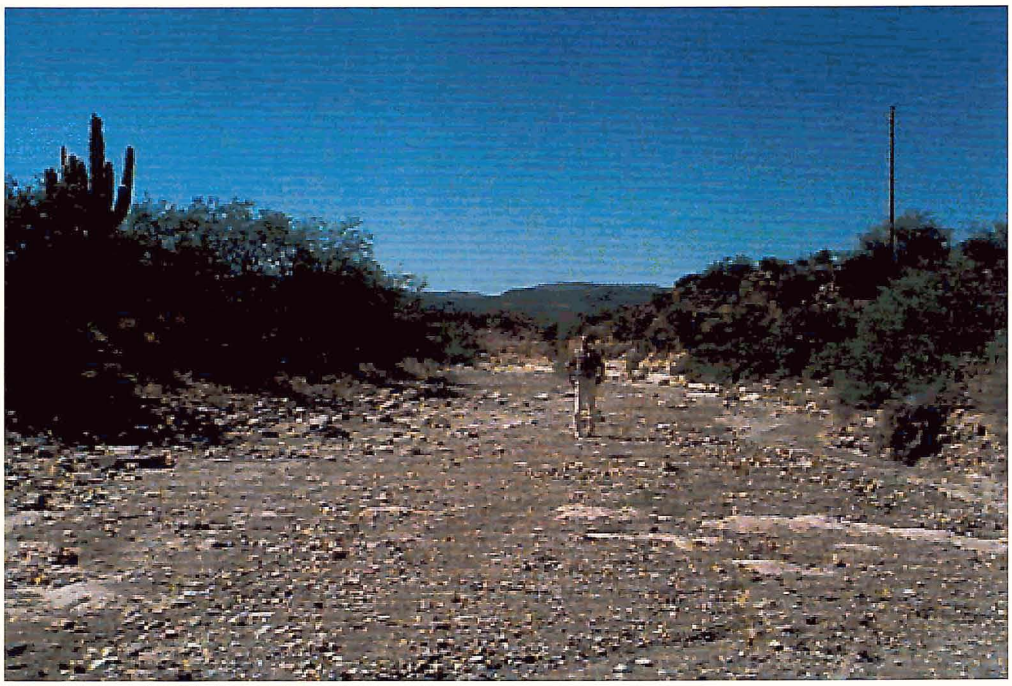
Photograph 21- Looking upstream.
Wash: 7N2ES6N
Sub-Basin: 2C

8N2ES31

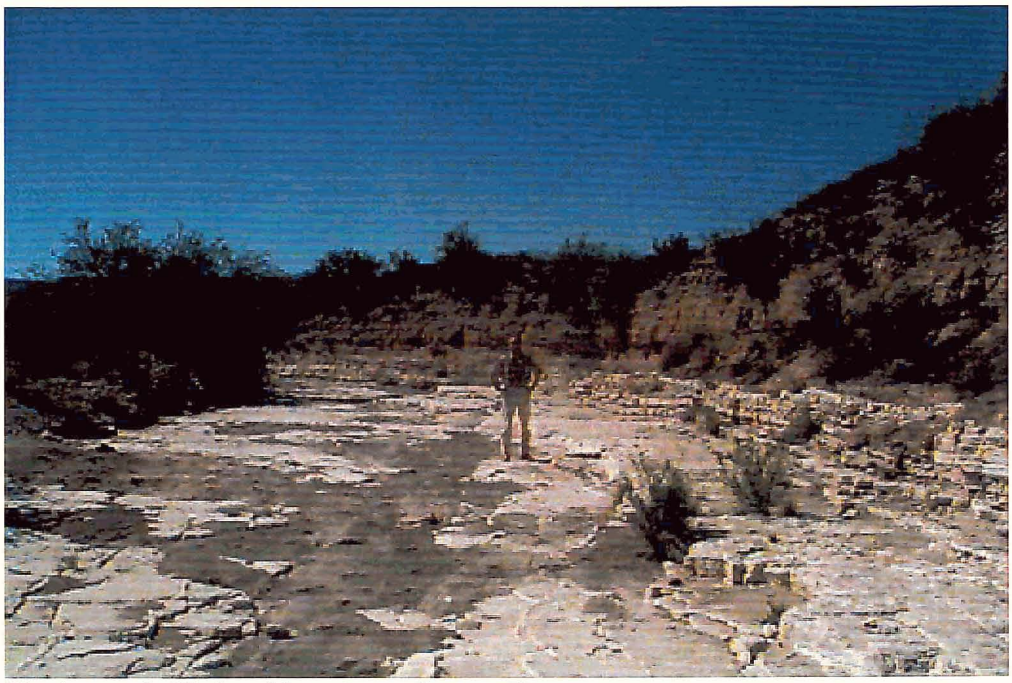


1000 0 1000 2000 Feet

N
W E
S



Photograph 22- Looking downstream
Wash: 8N2ES31
Sub-Basin: 2D



Photograph 23- Looking downstream along
Wash: 8N2ES31
Sub-Basin: 2D

Photograph 24- Looking at the channel lining (natural conditions)
Wash: 8N2ES31
Sub-Basin: 2D

Photograph 25- Looking upstream along the thalweg of the wash
Wash: 8N2ES31
Sub-Basin: 2D

Photograph 26- Looking downstream along the channel of the wash
Wash: 8N2ES31
Sub-Basin: 2D

E.1.2- Manning's "n" Determination

The procedure used to determine Manning's "n" values is outlined in the USGS publication "Estimated Manning's Roughness Coefficients for Stream Channels and Floodplains in Maricopa County, Arizona" (April 1991). The following equation was used:

$$n = (n_b + n_1 + n_2 + n_3 + n_4)m$$

Where n = estimated Manning's roughness coefficient
n_b = base value of n for a straight, uniform channel,
n_1 = value for surface irregularities,
n_2 = value for obstruction,
n_3 = value for vegetation,
n_4 = value for variation in channel cross section, and
m = degree of meandering.

FEMA 37, "Guidelines and Specifications for Study Contractors", recommends that one n-value be selected for each stream or wash when performing Zone A delineations, and that the cross sections used be kept to a minimum, preferably 1 or 2 per stream (pg. 6-2). For this reason the n_4 value and m multiplier were included in the calculation. Manning's "n" values were determined for both the overbank floodplains and the channels.

The Manning's "n" values for the washes that were inaccessible were estimated based by comparing the SCS soils maps, aerial photographs, and the surrounding conditions. Table E.1-2 lists the Manning's "n" calculations.

Table E.1-2- Manning's "n" Calculations for Watershed 1 (East Lake Pleasant)

Wash Name	Location	n_b	n_1	n_2	n_3	n_4	m	n
7N2ES7	Channel	0.030	0.005	0.005	0.005	0.000	1.0	**0.045**
	Overbanks	0.030	0.005	0.010	0.025	0.00	1.0	**0.070**
7N2ES6S	Channel	0.025	0.010	0.005	0.005	0.00	1.0	**0.045**
	Overbanks	0.020	0.015	0.010	0.025	0.00	1.0	**0.070**
7N2ES6N	Channel	0.030	0.005	0.005	0.005	0.00	1.0	**0.045**
	Overbanks	0.020	0.015	0.010	0.025	0.00	1.0	**0.070**
7N2ES6N T1	Channel	0.030	0.005	0.005	0.005	0.00	1.0	**0.045**
	Overbanks	0.020	0.015	0.010	0.025	0.00	1.0	**0.070**
8N2ES31	Channel	0.030	0.005	0.005	0.005	0.00	1.0	**0.045**
	Overbanks	0.020	0.015	0.010	0.025	0.00	1.0	**0.070**
8N2ES31-T1	Channel	0.025	0.005	0.005	0.005	0.00	1.0	**0.045**
	Overbanks	0.020	0.005	0.010	0.025	0.00	1.0	**0.060**

E.2 Cross Section Plots (See Appendix E.5)

E.3 Expansion and Contraction Coefficients (Not Considered)

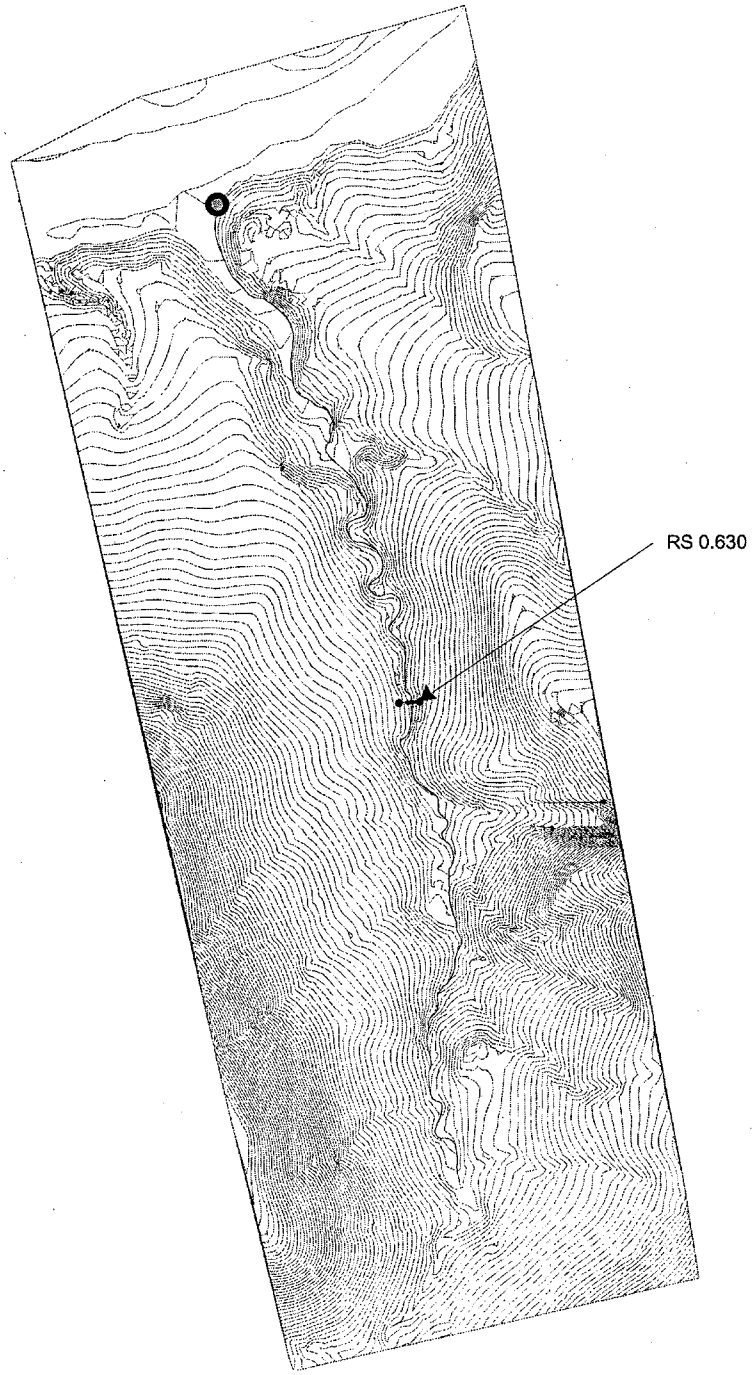
E.4 Analysis of Structures (Not Considered)

E.5 Hydraulic Calculations

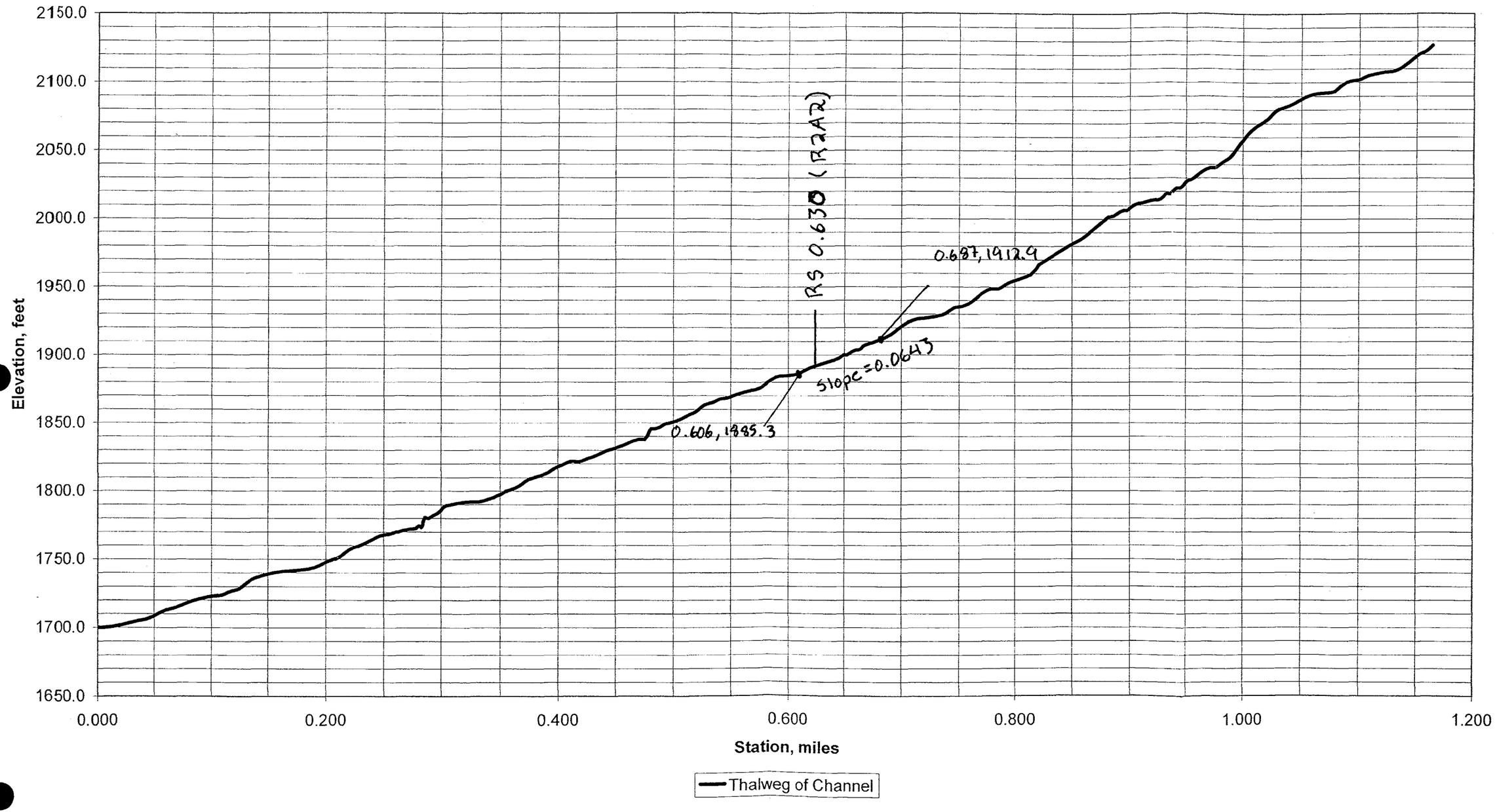
The following hydraulic calculations were performed completely within WMS 6.1 (August 13, 2002). The cross-sections were produced using a triangulated irregular network (TIN) within WMS. The TIN has a 10 foot contour interval with an accuracy of approximately 5 feet. The channel calculator in WMS was used to calculate the normal depth of the channel at each section. For a further explanation, see Section 5 of the Technical Data Notebook.

7N2ES7

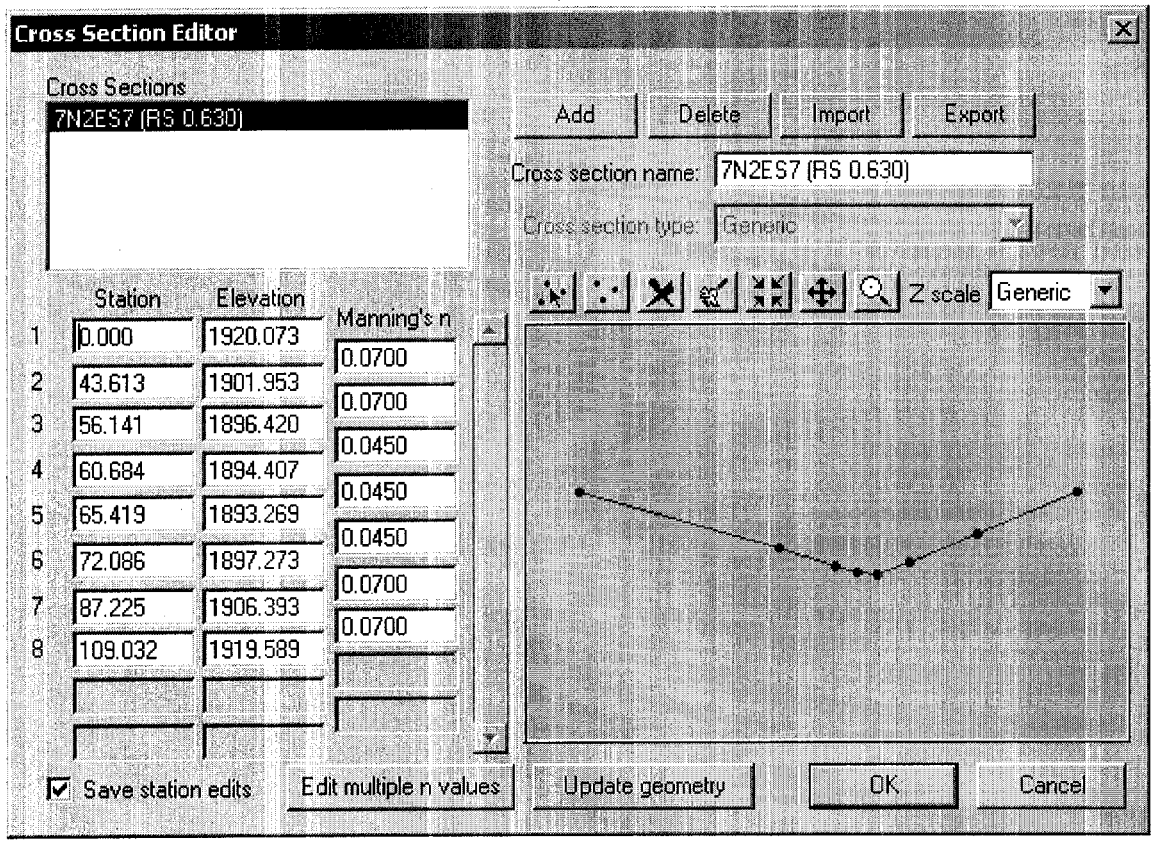
(WATERSHED 2A)



7N2ES7


2150.0
2100.0
2050.0
2000.0
1950.0
1900.0
1850.0
1800.0
1750.0
1700.0
1650.0
Elevation, feet
0.000
0.200
0.400
0.600
0.800
1.000
1.200
Station, miles
RS 0.630 (R2AR)
0.687, 1912.9
slope = 0.0643
0.606, 1885.3
Thalweg of Channel

7N2ES7
(WATERSHED 2A)

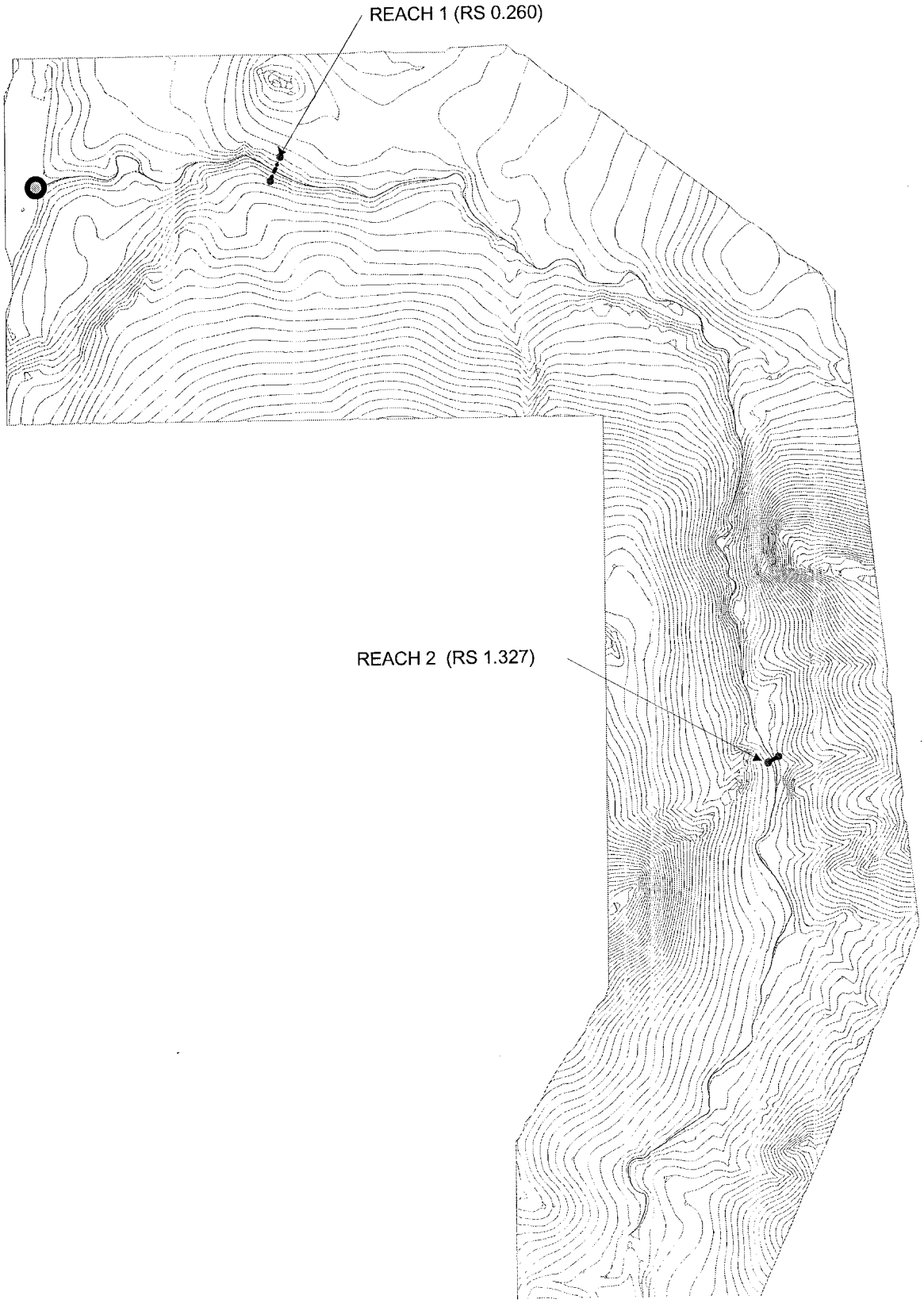


Calculated Values

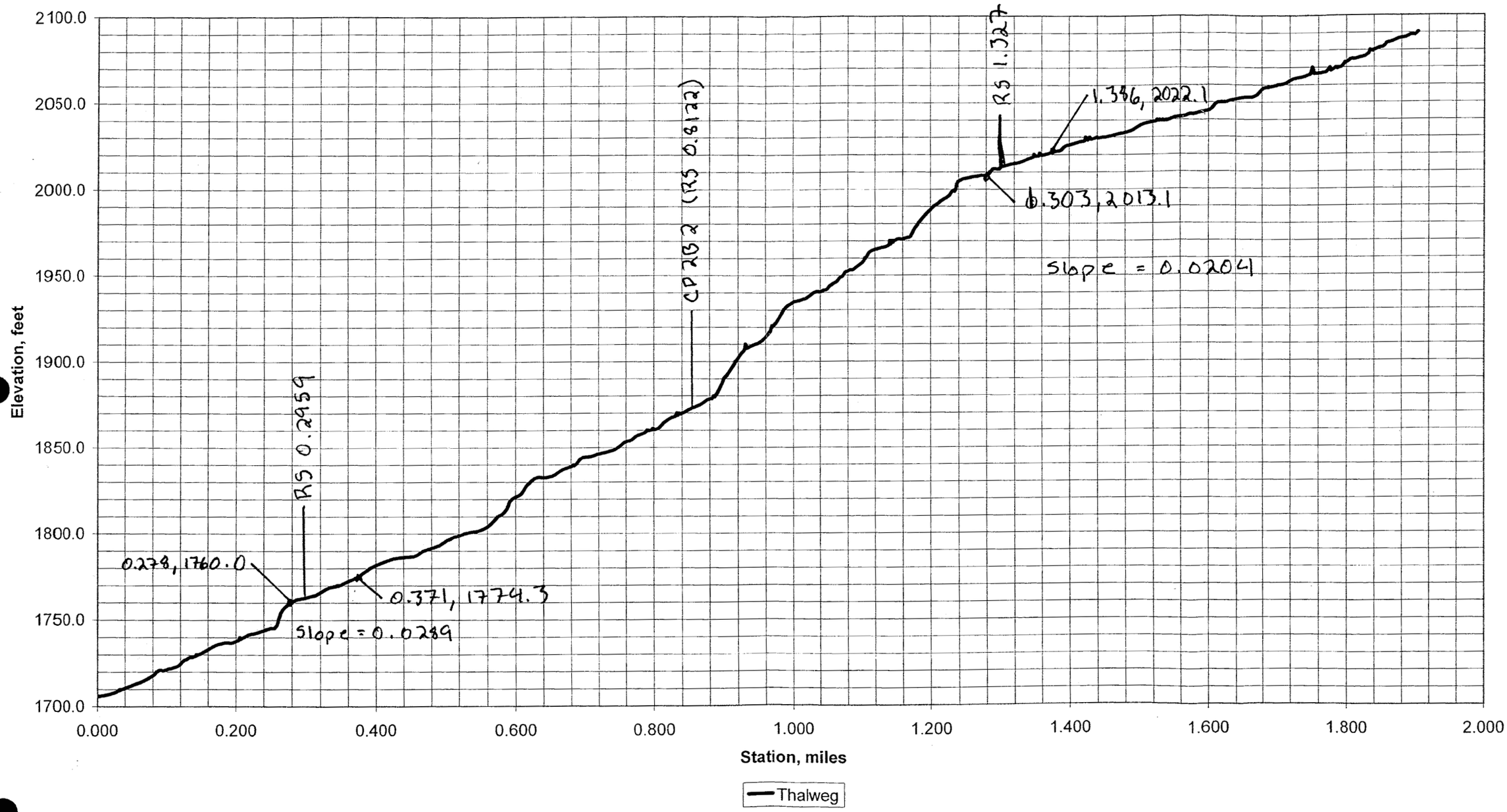
Longitudinal Slope: 0.0643
Flow: 2050.000 cfs
Depth: 7.708 ft
Area of Flow: 132.004 sq ft
Wetted Perimeter: 36.072 ft
Average Velocity: 15.530 fps
Top Width (T): 32.410 ft
Froude Number: 1.356
Critical Depth: 8.762 ft
Critical Velocity: 12.177 fps
Critical Slope: 0.03528
Manning's Roughness: 0.05779

7N2ES6S

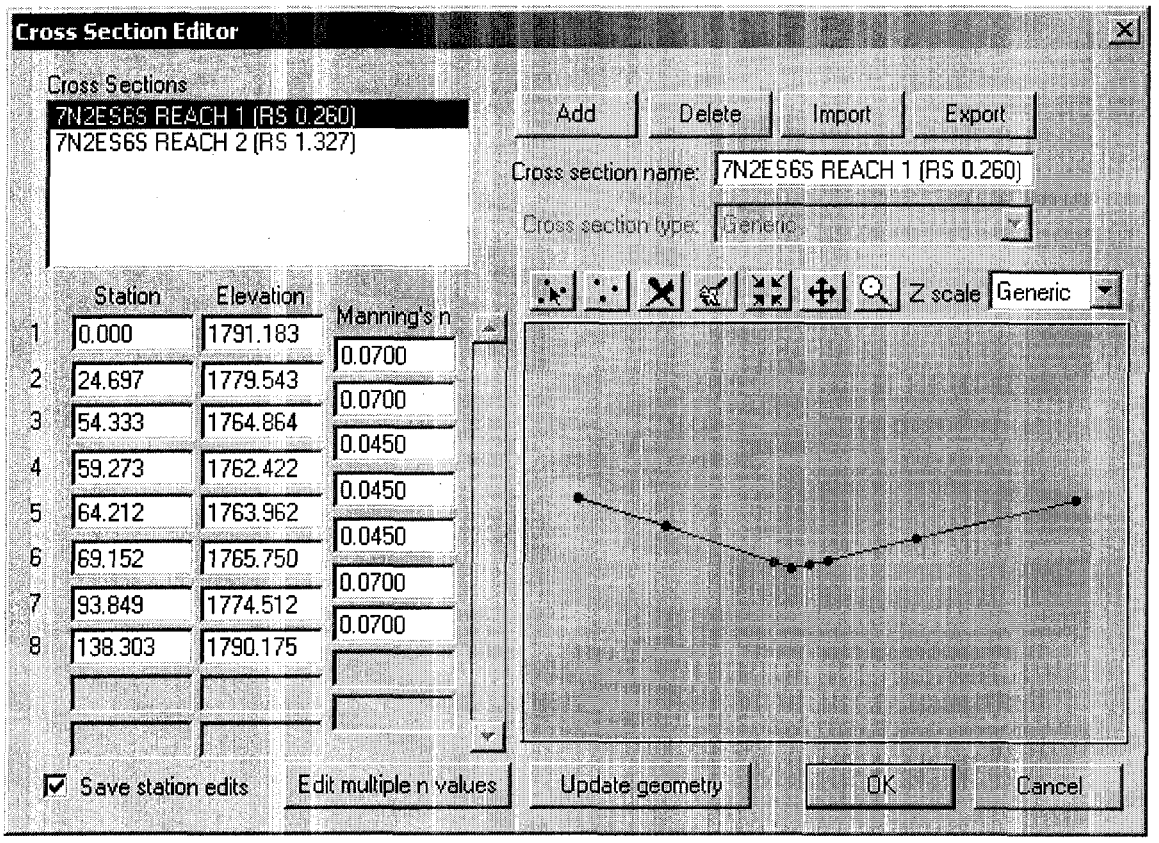
(WATERSHED 2B)



7N2ES6S

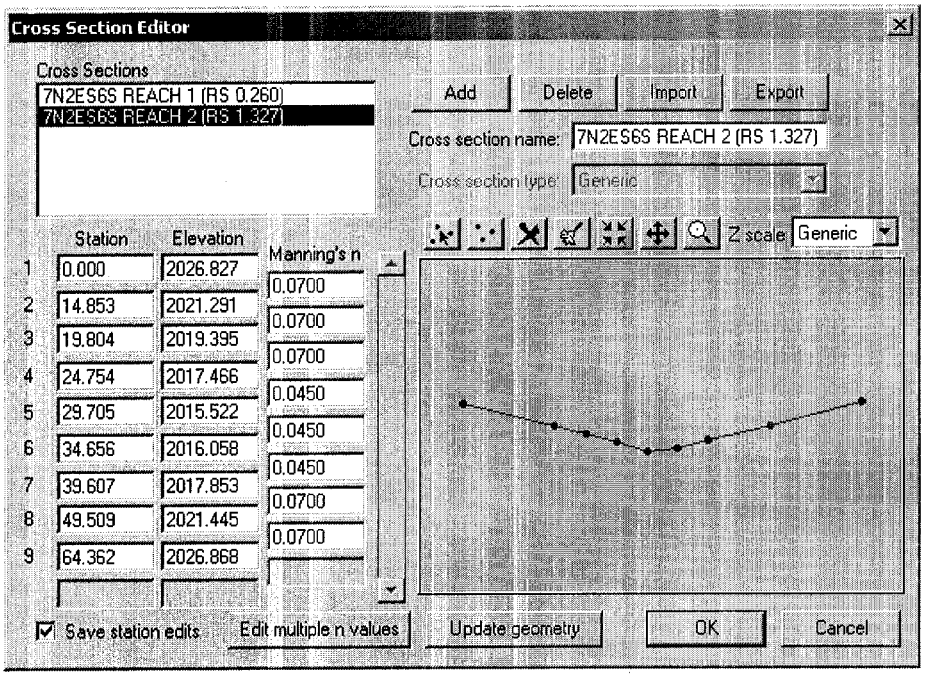

2100.0
2050.0
2000.0
1950.0
1900.0
1850.0
1800.0
1750.0
1700.0
Elevation, feet
0.000
0.200
0.400
0.600
0.800
1.000
1.200
1.400
1.600
1.800
2.000
Station, miles
Thalweg
CP 282 (RS 0.8122)
RS 1.327
1.346, 2022.1
0.303, 2013.1
slope = 0.0204
RS 0.2959
0.278, 1760.0
0.371, 1774.3
slope = 0.0289

7N2ES6S
(WATERSHED 2B)



Calculated Values

Longitudinal Slope : 0.0289
Flow: 1947.000 cfs
Depth: 8.663 ft
Area of Flow: 185.700 sq ft
Wetted Perimeter: 45.910 ft
Average Velocity: 10.485 fps
Top Width (T): 42.416 ft
Froude Number: 0.883
Critical Depth: 8.239 ft
Critical Velocity: 11.581 fps
Critical Slope: 0.03712
Manning's Roughness: 0.06132

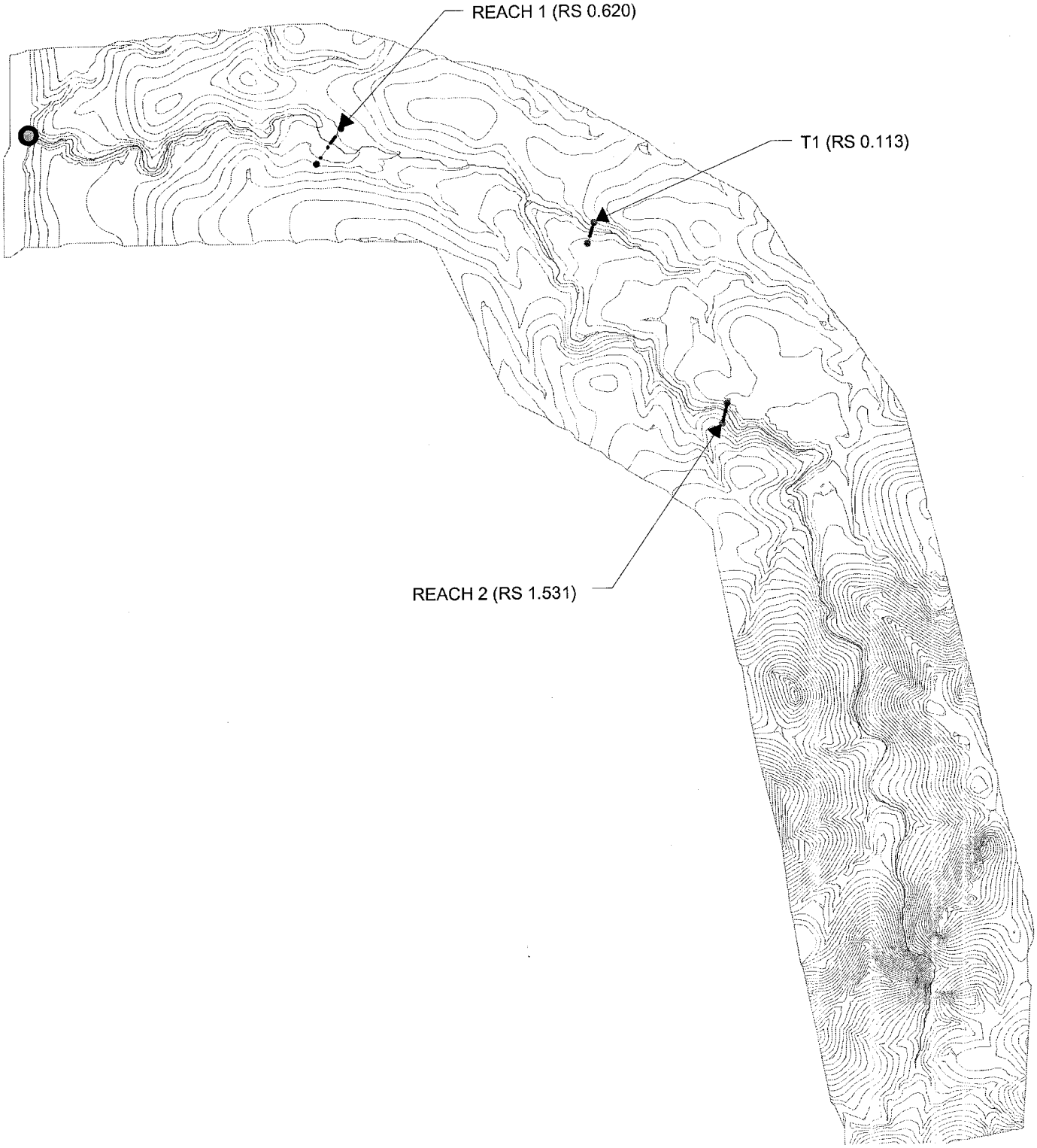


Calculated Values

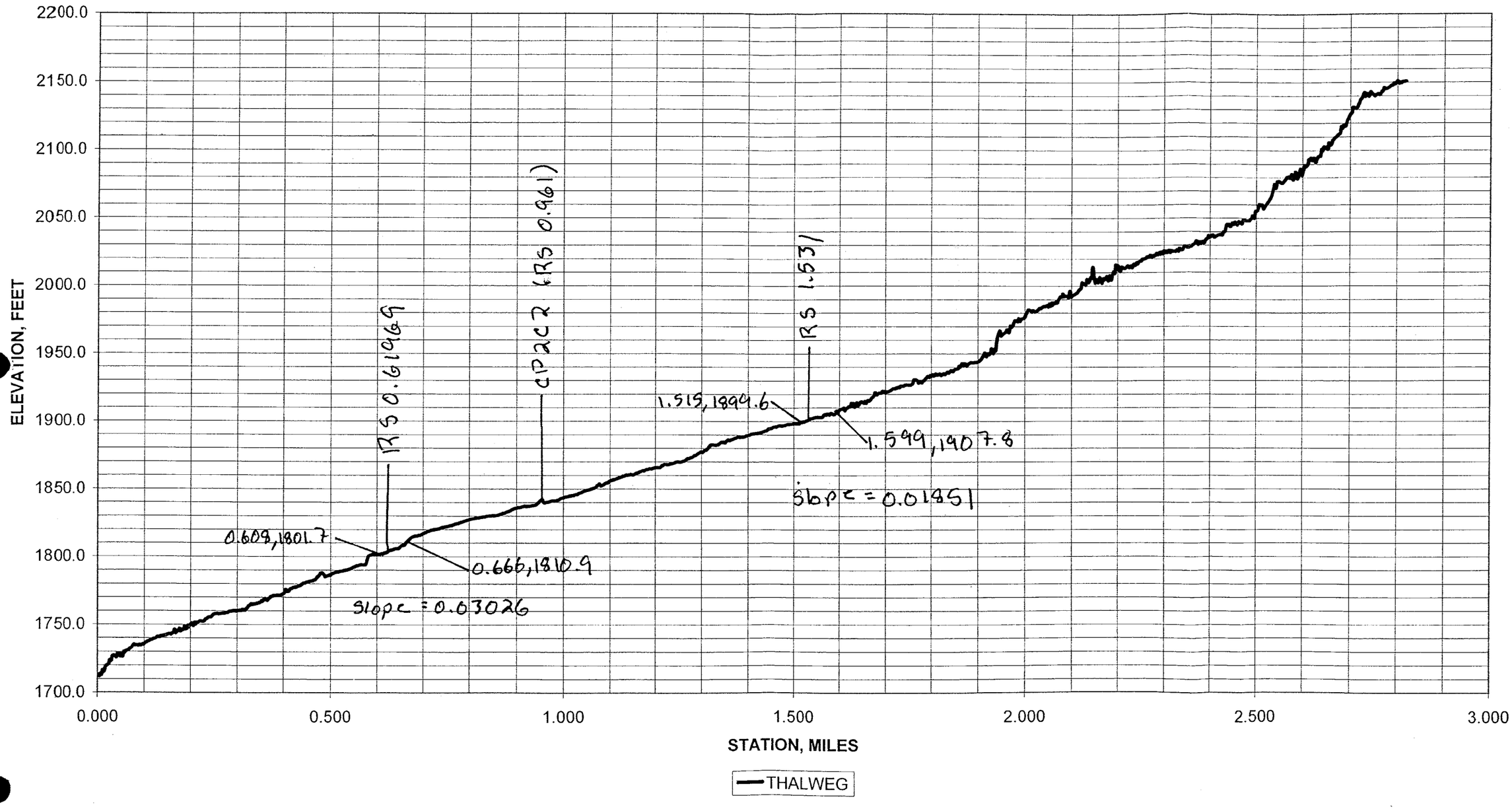
Longitudinal Slope: 0.0204 ft/ft
Flow: 1733.000 cfs
Depth: 8.864 ft
Area of Flow: 194.323 sq ft
Wetted Perimeter: 46.964 ft
Average Velocity: 8.918 fps
Top Width (T): 43.388 ft
Froude Number: 0.743
Critical Depth: 7.860 ft
Critical Velocity: 11.314 fps
Critical Slope: 0.03717
Manning's Roughness: 0.06152

7N2ES6N

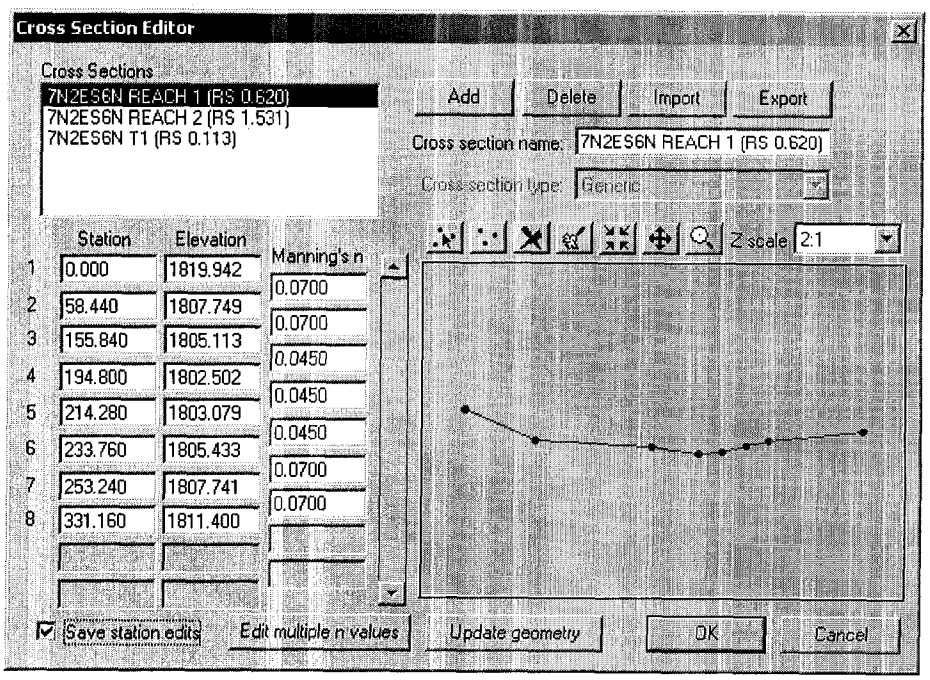
(WATERSHED 2C)



7N2ES6N

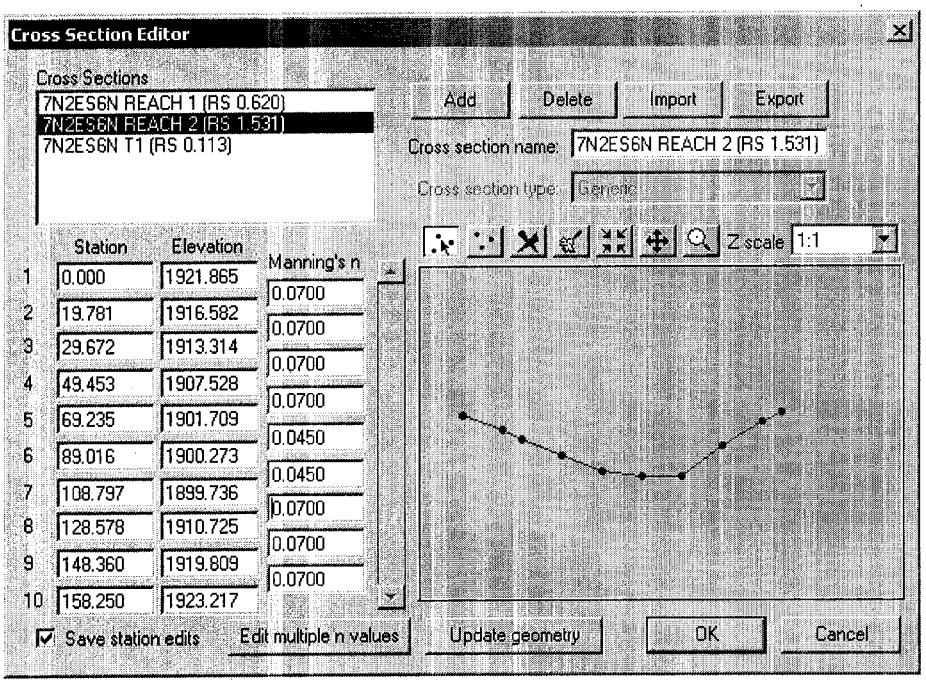

2200.0
2150.0
2100.0
2050.0
2000.0
1950.0
1900.0
1850.0
1800.0
1750.0
1700.0
ELEVATION, FEET
0.000
0.500
1.000
1.500
2.000
2.500
3.000
STATION, MILES
THALWEG
RS 0.61969
CP2C2 (RS 0.961)
RS 1.531
1.515, 1899.6
1.599, 1907.8
slope = 0.01851
0.609, 1801.7
0.666, 1810.9
slope = 0.03026

7N2ES6N
(WATERSHED 2C)



Calculated Values

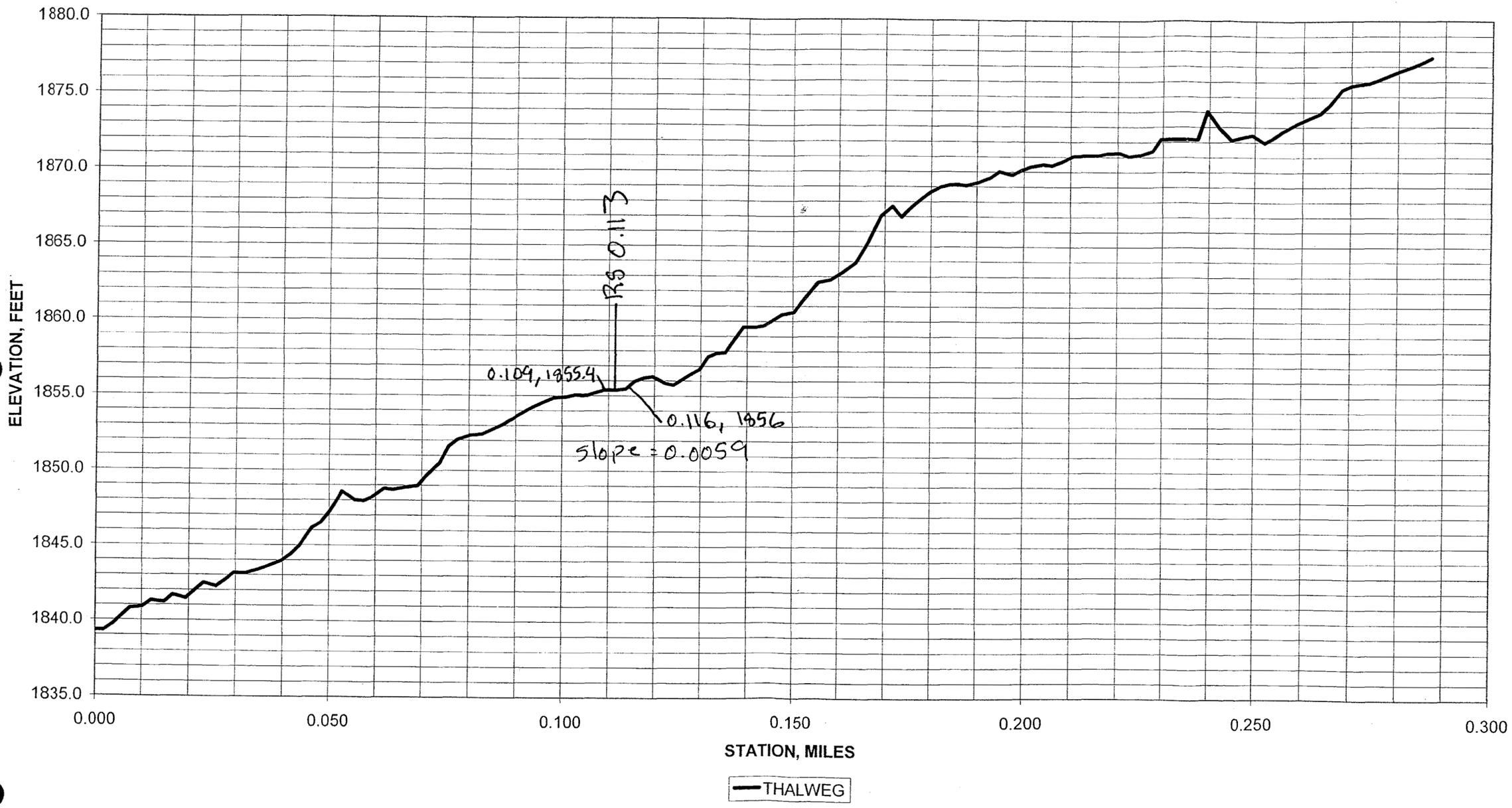
Longitudinal Slope: 0.0303
Flow: 1684.000 cfs
Depth: 3.837 ft
Area of Flow: 239.455 sq ft
Wetted Perimeter: 131.127 ft
Average Velocity: 7.033 fps
Top Width (T): 130.819 ft
Froude Number: 0.916
Critical Depth: 3.702 ft
Critical Velocity: 7.576 fps
Critical Slope: 0.03548
Manning's Roughness: 0.05510

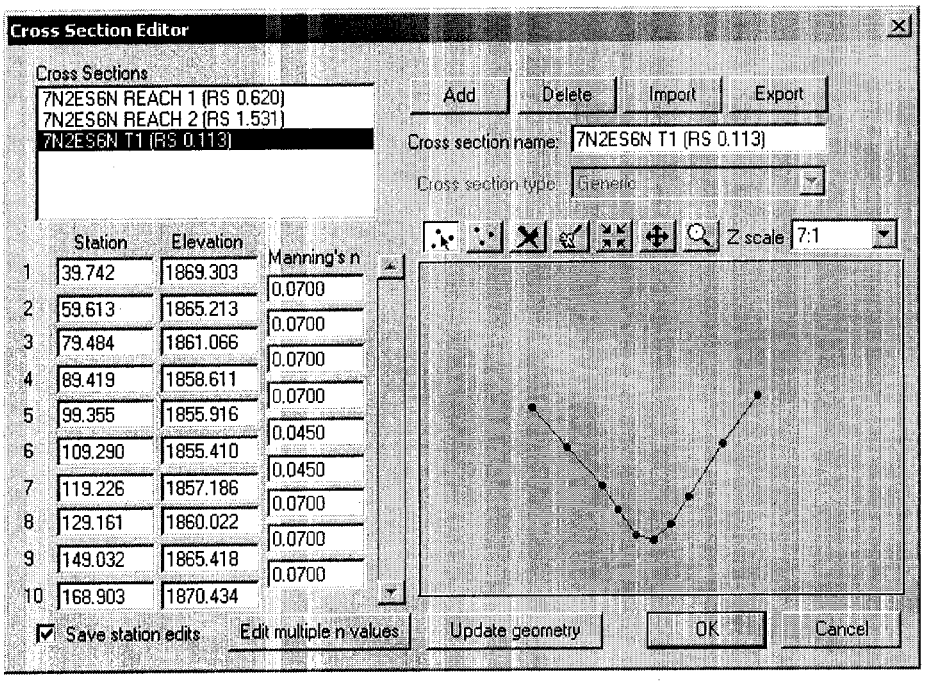


Calculated Values

Longitudinal Slope: 0.0185
Flow: 1626.000 cfs
Depth: 4.807 ft
Area of Flow: 194.497 sq ft
Wetted Perimeter: 59.564 ft
Average Velocity: 8.360 fps
Top Width (T): 57.851 ft
Froude Number: 0.803
Critical Depth: 4.293 ft
Critical Velocity: 9.826 fps
Critical Slope: 0.02876
Manning's Roughness: 0.05337

7N2ES6NT1


1880.0
1875.0
1870.0
1865.0
1860.0
1855.0
1850.0
1845.0
1840.0
1835.0
ELEVATION, FEET
0.000
0.050
0.100
0.150
0.200
0.250
0.300
STATION, MILES
RS 0.113
0.104, 1855.4
0.116, 1856
slope = 0.0059
THALWEG

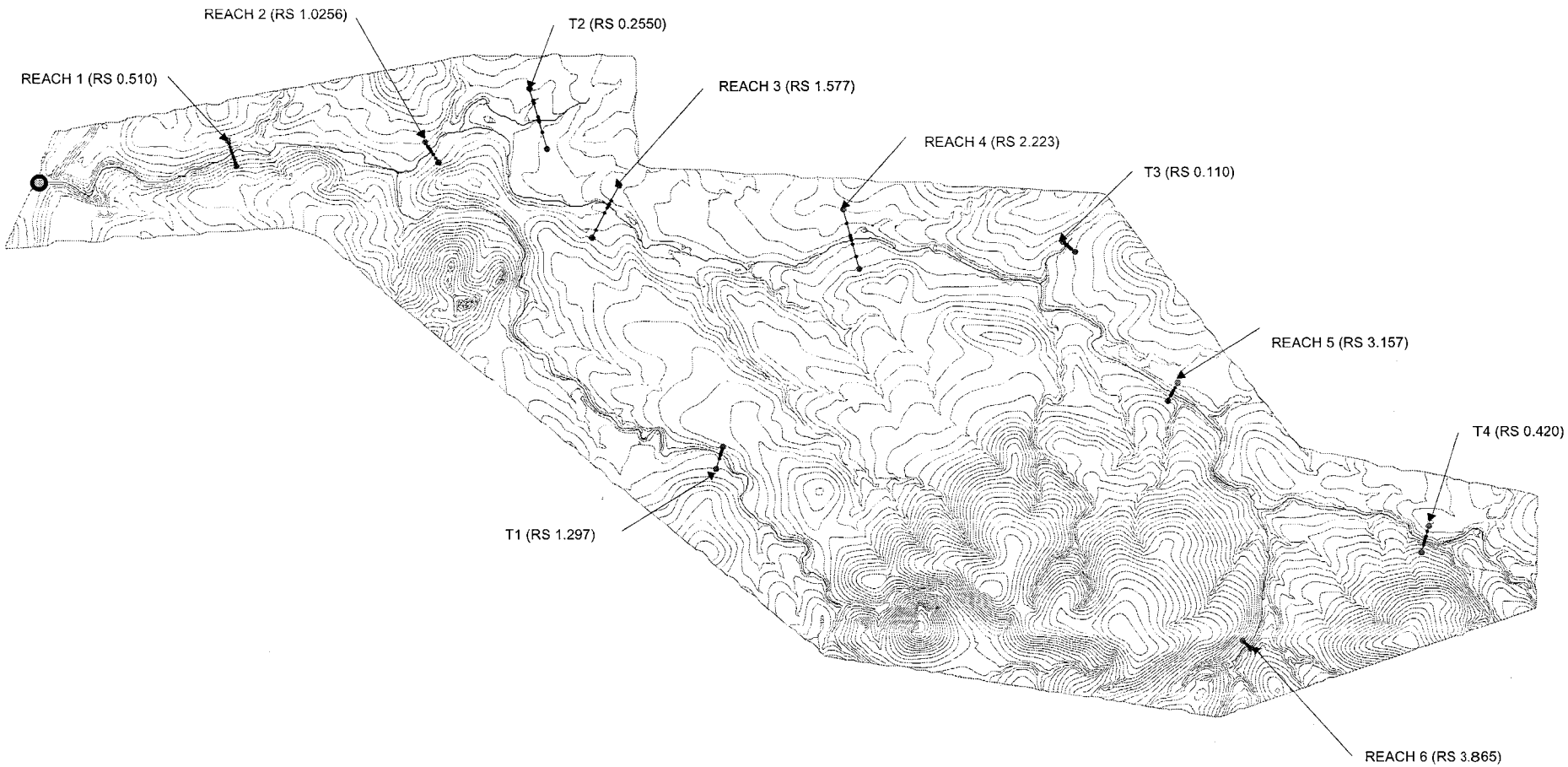


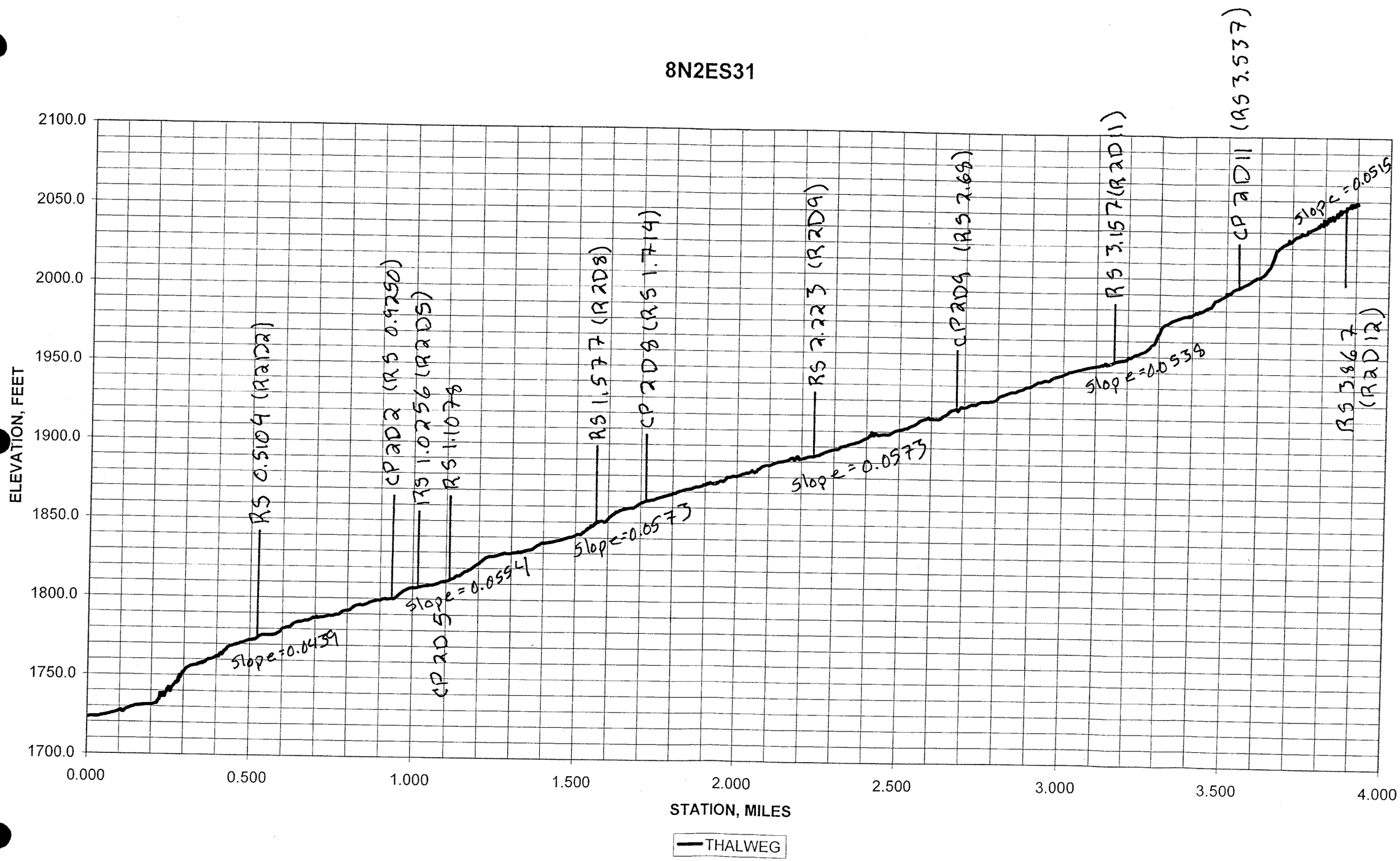
Calculated Values

Longitudinal Slope: 0.0059
Flow: 560.000 cfs
Depth: 3.742 ft
Area of Flow: 135.839 sq ft
Wetted Perimeter: 53.598 ft
Average Velocity: 4.123 fps
Top Width (T): 52.314 ft
Froude Number: 0.451
Critical Depth: 2.536 ft
Critical Velocity: 7.316 fps
Critical Slope: 0.02990
Manning's Roughness: 0.05152

8N2ES31

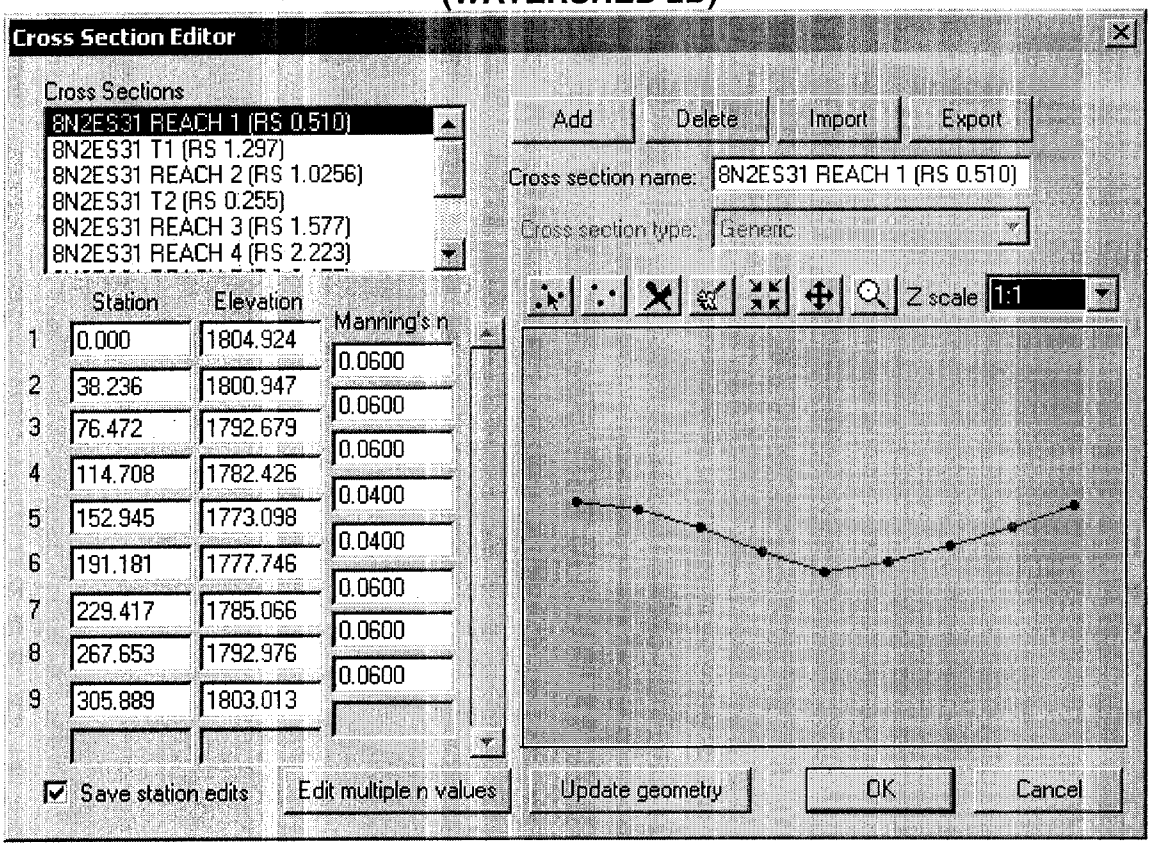
(WATERSHED D)




8N2ES31
ELEVATION, FEET
2100.0
2050.0
2000.0
1950.0
1900.0
1850.0
1800.0
1750.0
1700.0
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
STATION, MILES
THALWEG
RS 0.5104 (R2D2)
CP 2D2 (RS 0.9250)
RS 1.0256 (R2D5)
RS 1.1078
RS 1.577 (R2D8)
CP 2D8 (RS 1.714)
RS 2.223 (R2D9)
CP 2D9 (RS 2.69)
RS 3.157 (R2D11)
CP 2D11 (RS 3.537)
RS 3.867 (R2D12)
slope=0.0439
slope=0.0554
slope=0.0573
slope=0.0573
slope=0.0538
slope=0.0515

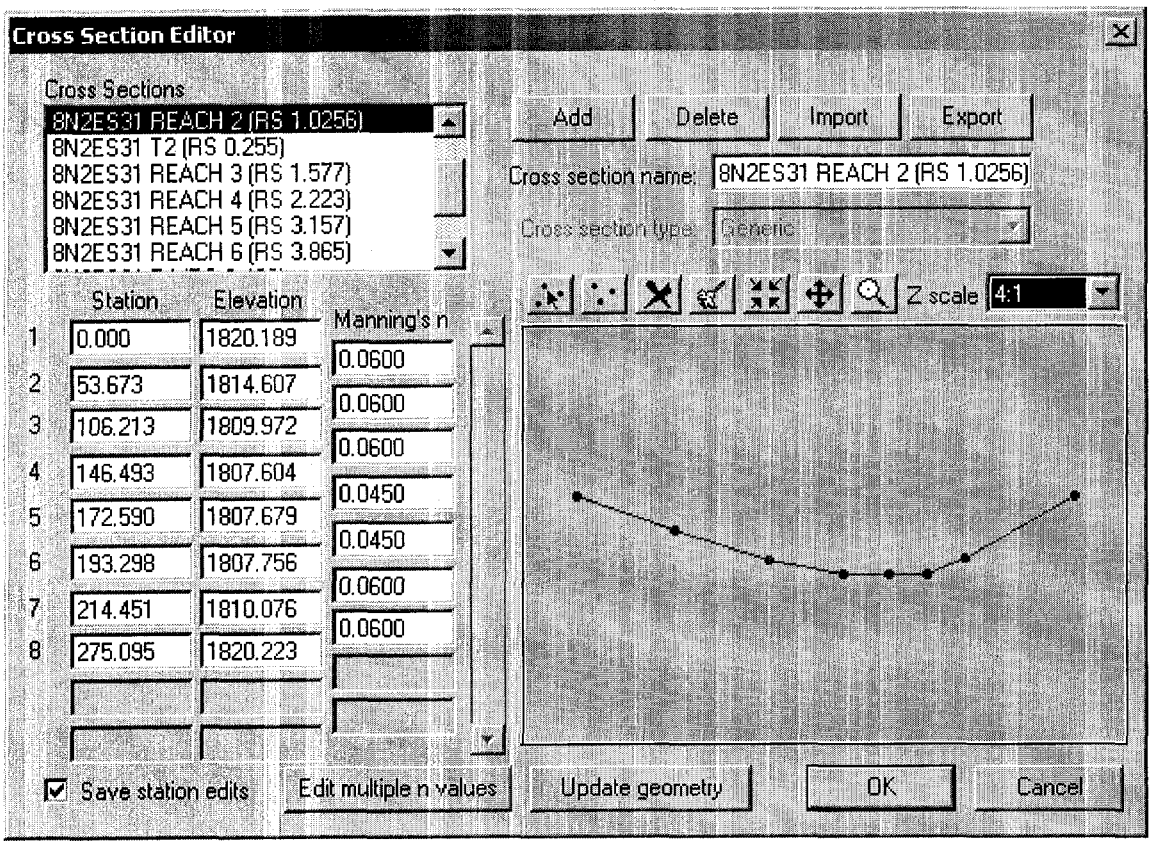
8N2ES31

(WATERSHED 2D)



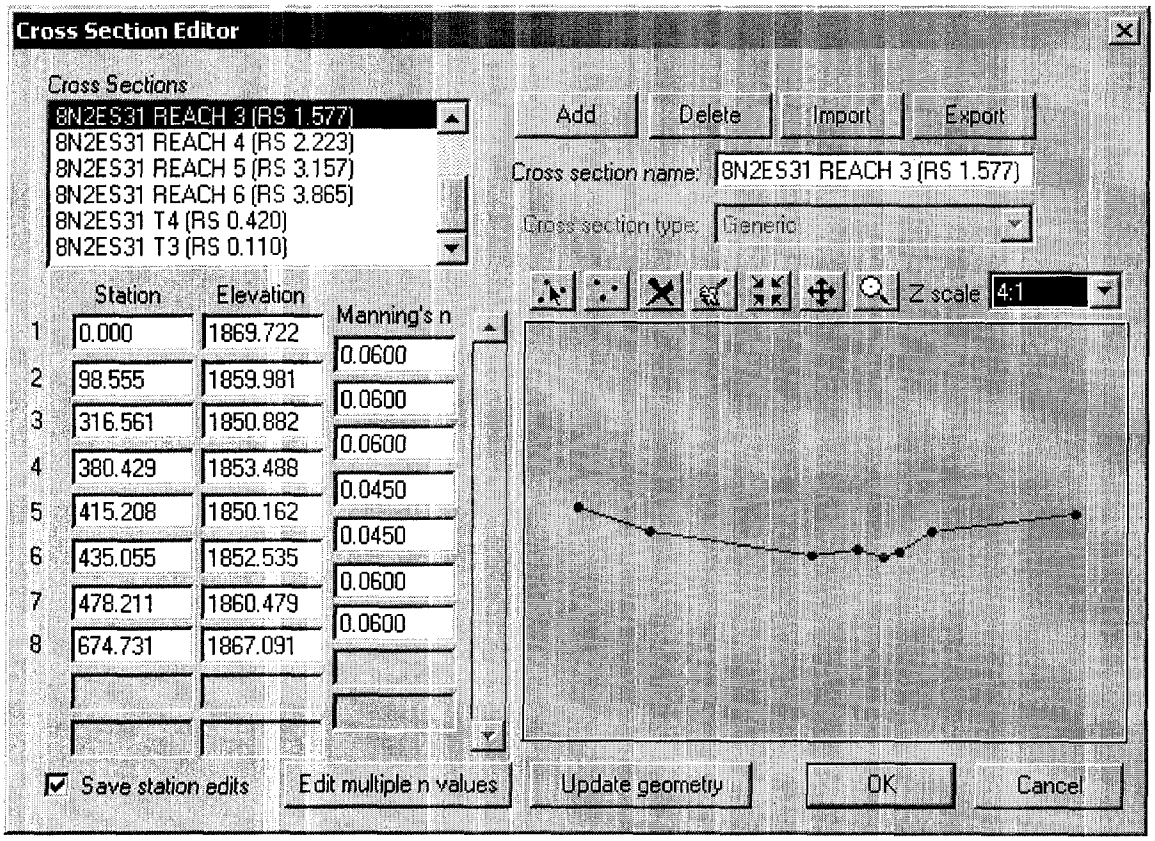
Calculated Values

Longintudinal Slope: 0.0439
Flow: 4891.000 cfs
Depth: 6.916 ft
Area of Flow: 287.029 sq ft
Wetted Perimeter: 79.758 ft
Average Velocity: 17.040 fps
Top Width (T): 78.430 ft
Froude Number: 1.570
Critical Depth: 8.343 ft
Critical Velocity: 11.974 fps
Critical Slope: 0.01764
Manning's Roughness: 0.04302



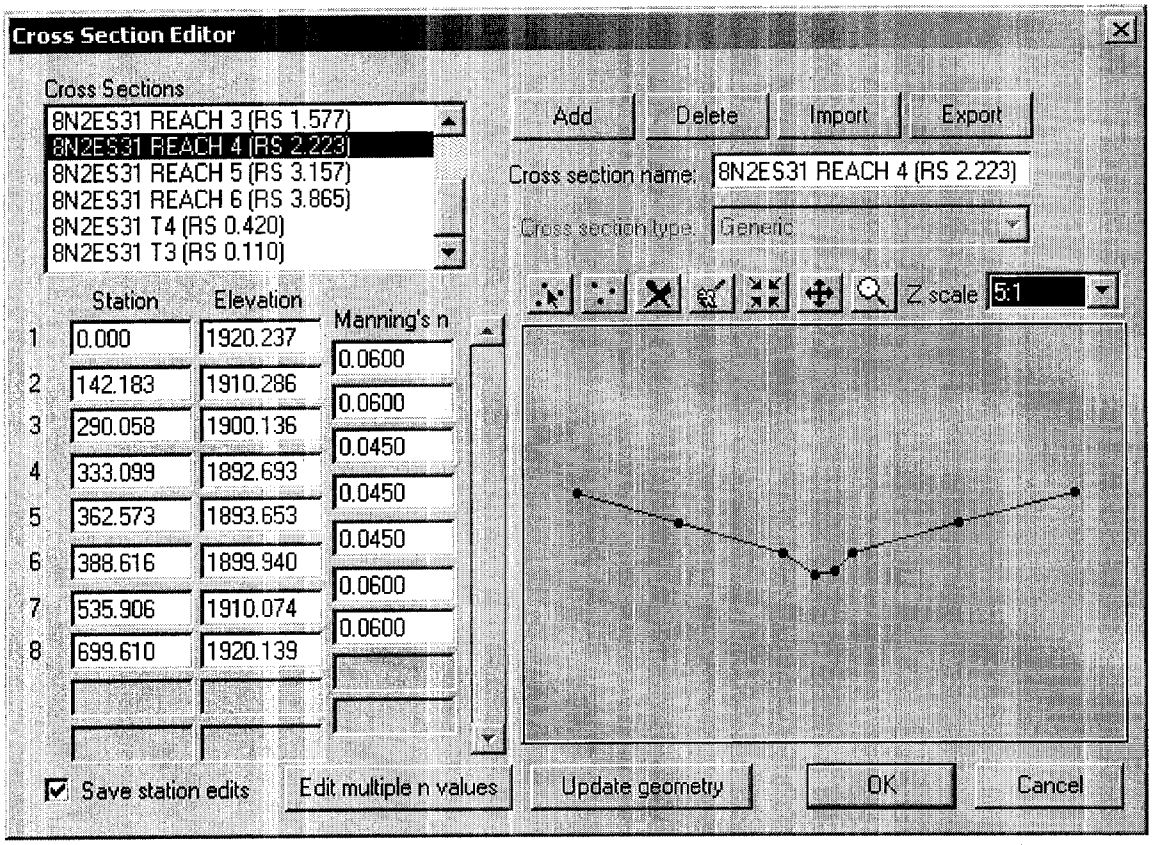
Calculated Values

Longitudinal Slope: 0.0554
Flow: 4074.000 cfs
Depth: 3.712 ft
Area of Flow: 337.894 sq ft
Wetted Perimeter: 131.253 ft
Average Velocity: 12.057 fps
Top Width (T): 130.895 ft
Froude Number: 1.322
Critical Depth: 4.297 ft
Critical Velocity: 9.762 fps
Critical Slope: 0.03072
Manning's Roughness: 0.05465



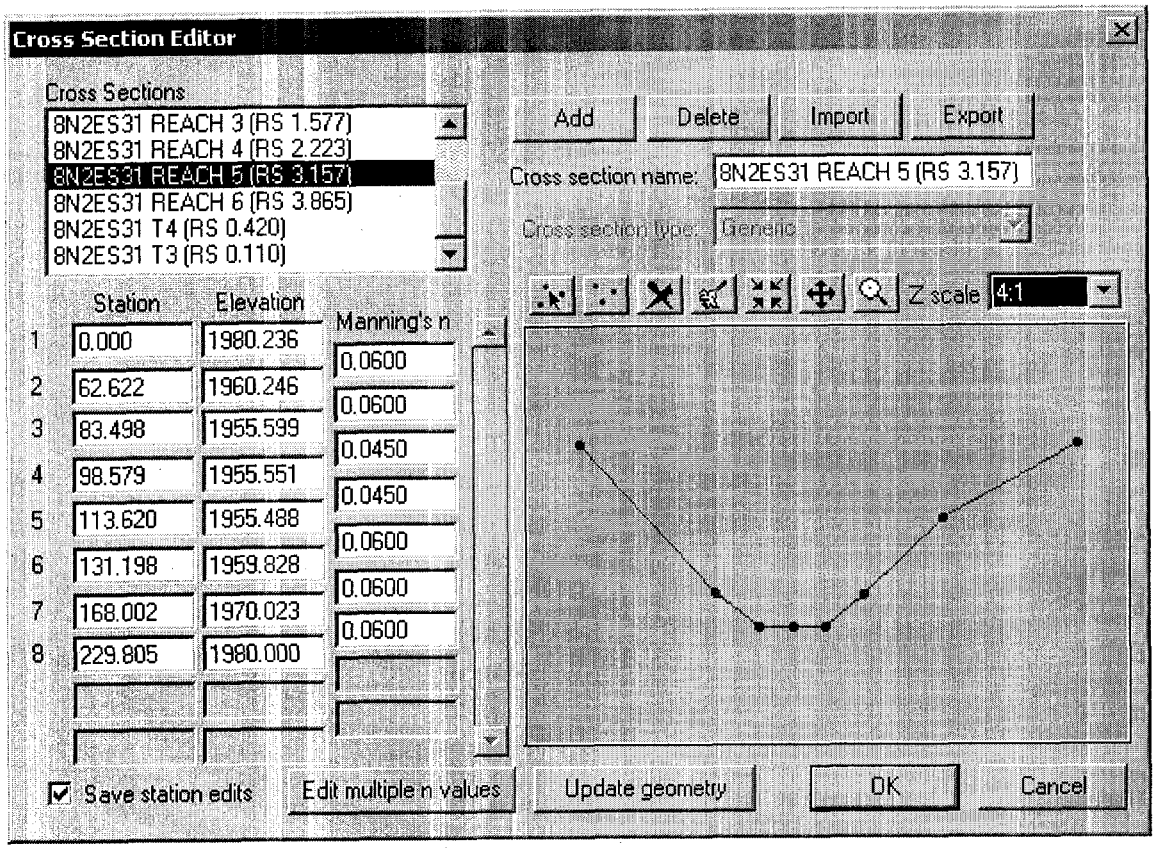
Calculated Values

Longitudinal Slope: 0.0573
Flow: 3999.000 cfs
Depth: 4.016 ft
Area of Flow: 402.849 sq ft
Wetted Perimeter: 206.981 ft
Average Velocity: 9.927 fps
Top Width (T): 206.409 ft
Froude Number: 1.252
Critical Depth: 4.360 ft
Critical Velocity: 8.410 fps
Critical Slope: 0.03538
Manning's Roughness: 0.05602



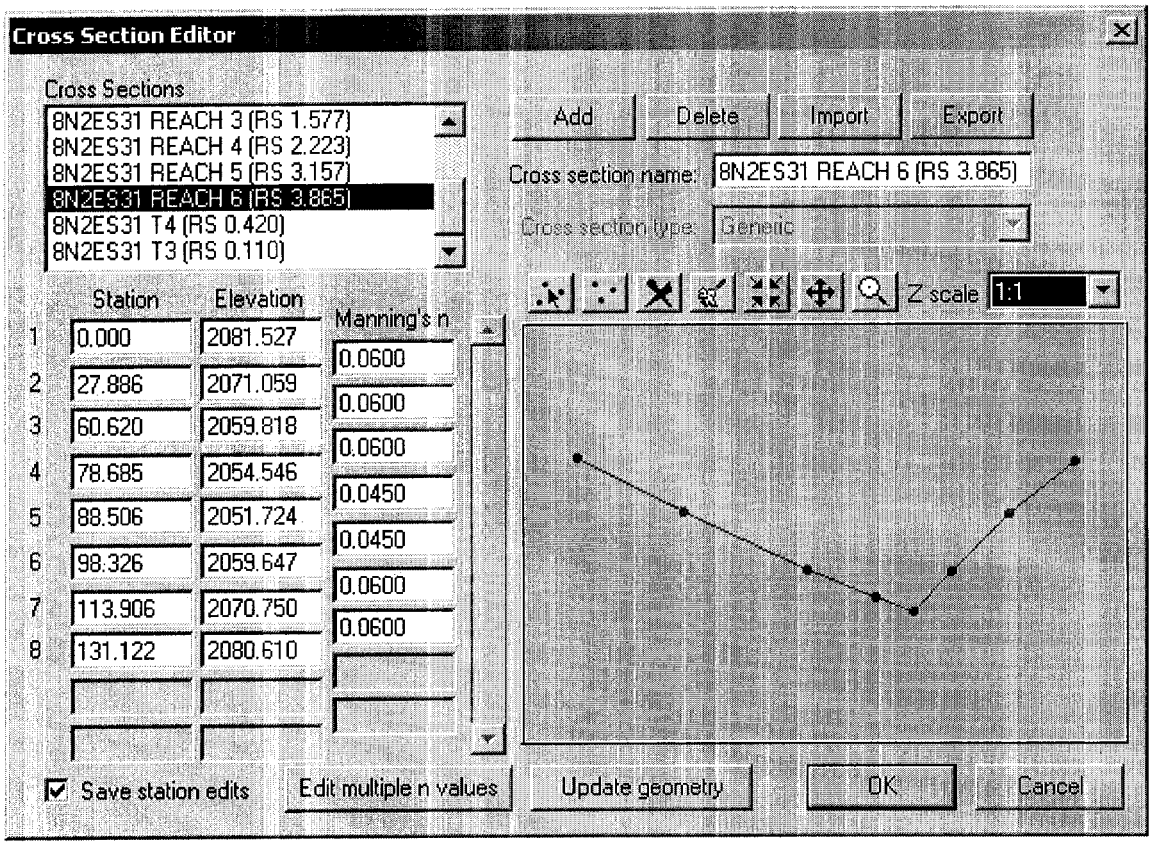
Calculated Values

Longintudinal Slope: 0.0573
Flow: 3601.000 cfs
Depth: 4.724 ft
Area of Flow: 218.954 sq ft
Wetted Perimeter: 73.253 ft
Average Velocity: 16.446 fps
Top Width (T): 72.384 ft
Froude Number: 1.666
Critical Depth: 6.074 ft
Critical Velocity: 11.057 fps
Critical Slope: 0.01916
Manning's Roughness: 0.04500



Calculated Values

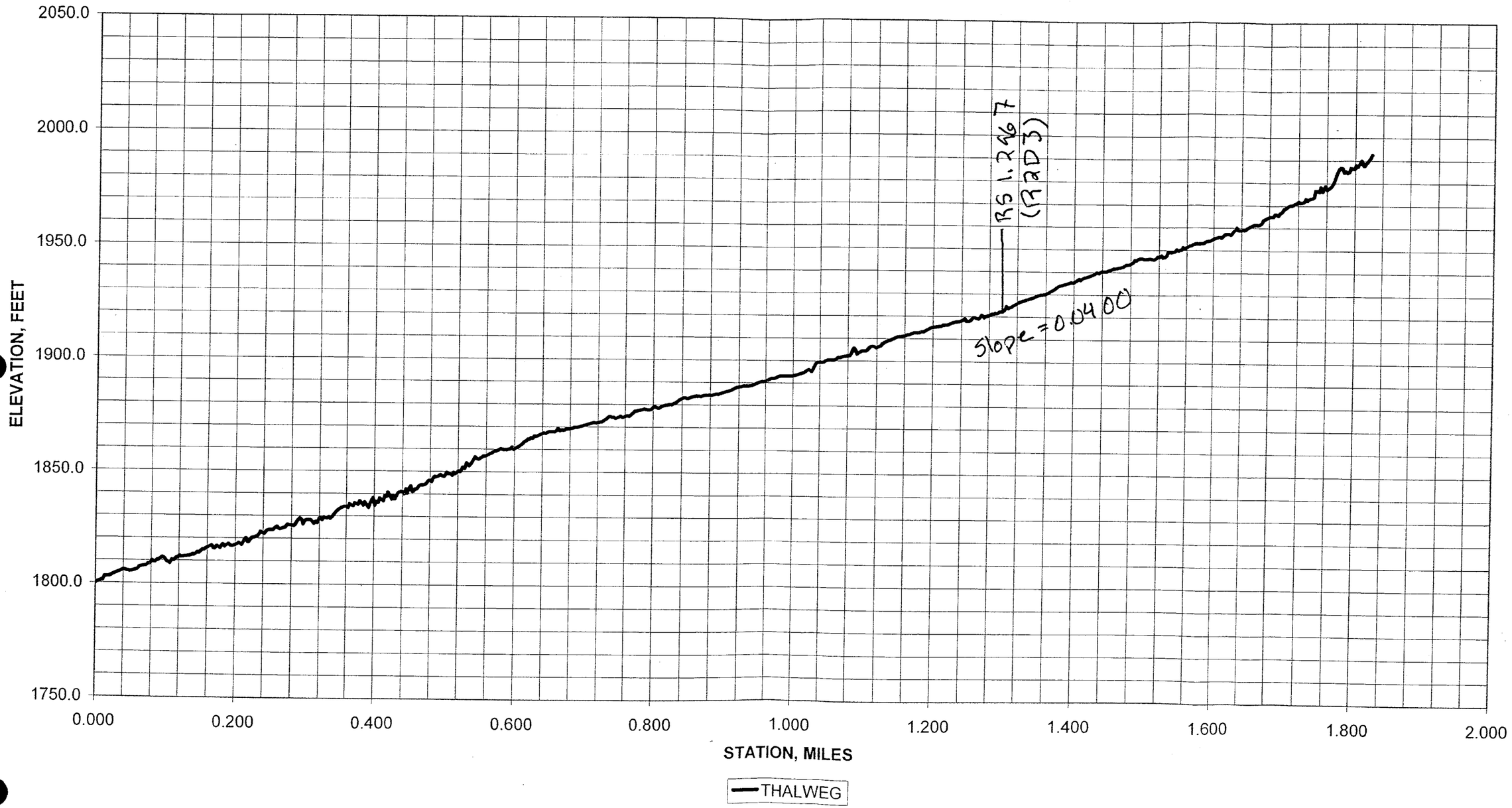
Longintudinal Slope: 0.0538
Flow: 2788.000 cfs
Depth: 4.304 ft
Area of Flow: 204.888 sq ft
Wetted Perimeter: 67.378 ft
Average Velocity: 13.607 fps
Top Width (T): 66.393 ft
Froude Number: 1.365
Critical Depth: 5.089 ft
Critical Velocity: 10.747 fps
Critical Slope: 0.02808
Manning's Roughness: 0.05329

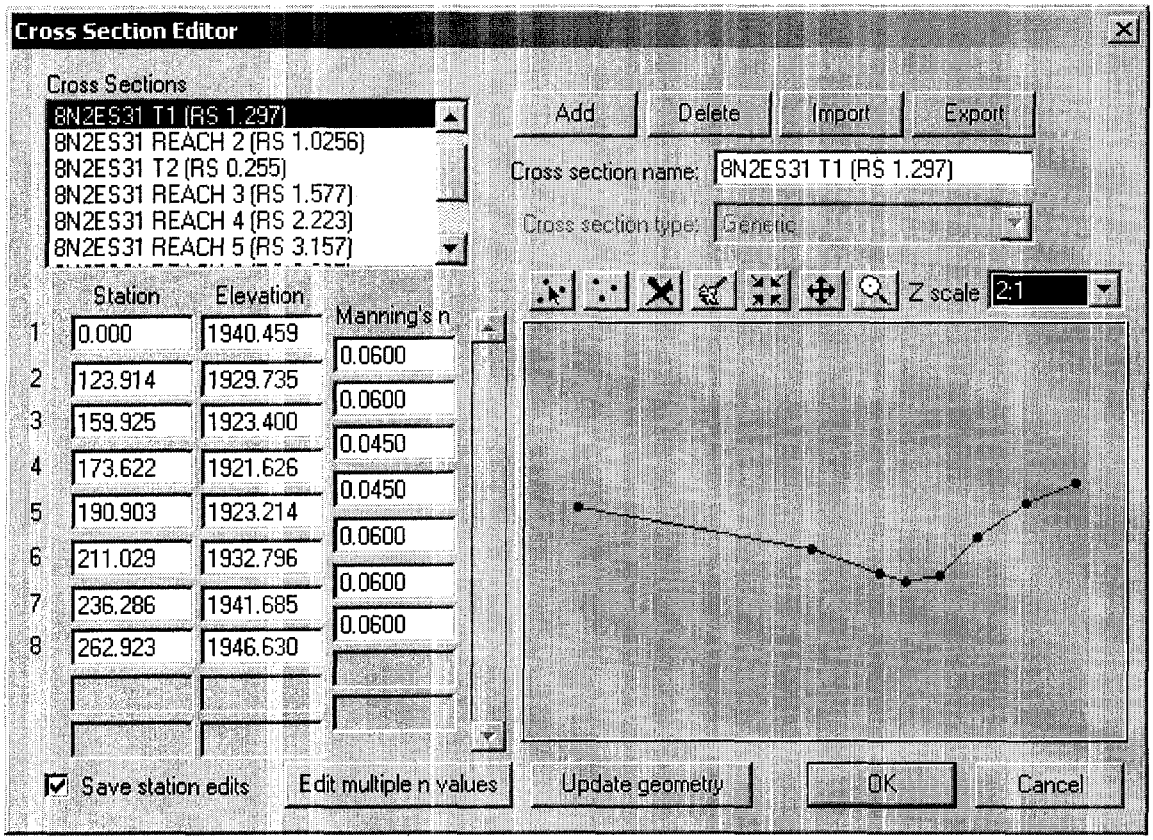


Calculated Values

Longitudinal Slope: 0.0515
Flow: 1275.000 cfs
Depth: 6.343 ft
Area of Flow: 94.590 sq ft
Wetted Perimeter: 32.885 ft
Average Velocity: 13.479 fps
Top Width (T): 29.745 ft
Froude Number: 1.332
Critical Depth: 7.115 ft
Critical Velocity: 10.717 fps
Critical Slope: 0.02849
Manning's Roughness: 0.05073

8N2ES31T1

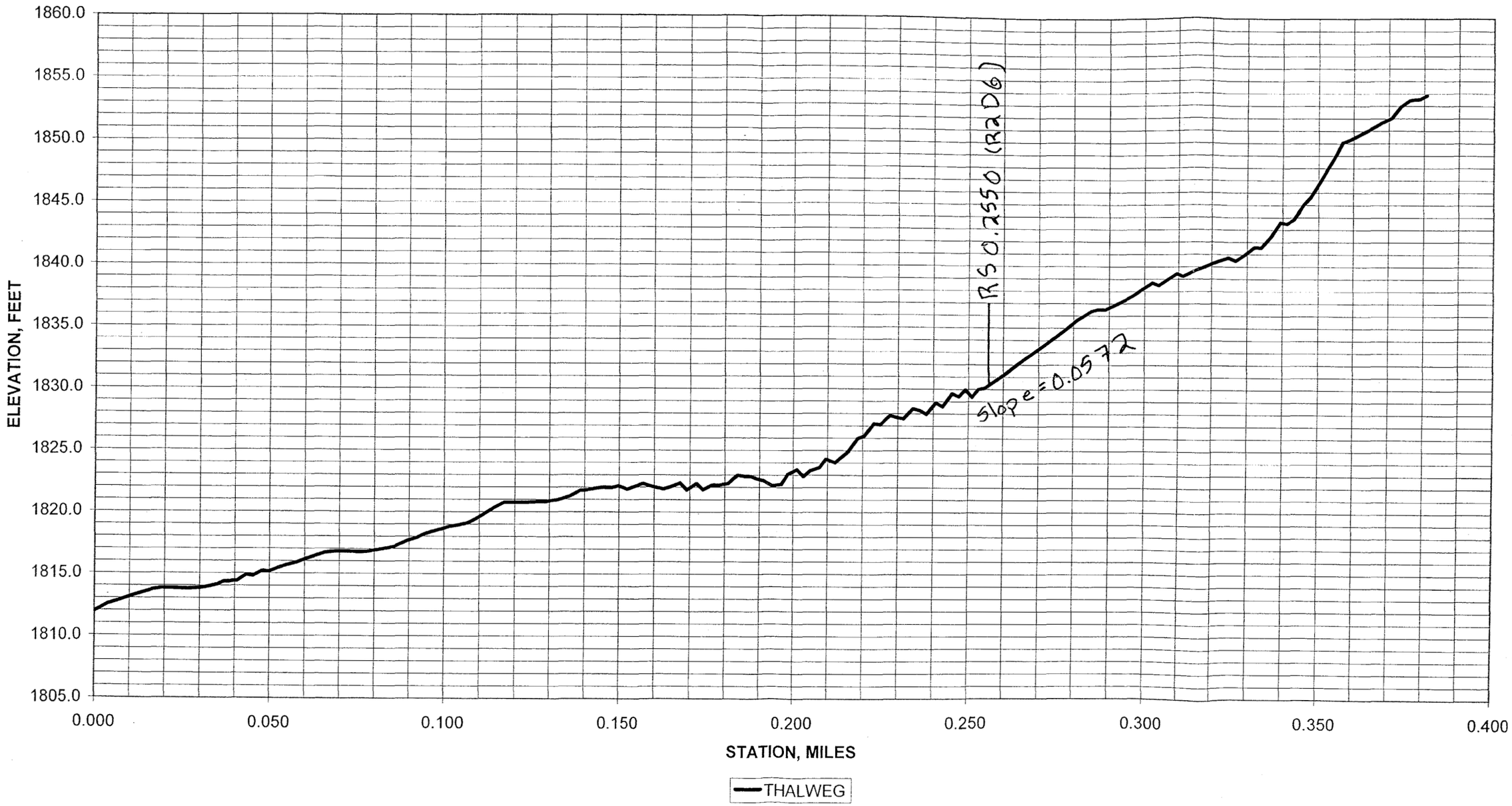

2050.0
2000.0
1950.0
1900.0
1850.0
1800.0
1750.0
ELEVATION, FEET
0.000
0.200
0.400
0.600
0.800
1.000
1.200
1.400
1.600
1.800
2.000
STATION, MILES
RS 1.2467
(R2D3)
slope = 0.0400
THALWEG

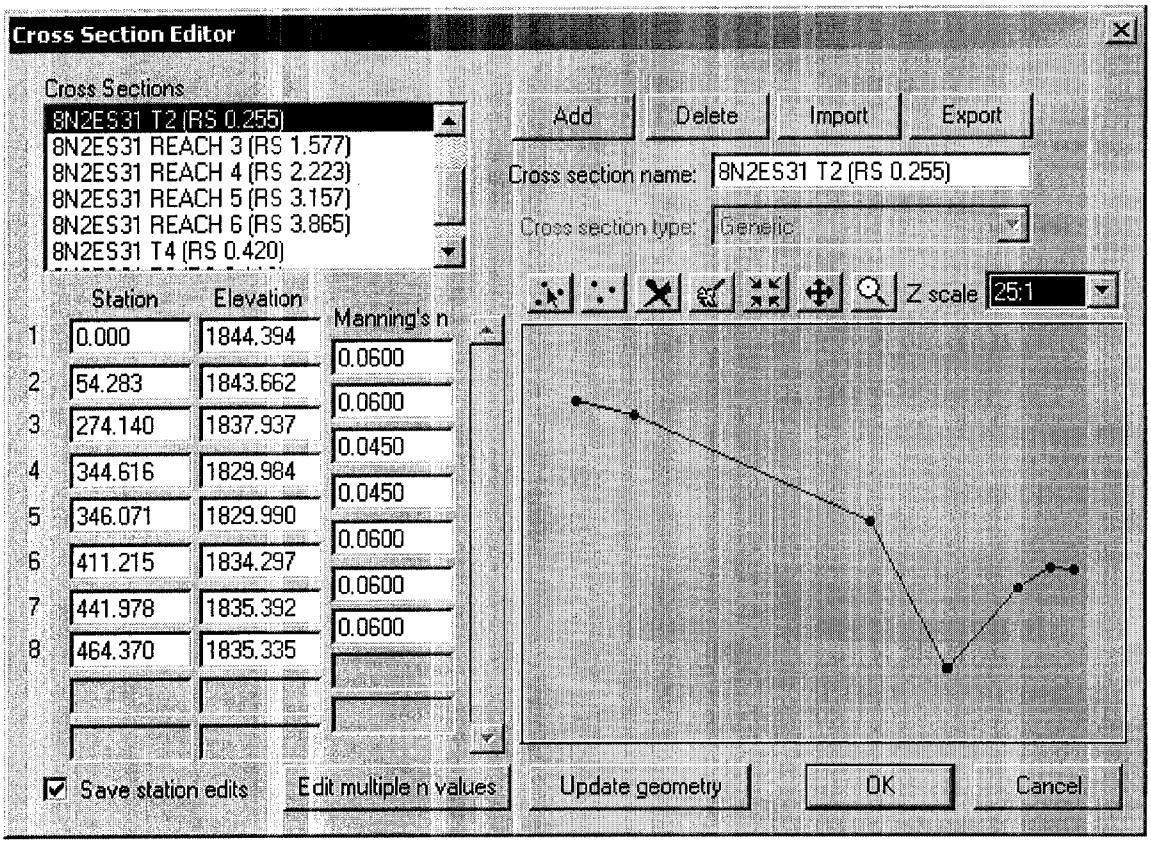


Calculated Values

Longitudinal Slope: 0.0400
Flow: 1096.000 cfs
Depth: 3.777 ft
Area of Flow: 107.586 sq ft
Wetted Perimeter: 47.822 ft
Average Velocity: 10.187 fps
Top Width (T): 46.965 ft
Froude Number: 1.186
Critical Depth: 4.089 ft
Critical Velocity: 8.940 fps
Critical Slope: 0.02826
Manning's Roughness: 0.05022

8N2ES31T2

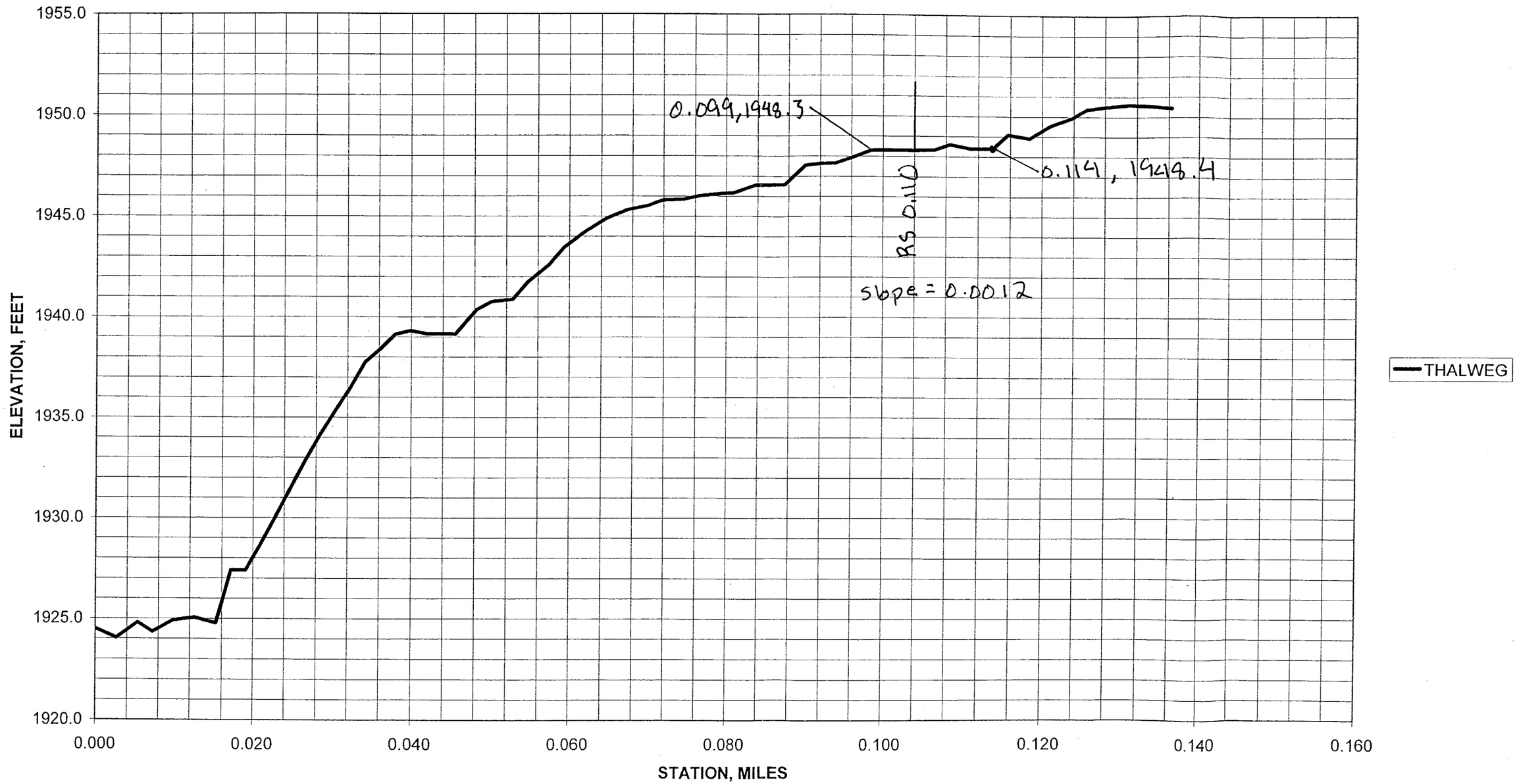

1860.0
1855.0
1850.0
1845.0
1840.0
1835.0
1830.0
1825.0
1820.0
1815.0
1810.0
1805.0
ELEVATION, FEET
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.400
STATION, MILES
THALWEG
RS 0.2550 (R2D6)
slope = 0.0572

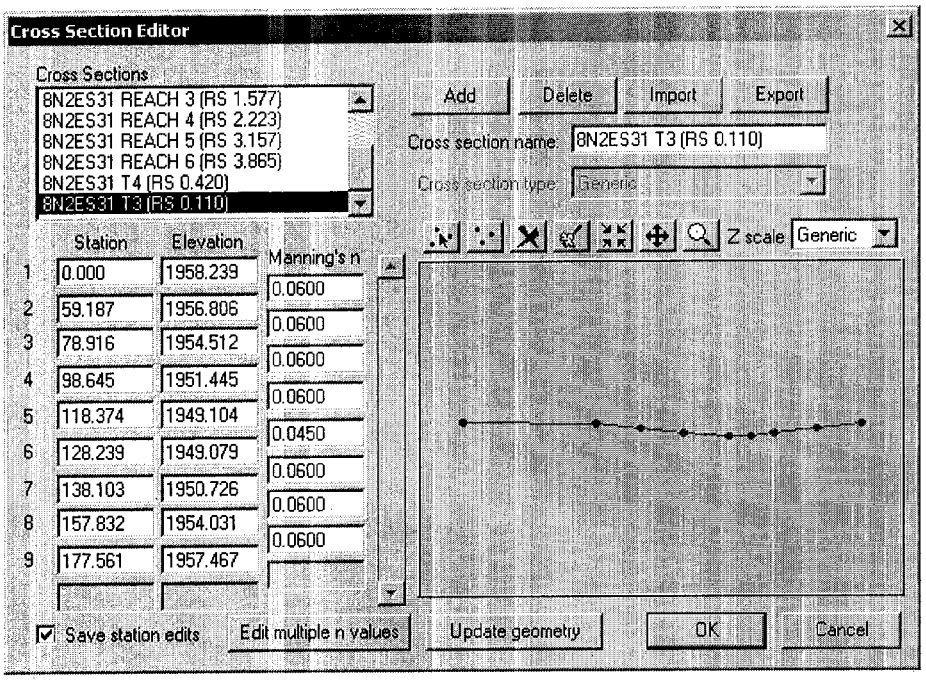


Calculated Values

Longitudinal Slope: 0.0572
Flow: 651.000 cfs
Depth: 2.571 ft
Area of Flow: 82.790 sq ft
Wetted Perimeter: 63.266 ft
Average Velocity: 7.863 fps
Top Width (T): 63.037 ft
Froude Number: 1.209
Critical Depth: 2.778 ft
Critical Velocity: 6.755 fps
Critical Slope: 0.03817
Manning's Roughness: 0.05422

8N2ES31T3

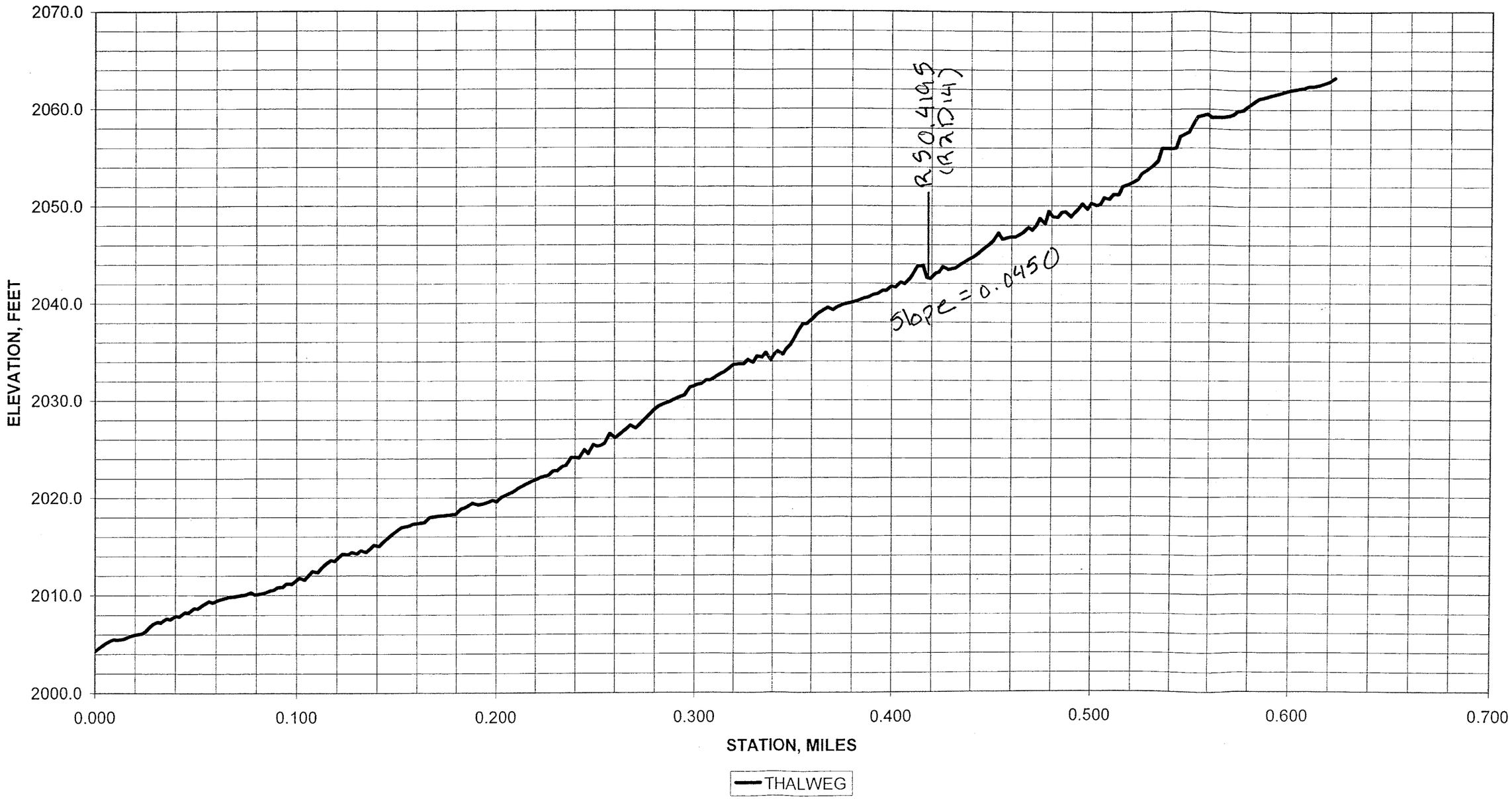

1955.0
1950.0
1945.0
1940.0
1935.0
1930.0
1925.0
1920.0
ELEVATION, FEET
0.000
0.020
0.040
0.060
0.080
0.100
0.120
0.140
0.160
STATION, MILES
THALWEG
0.099, 1948.3
0.114, 1948.4
RS 0.110
slope = 0.0012

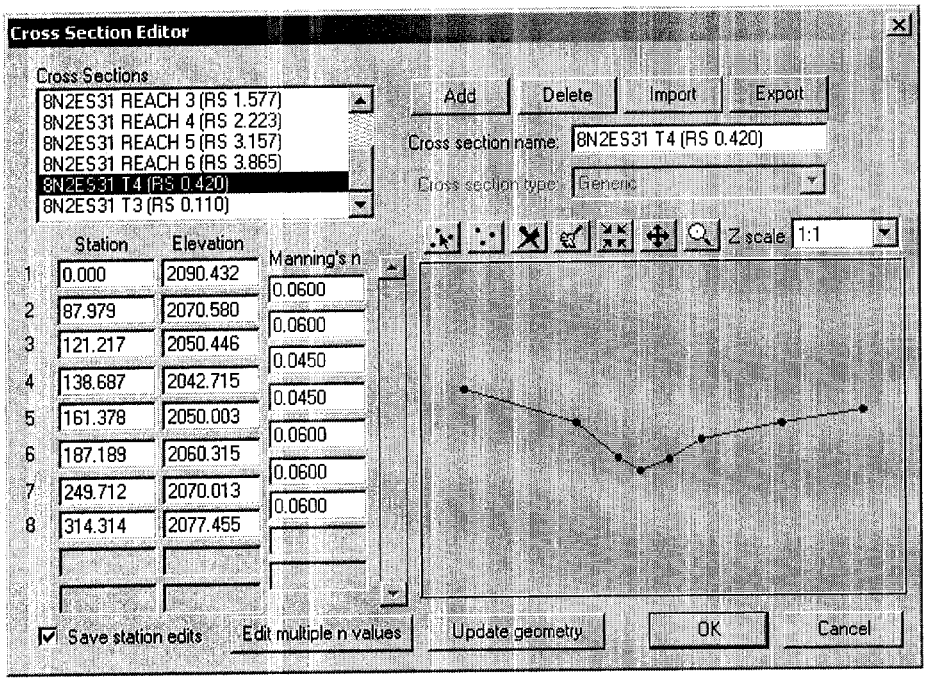


Calculated Values

Longitudinal Slope: 0.0012
Flow: 641.000 cfs
Depth: 6.131 ft
Area of Flow: 316.057 sq ft
Wetted Perimeter: 92.617 ft
Average Velocity: 2.028 fps
Top Width (T): 91.687 ft
Froude Number: 0.193
Critical Depth: 2.856 ft
Critical Velocity: 7.455 fps
Critical Slope: 0.03980
Manning's Roughness: 0.05840

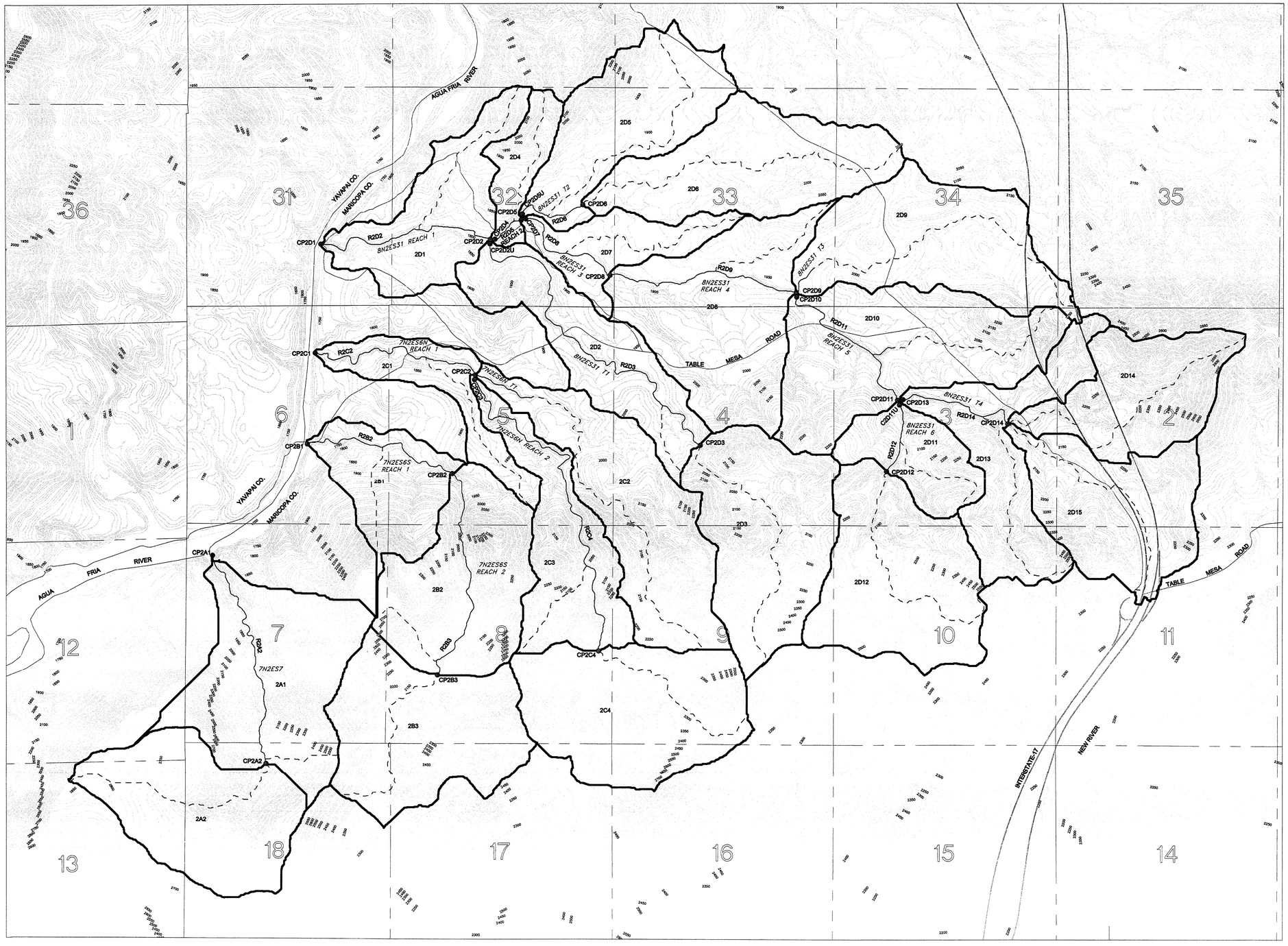
8N2ES31T4


2070.0
2060.0
2050.0
2040.0
2030.0
2020.0
2010.0
2000.0
ELEVATION, FEET
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
STATION, MILES
THALWEG
R50.4195
(RRD14)
slope = 0.0450



Calculated Values

Longitudinal Slope: 0.0450
Flow: 1562.000 cfs
Depth: 6.334 ft
Area of Flow: 107.778 sq ft
Wetted Perimeter: 36.364 ft
Average Velocity: 14.493 fps
Top Width (T): 34.033 ft
Froude Number: 1.435
Critical Depth: 7.318 ft
Critical Velocity: 10.857 fps
Critical Slope: 0.02085
Manning's Roughness: 0.04500



SCALE: 1" = 1000'

0 1000 2000 3000

LEGEND

- • CONCENTRATION POINT
- CP2A1 CONFLUENCE NAME
- WASHES
- 8N2ES31 WASH NAME
- LONGEST FLOW PATH
- SUB-BASIN BOUNDARIES
- 2A1 SUB-BASIN NAME
- R2A2 ROUTING REACH NAME
- 35 SECTION NUMBER

PEAK FLOW SUMMARY

I.D.	Q_{100} CFS	I.D.	Q_{100} CFS
2A2	1,304	2D15	698
2A1	1,156	CP2D14	1,192
CP2A1	2,050	2D13	610
2B3	1,215	CP2D13*	1,562
2B2	883	CP2D11	2,340
CP2B2	1,733	2D10	841
2B1	518	CP2D10*	2,788
CP2B1	1,947	2D9	641
2C4	1,249	CP2D9	3,145
2C3	415	2D8	980
CP2C3*	1,349	CP2D8	3,601
2C2	560	2D7	185
CP2C2	1,626	CP2D7*	3,664
2C1	178	2D6	381
CP2C1	1,684	2D5	414
2D3	935	CP2D5U*	651
2D2	405	CP2D5	3,999
CP2D2U*	1,096	2D4	223
2D12	1,027	CP2D4*	4,074
2D11	402	CP2D2	4,733
C2D11U*	1,275	2D1	544
2D14	611	CP2D1	4,891

* CP2C3 COMBINES R2C4 & 2C3, CP2D2U COMBINES R2D3 & 2D2
C2D11U COMBINES R2D12 & 2D11, CP2D13 COMBINES R2D14 & 2D13
CP2D10 COMBINES R2D11 & 2D10, CP2D7 COMBIES R2D8 & 2D7
CP2D5U COMBINES R2D6 & 2D5, CP2D4 COMBINES R2D5 & 2D4

Registered Professional Engineer (Civil) CERTIFICATE NO. 38779 WILLIAM J. KING 4-11-03

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
ZONE A FLOODPLAIN DELINEATION STUDY
WATERSHED #2 (TABLE MESA ROAD AREA)
SUB-BASIN BOUNDARIES
EXHIBIT 1

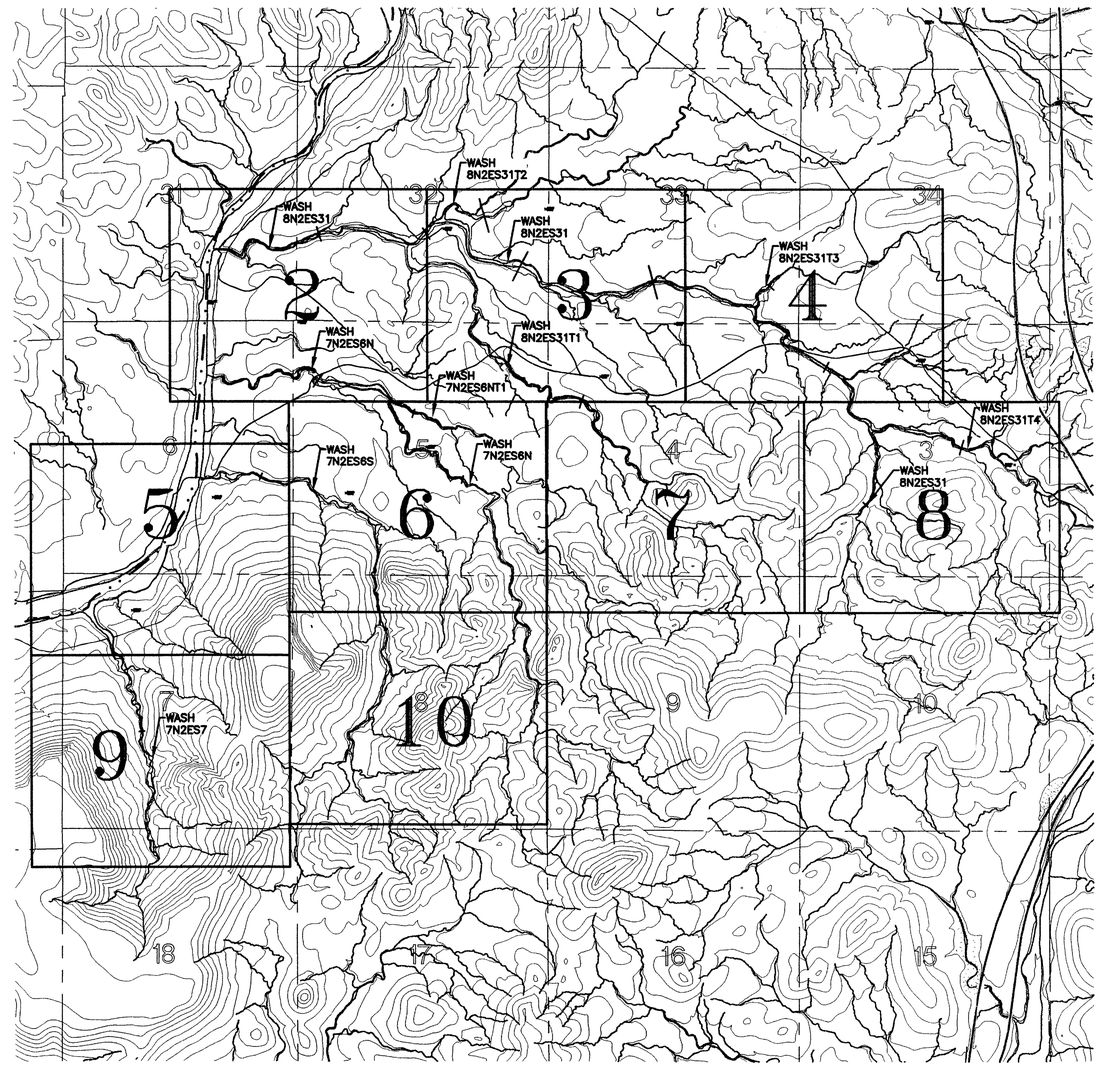
RBF CONSULTING
PLANNING ■ DESIGN ■ CONSTRUCTION
16605 NORTH 28th AVENUE, SUITE 100
PHOENIX, ARIZONA 85053-7550
602.467.2200 • FAX 602.467.2201 • www.RBF.com

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\0648HYDRO.DWG WKING 4/11/03 9:36 am

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

SUB WATERSHED #2
UPPER AGUA FRIA WATERSHED
ZONE A FLOODPLAIN DELINEATION STUDY
CONTRACT F.C.D. 2000C020



HYDROLOGY & HYDRAULICS

RBF CONSULTING
16605 N 28TH AVENUE, SUITE 100
PHOENIX, ARIZONA, 85053
(602)467-2200

AERIAL PHOTOGRAPHY

LANDATA AIRBORN SYSTEMS

CONTOUR INTERVAL: 10 FEET

GROUND CONTROL

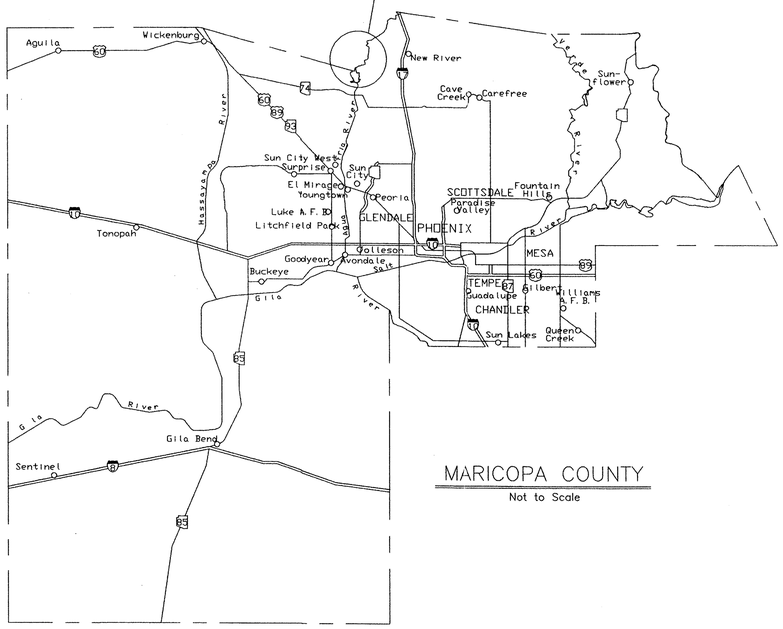
RBF CONSULTING
16605 N 28TH AVENUE, SUITE 100
PHOENIX, ARIZONA, 85053
(602)467-2200

THE SURVEY CONTROL FOR THE AERIAL TOPOGRAPHY WAS DONE UNDER MY DIRECTION AND SUPERVISION DURING THE MONTH OF DECEMBER 2000.

REGISTERED LAND SURVEYOR 29891 BRENT J. SMITH ARIZONA, U.S.A. 12/11/02

BRENT J. SMITH, R.L.S. 29891

PROJECT LOCATION



MARICOPA COUNTY

Not to Scale

STUDY AREA MAP AND SHEET INDEX

SHEET INDEX

SHEET 2-10 FLOOD DELINEATION STUDY

1500' 0' 1500' 3000'

SCALE: 1"= 1500 FEET
FLIGHT DATES:
12/16/2000-03/15/2001

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Arizona U.S.A. 12/11/02

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/16/02
PLANS	JMM	5/02/02
PLANS CHK.	RBM	5/22/02

SHEET 01 OF 10

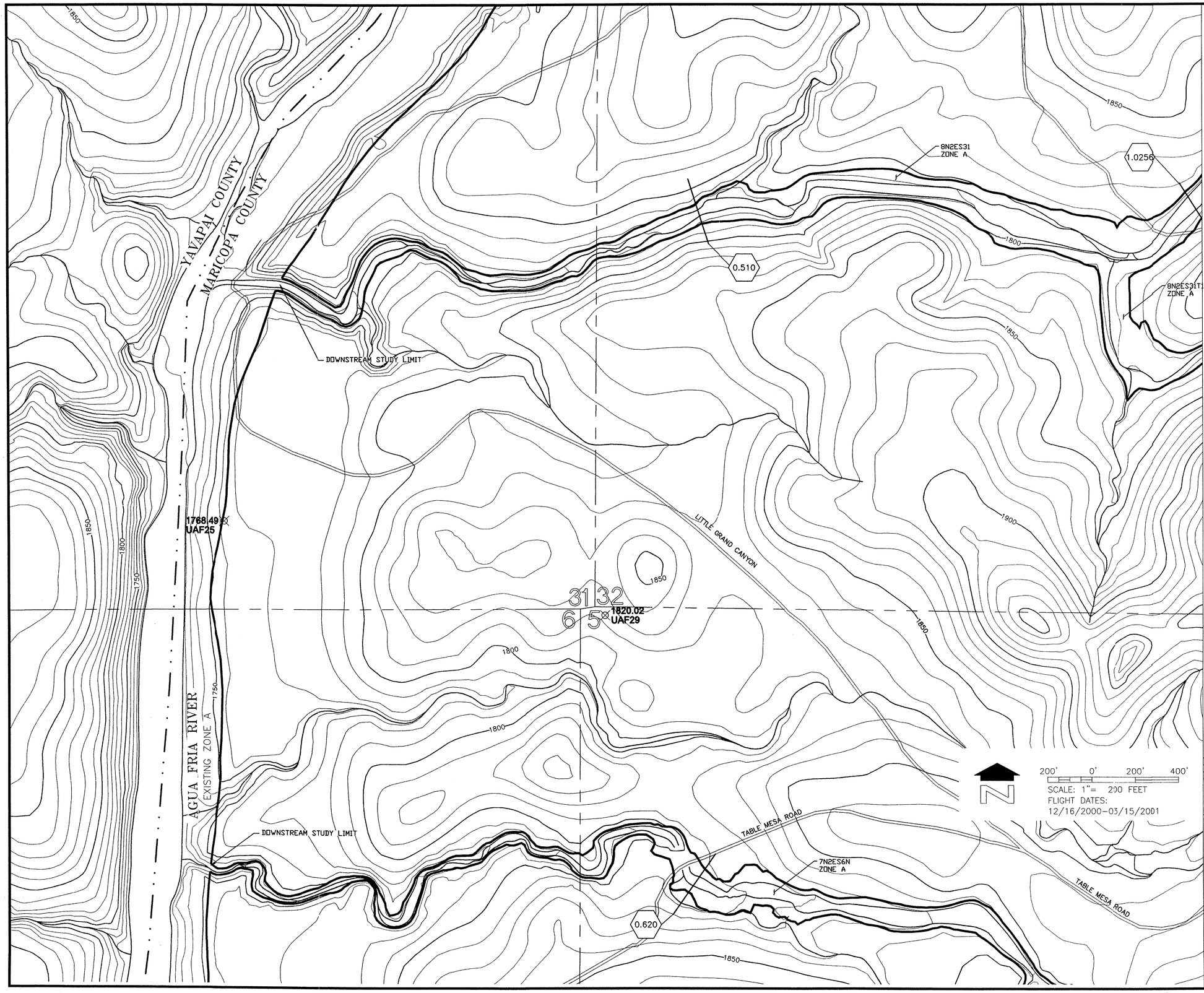
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS201.DWG 12/11/02 1:07 pm



LEGEND

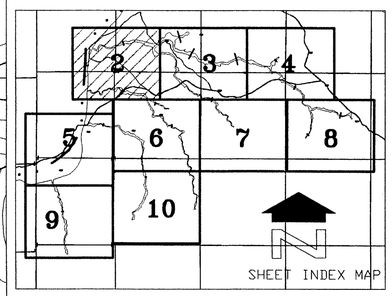
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION RIVER MILE DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 25	1768.49	SET FCDMC BRASS CAP AT LAT. N 33° 59' 18" LONG W. 112° 11' 34".
UAF 29	1820.02	SET FCDMC BRASS CAP AT LAT. N 33° 59' 14" LONG W. 112° 11' 13"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) Certificate No. 36122 ROY B. McDANIEL Date Signed 1-NOV-02 Arizona, U.S.A.

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 02 OF 10

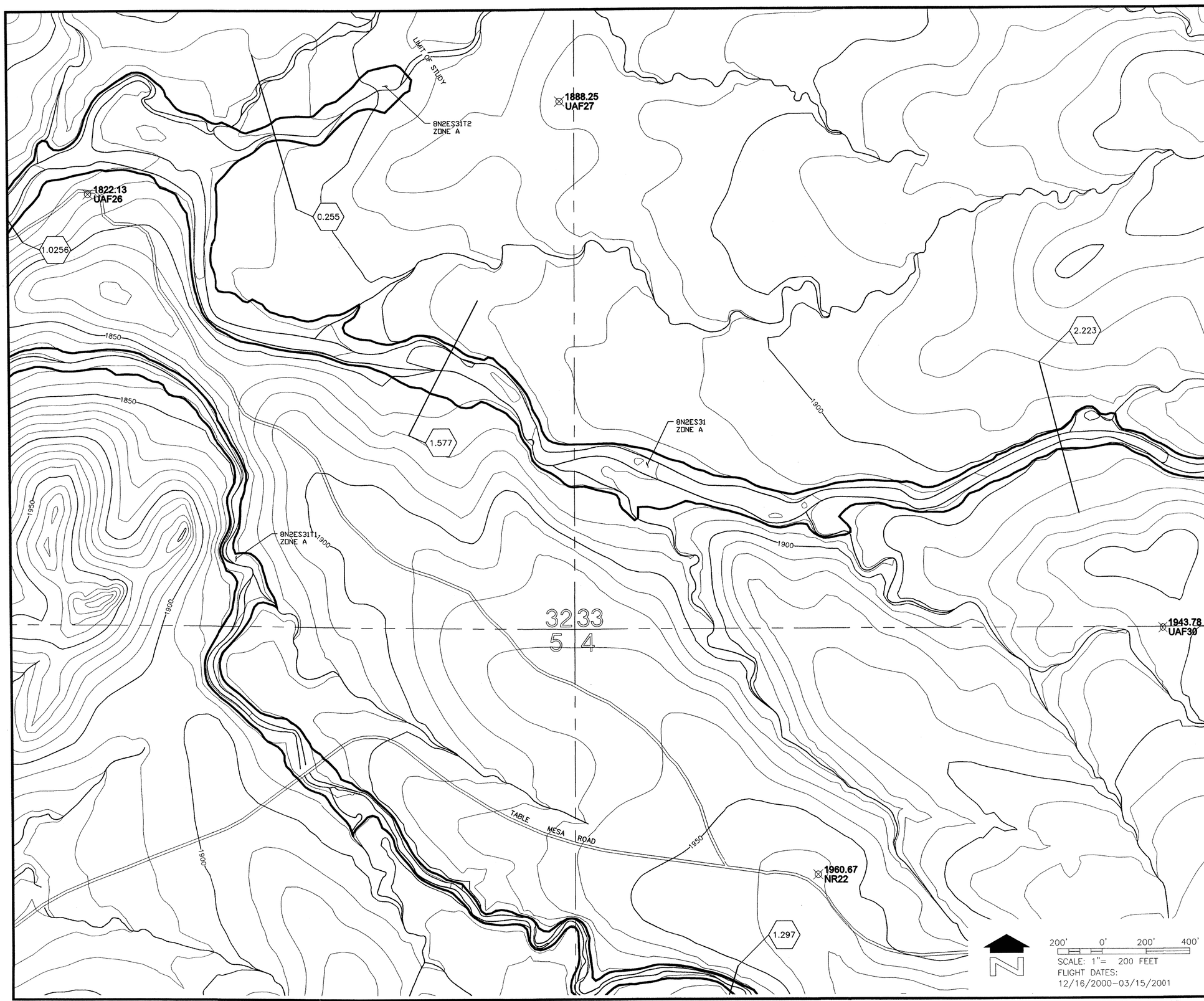
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS202.DWG 12/12/02 5:29 pm



LEGEND

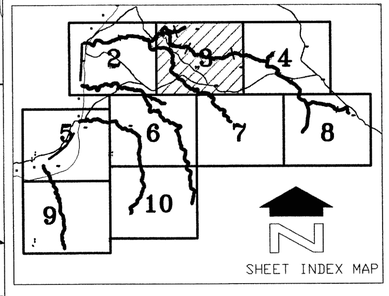
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 26	1822.13	SET FCDMC BRASS CAP AT LAT. N 33° 59' 33" LONG W. 112° 10' 37".
UAF 27	1888.25	SET FCDMC BRASS CAP AT LAT. N 33° 59' 37" LONG W. 112° 10' 11"
UAF 30	1943.78	SET FCDMC BRASS CAP AT LAT. N 33° 59' 13" LONG W. 112° 09' 39"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Date Signed 12/10/02 Arizona U.S.A.

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 03 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

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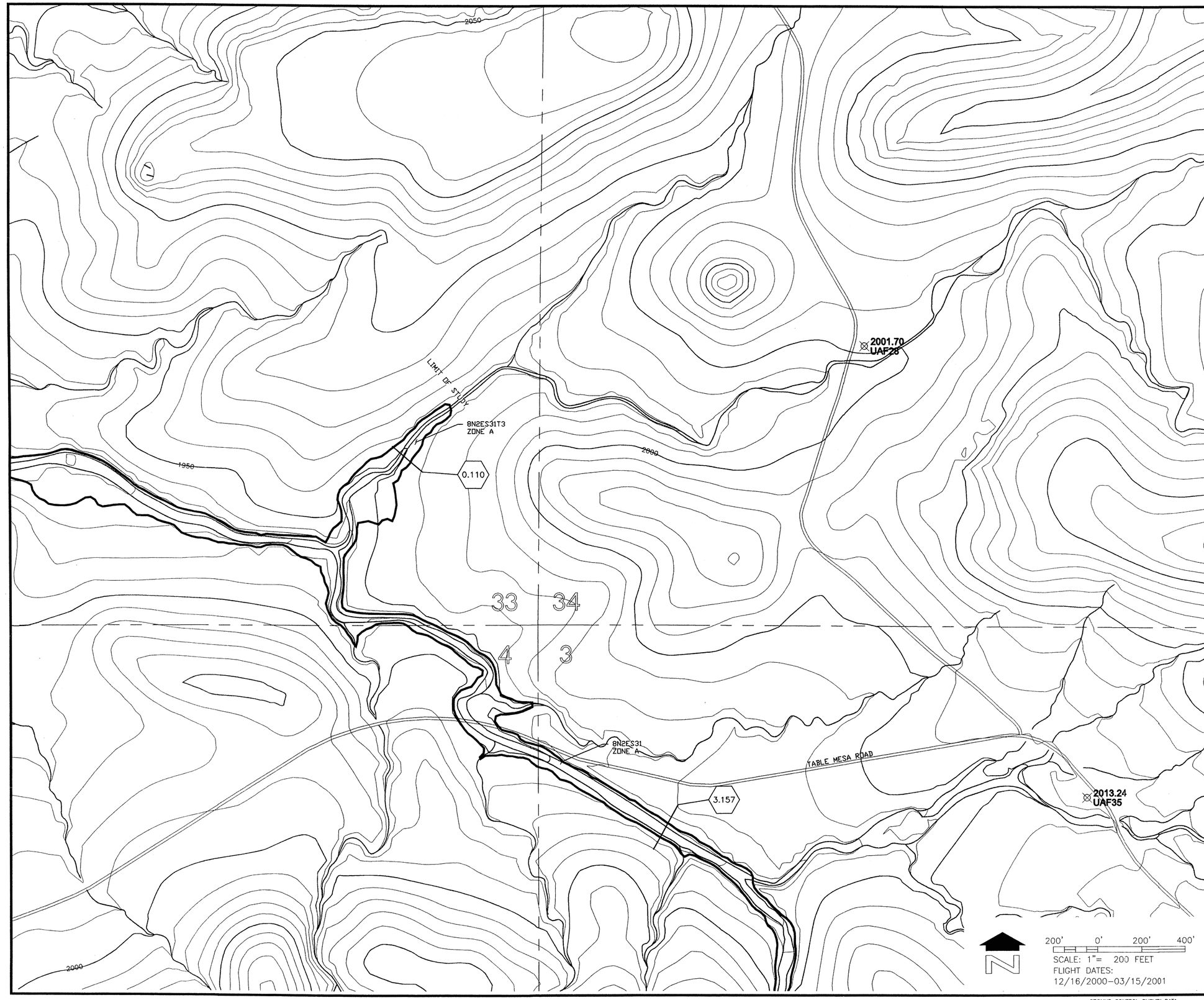


LEGEND

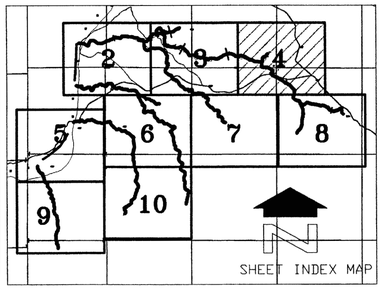
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION PRIOR MILE DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 28	2001.70	SET FCDMC BRASS CAP AT LAT. N 33° 59' 26" LONG W. 112° 08' 51".
UAF 35	2013.24	SET FCDMC BRASS CAP AT LAT. N 33° 59' 06" LONG W. 112° 08' 40"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Date Signed 12/11/02

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 04 OF 10

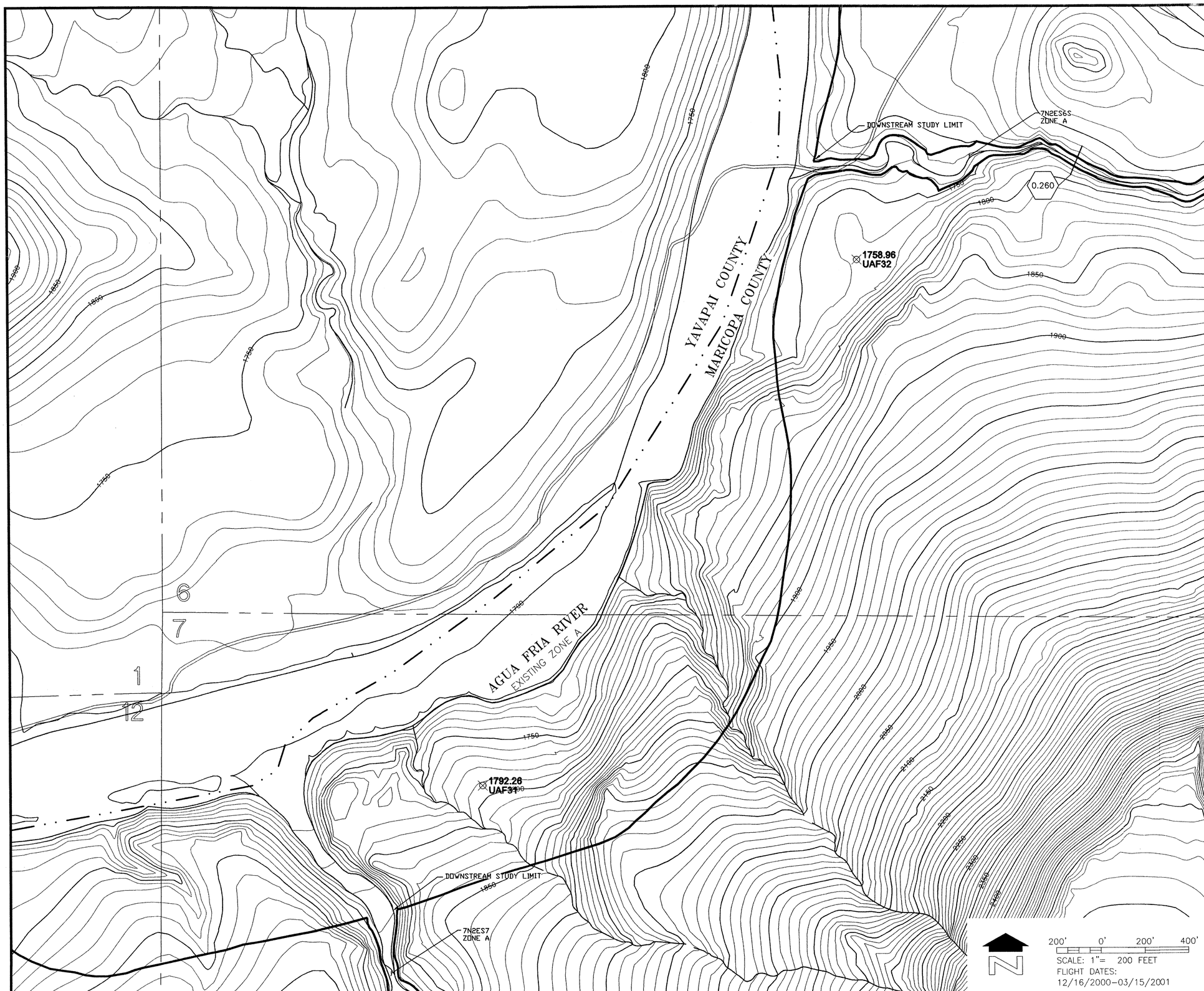
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS204.DWG 12/12/02 5:29 pm



LEGEND

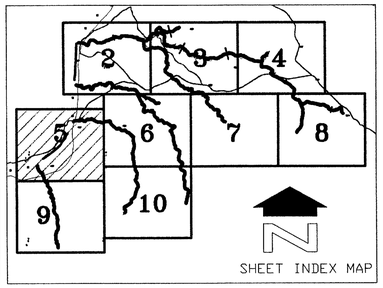
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION RIVER MILE DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 31	1792.26	SET FCDMC BRASS CAP AT LAT. N 33° 58' 14" LONG W. 112° 11' 54".
UAF 32	1758.96	SET FCDMC BRASS CAP AT LAT. N 33° 58' 40" LONG W. 112° 11' 34"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

RBF CONSULTING

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Date 12/12/02

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 05 OF 10

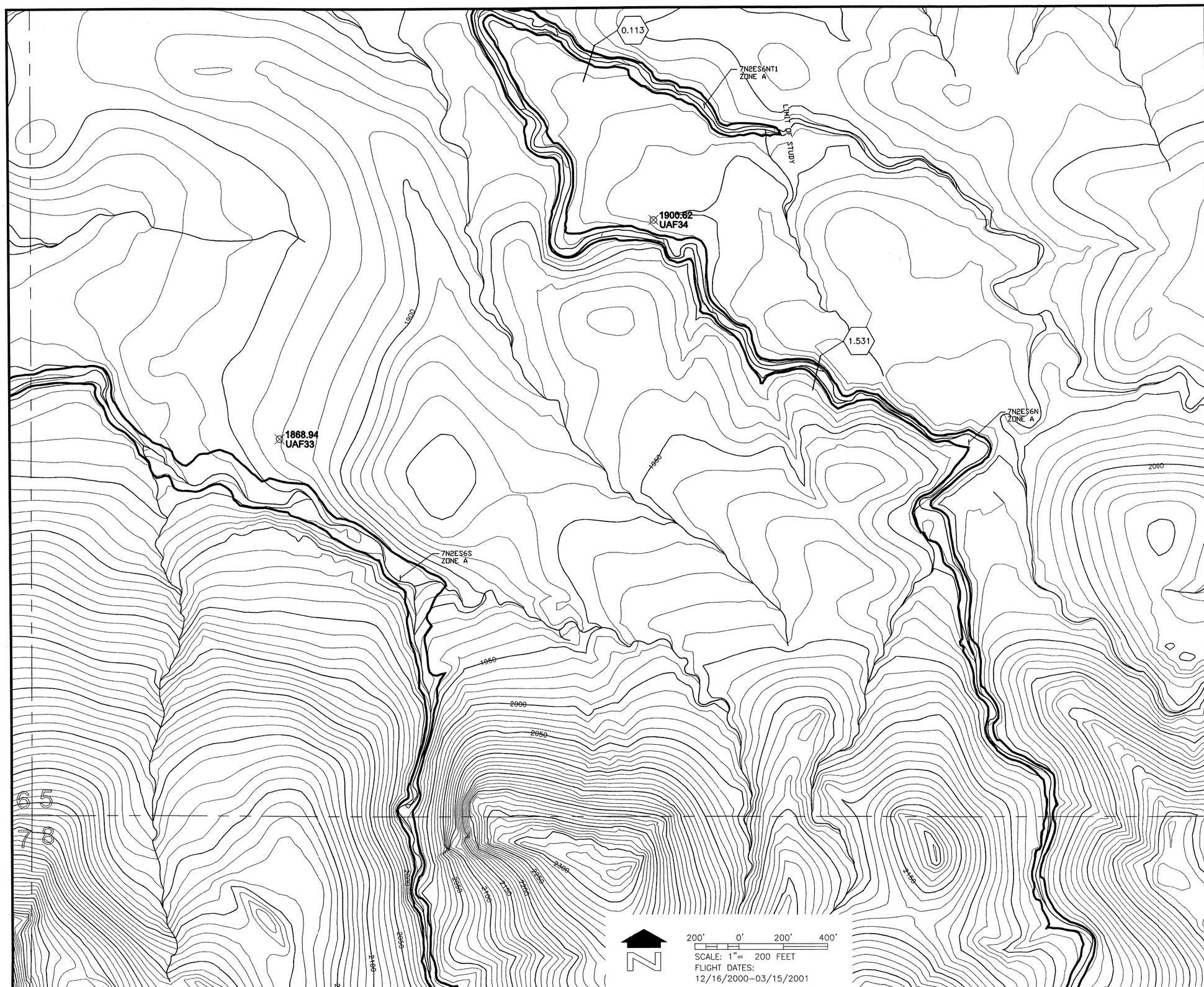
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS205.DWG 12/12/02 5:26 pm



LEGEND

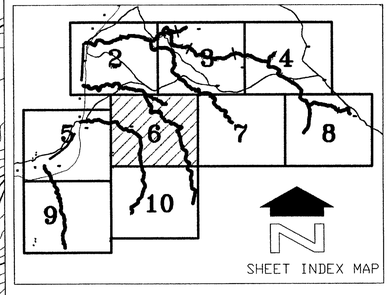
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION RIVER MILE DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 33	1868.94	SET FCDMC BRASS CAP AT LAT. N 33° 58' 39" LONG W. 112° 11' 01".
UAF 34	1900.62	SET FCDMC BRASS CAP AT LAT. N 33° 58' 48" LONG W. 112° 10' 40"

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Date Signed 12/11/02 Arizona U.S.A.

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 06 OF 10

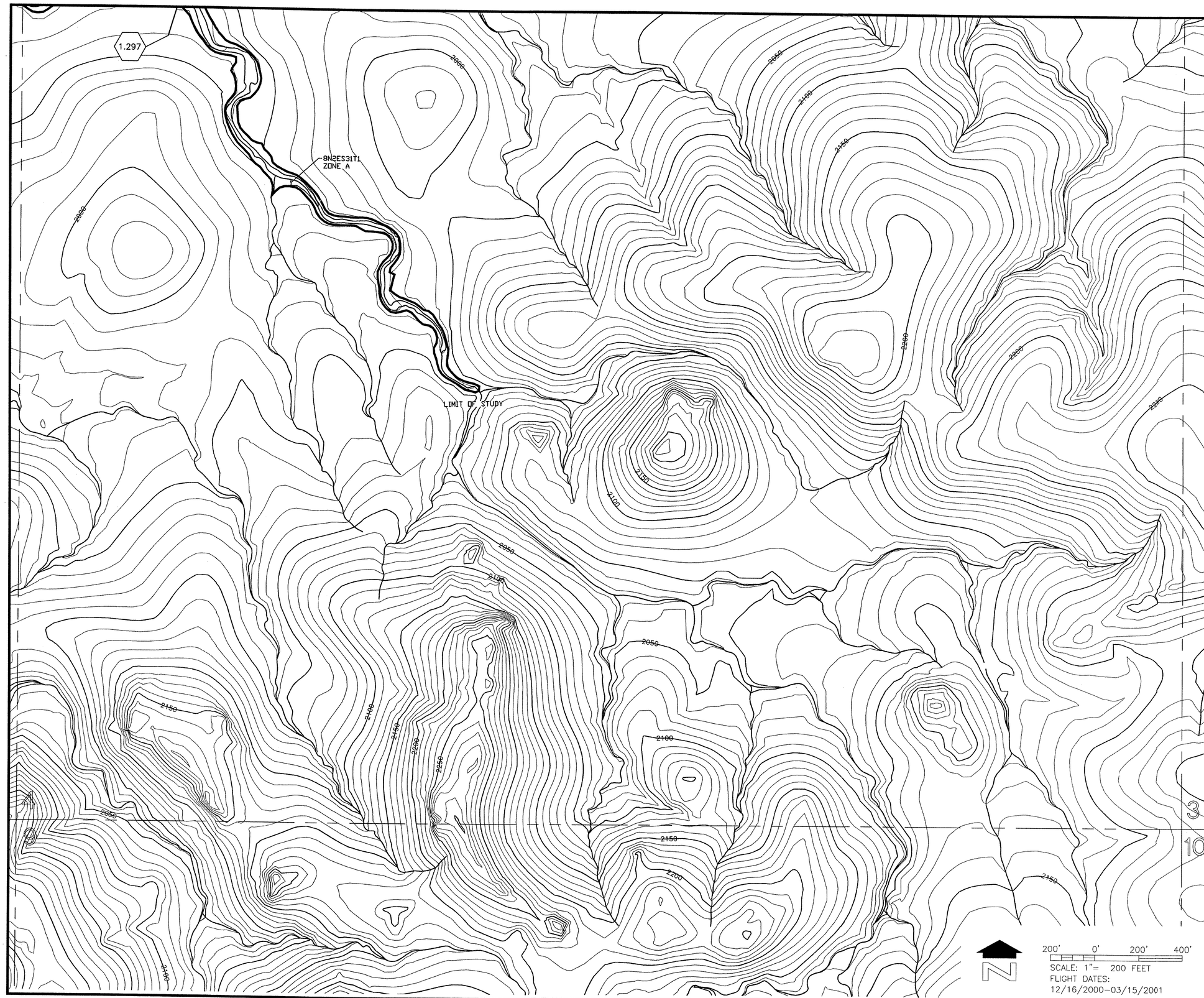
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS206.DWG 12/12/02 4:47 pm



LEGEND

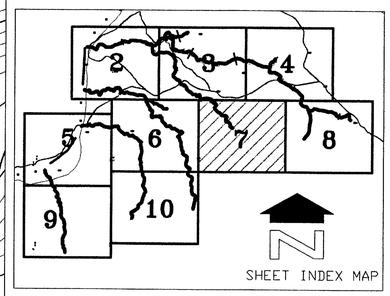
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION (0.1000)	CROSS SECTION RHES MEZ DESIGNATION
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	⊗1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL ARIZONA U.S.A. Expires 12/31/03

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 07 OF 10

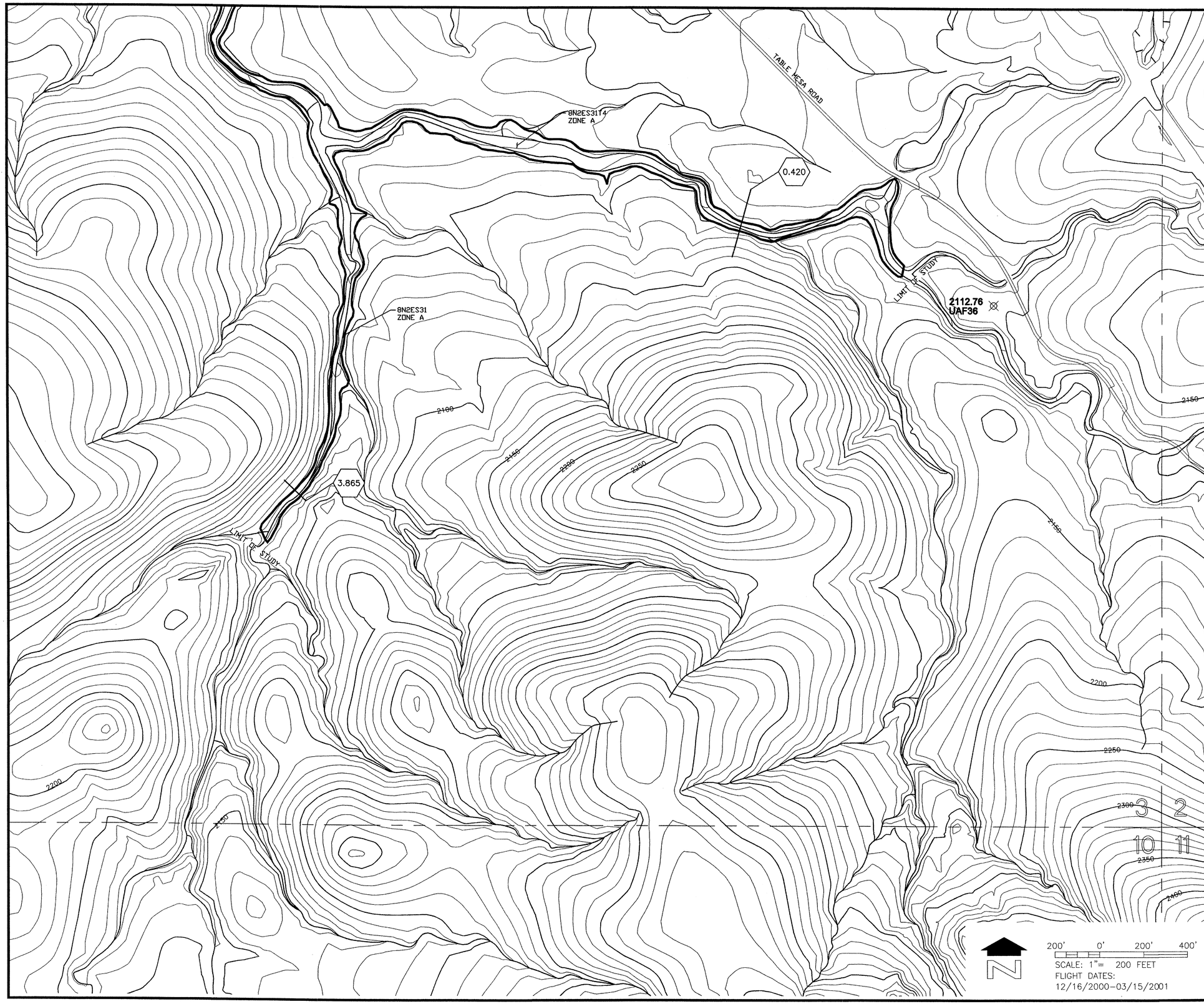
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS207.DWG 12/13/02 8:38 am



LEGEND

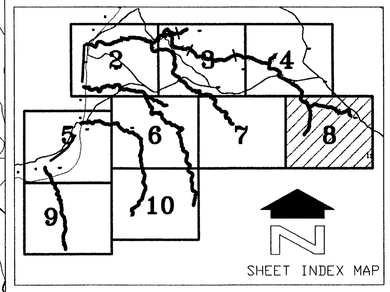
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION INDEX MILE DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
UAF 36	2112.76	SET FCDMC BRASS CAP AT LAT. N 33° 58' 45" LONG W. 112° 08' 15".

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL, JR. ARIZONA U.S.A. 12/13/02

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 08 OF 10

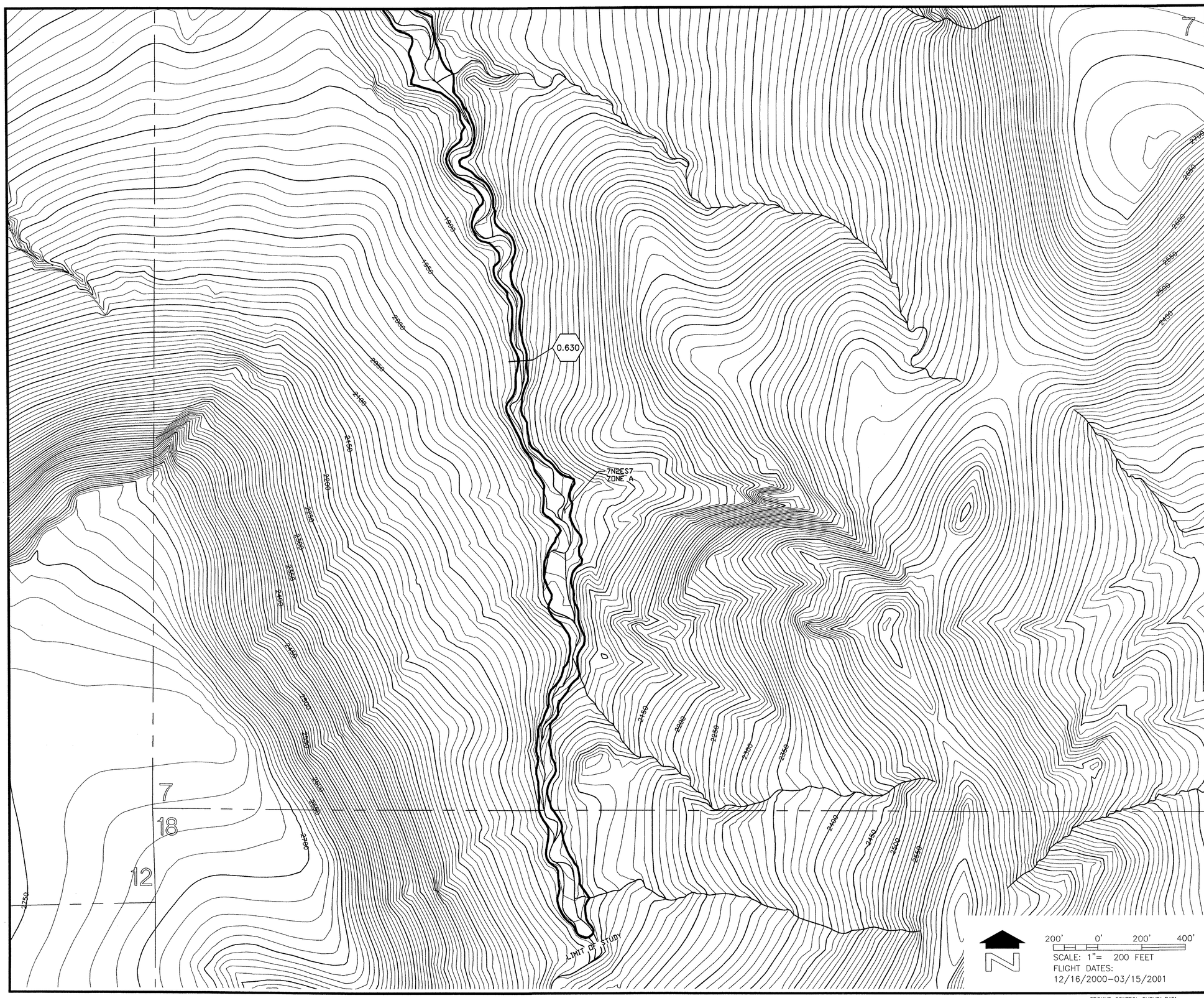
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS208.DWG 12/12/02 4:50 pm



LEGEND

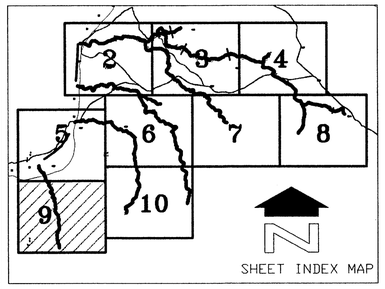
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (CROSS SECTION DESIGNATION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	1758.96 UAF 32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Date Signed 12-17-02 Arizona U.S.A.

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 09 OF 10

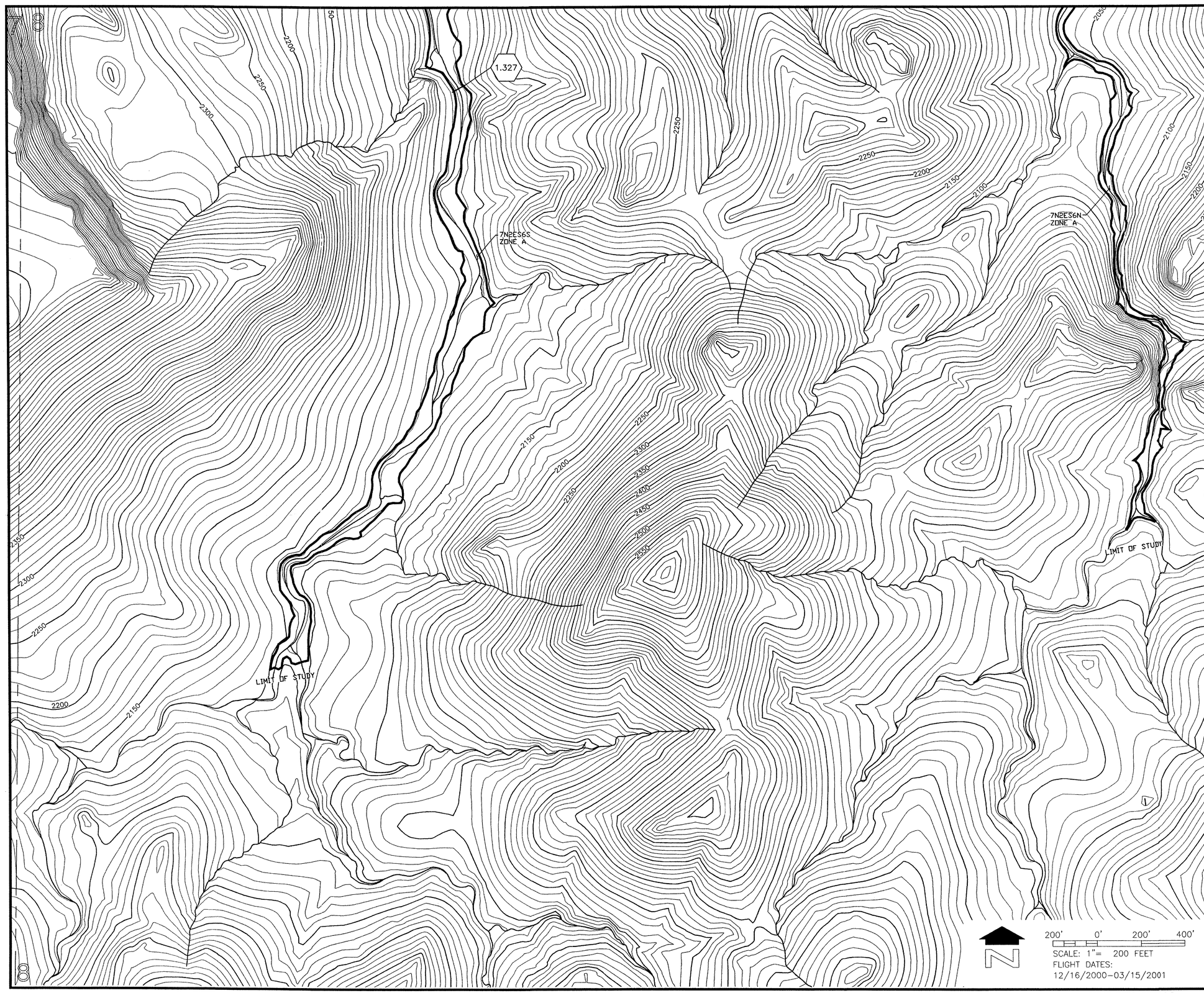
THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) PREPARED FROM AERIAL PHOTOGRAPHS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

H:\PDATA\45100648\DWG\WS2\648WS209.DWG 12/12/02 4:51 pm



LEGEND

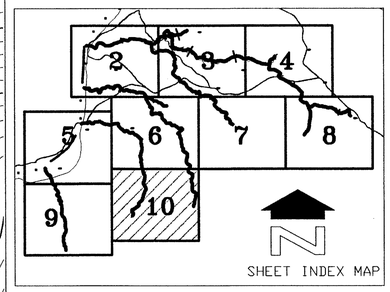
100-YR FLOODPLAIN BOUNDARY	
CROSS SECTION	0.1000 (DATO TOTOR / 1000 FT. / DESCRIPTION)
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINE	
ELEVATION REFERENCE MARK	⊗1758.96 UAF32
SECTION NUMBERS	32

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. TO CONVERT TO 1929 NGVD, SUBTRACT 2.27 FEET.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

UPPER AGUA FRIA WATERSHED
SUB WATERSHED #2
ZONE A
FLOODPLAIN DELINEATION STUDY
F.C.D. CONTRACT NO. 2000C020

Registered Professional Engineer (Civil) CERTIFICATE NO. 36122 ROY B. McDANIEL Date Signed 8/16/02 ARIZONA U.S.A.

RBF CONSULTING

	BY	DATE
DESIGN	RBM	8/14/02
DESIGN CHK.	WJK	8/18/02
PLANS	JEM	8/16/02
PLANS CHK.	RBM	8/22/02

SHEET 10 OF 10

THIS MAP WAS PREPARED FROM MARICOPA COUNTY DIGITAL TERRAIN MODELS (DTM) OF PRE-EXISTING FLOOD HAZARD AREAS. DTM WAS FLOWN IN DECEMBER 2000.

LANDATA AIRBORNE SYSTEMS

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING

RBF JN 45-100648

UPPER AGUA FRIA WATERSHED (WATERSHED UU) ZONE A
FLOODPLAIN DELINEATION STUDY
WATERSHED NO. 2 (TABLE MESA ROAD AREA)
CONTRACT FCD 2000CO20

Unincorporated Maricopa County, Arizona
October 22, 2002
RBF Consulting, JN 45-100648
Washes 7N2ES7, 7N2ES6S, 7N2ES6N,AND 8N2ES31, WHICH ARE TRIBUTARIES TO THE AGUA FRIA RIVER.

THIS CD CONTAINS THE DIGITAL FILES USED IN THE FLOODPLAIN DELINEATION STUDY IDENTIFIED ABOVE. BOTH THE HYDROLOGIC AND HYDRAULIC CALCULATIONS ARE PROVIDED ON THIS CD. THE HYDROLOGY WAS PERFORMED USING ArcView 3.2a, WMS 6.1, HEC-1, AND THE NFF EQUATIONS, AS OUTLINED IN THE TECHNICAL DATA NOTEBOOK (TDN). HYDRAULIC CALCULATIONS AND FLOODPLAIN DELINEATION WERE PERFORMED USING WMS 6.1 , AS OUTLINED IN THE TDN.

THE FILES ON THIS CD MATCHED THE INFORMATION IN THE TECHNICAL DATA NOTEBOOK AT THE TIME OF THE CD'S CREATION PRIOR TO SUBMISSION TO FEMA. ANY PERSON USING THESE FILES NEEDS TO VERIFY THAT THEY MATCH THE FEMA APPROVED FLOODPLAIN DELINEATION. RBF CONSULTING DOES NOT ACCEPT ANY RESPONSIBILITY FOR THE USE OF THESE FILES IF THE DELINEATION CHANGES AS A RESULT OF FEMA REVIEW.

THE CD CONTAINS THE FOLLOWING FOLDER STRUCTURE

```
CD ROM
     CADD
     HEC1
     HYDRAULICS
          FLOODPLAIN
          ROUTING
     NFF
```

THE CADD FOLDER CONTAINS THE FOLLOWING FILES:

ZONEA.DXF CADD DRAWING OF FLOODPLAIN BOUNDARIES IN AUTOCAD RELEASE 12 DXF FORMAT.

THE HEC1 FOLDER CONTAINS THE FOLLOWING FILES:

648WS2.wpr	WMS project file
0648WS2.ini	WMS project settings and initialzation file
0648WS2.tre	WMS tree file, which stores sub-basin parameters (can be loaded independent from other files)
0648WS2.map	WMS map file, which contains feature points, arcs, and polygons (can be loaded independent from other files)
0648WS2.lsf	WMS land use and soil type specification file. Stores rainfall loss parameters.
0648ws2.fac	WMS flow accumulation grid.
0648ws2.fdr	WMS flow direction grid.
0648ws2.gdm	WMS elevation grid.
GREENSO.tbl	Text file which contains soil type and XKSAT information. Imported into WMS.

GREENLU.tbl	Text file which contains land use information. Imported into WMS.
0648ws2.basin	WMS file that relates the hydrologic units to the digital elevation model (DEM).
flovec.dat	Topaz output file containing flow direction grid.
relief.dat	Topaz output file containing grid information.
uparea.dat	Topaz output file containing accumulation grid values.
WMSBASE.hc1	Preliminary HEC-1 input file (Does not contain final results).
WMSBASE.out	Preliminary HEC-1 output file (Does not contain final results).
0648ws2.hc1	Final HEC-1 input file (Do not run with WMS project file!).
0648ws2.out	Final HEC-1 output file.

BOTH THE FLOODPLAIN AND ROUTING FOLDERS, WITHIN THE HYDRAULICS FOLDER, CONTAIN SEVERAL FILES SPECIFIED BY THE WASH OR REACH NAME. EACH WASH OR REACH NAME CONTAINS THE FOLLOWING FILE TYPES, WHICH ARE LOADED INTO WMS BY OPENING THE FILE WITH THE "WPR" EXTENSION.

*.wpr	WMS Project file used to open all other files
*.ini	WMS Project settings and initialization file.
*.map	WMS Map File that contains all feature point, arcs, and polygons, including cross sections and floodplain.
*.sdat	WMS ASCII dataset file that contains watersurface elevation data. Used with *.xy files (2D Scatter Data).
*.tdat	WMS ASCII dataset file that contains flood depth information. Used with *.tin files (WMS TIN files).
*.tin	WMS TIN file that contains ground elevation information.
*.tre	WMS tre file
*.xy	WMS 2D scatter data that contains the floodplain stage along the washes being delineated.

THE NFF FOLDER CONTAINS SEVERAL TEXT FILES OF THE FOLLOWING TYPES:

*.nff	NFF/WMS input file containing regional regression equation parameters.
*.txt	Output files containing NFF/Regional Regression equation results.

Each file contains a description of the sub-basin, or group of sub-basins it represents.